GEOLOGICAL
SURVEY
OF
CANADA

DEPARTMENT OF ENERGY,
MINES AND RESOURCES

PAPER 66-17

AGE DETERMINATIONS AND GEOLOGICAL STUDIES
K-Ar Isotopic Ages, Report 7

(Report, 3 tables and 1 figure)

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

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ABSTRACT

New potassium-argon age determinations are reported for 153 Canadian mineral and rock samples, listed according to their provincial and territorial distribution. Each sample is described, and a geological interpretation of its determined age is given. The techniques employed are described in outline form. Two recent geological time scales are summarized in tabular form.

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

G. R. Lachance - Potassium determination by 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 release of potassium-argon age measurements, the seventh annual report of age determinations carried out in the Isotope Geology Laboratories of the Geological Survey of Canada, presents experimental work completed during 1965. The publication of this group of determinations brings the total number of Canadian K-Ar ages reported to 1146.

Automatic printing techniques have been employed for the first time to prepare the main portion of this report. The authors are indebted to K. R. Dawson for his continued interest and assistance in overcoming numerous problems encountered in the translation of experimental data to card form for eventual processing on the off-line printer.

Due to certain limitations in the automatic equipment it was not possible to use conventional symbols in all instances and the following conventions of punctuation are used:

(0) EQUALS A QUESTION MARK (?)

.....INDICATES A QUOTATION "....."

Procedure

The samples were examined mineralogically and all mineral concentrates were analyzed by X-ray diffraction in order to determine the degree of chloritization. X-ray fluorescence techniques were used to determine the potassium content (see Lachance, in Wanless et al., 1965, pp. 4-7). A high frequency generator was employed to fuse the sample material in vacuo, and the radiogenic argon content was determined using isotope dilution techniques.

Precision of Age Determinations

The various factors to be considered in assigning experimental error limits to individual age determinations were discussed in detail in Report 5 (GSC Paper 64-17, Part 1). The procedure outlined has been followed in determining the error limits quoted for the 95% confidence level. For samples with low potassium contents the major error contribution arises from the uncertainty assigned to routine potassium determinations. The table below will serve to illustrate the variation in experimental error with potassium content.

TABLE I

Error Limits Assigned to Potassium Determinations

% K	% Error (δ K)
5 - 9	$\pm$ 1.5
3 - 5	$\pm$ 5
1 - 3	$\pm$ 6
0.5 - 1	$\pm$ 8
0.2 - 0.5	$\pm$ 10

Constants Employed in Age Calculations

Age calculations are based on the following:

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

$$\lambda_{total} = 5.30 \times 10^{-10} \text{ yr}^{-1}$$

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

Geological Time Scale

The Phanerozoic time scales of the Geological Society of London (1964), and Holmes (1959) are summarized in tabular form in Table II. 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 III of this paper.

References

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

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

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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.

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

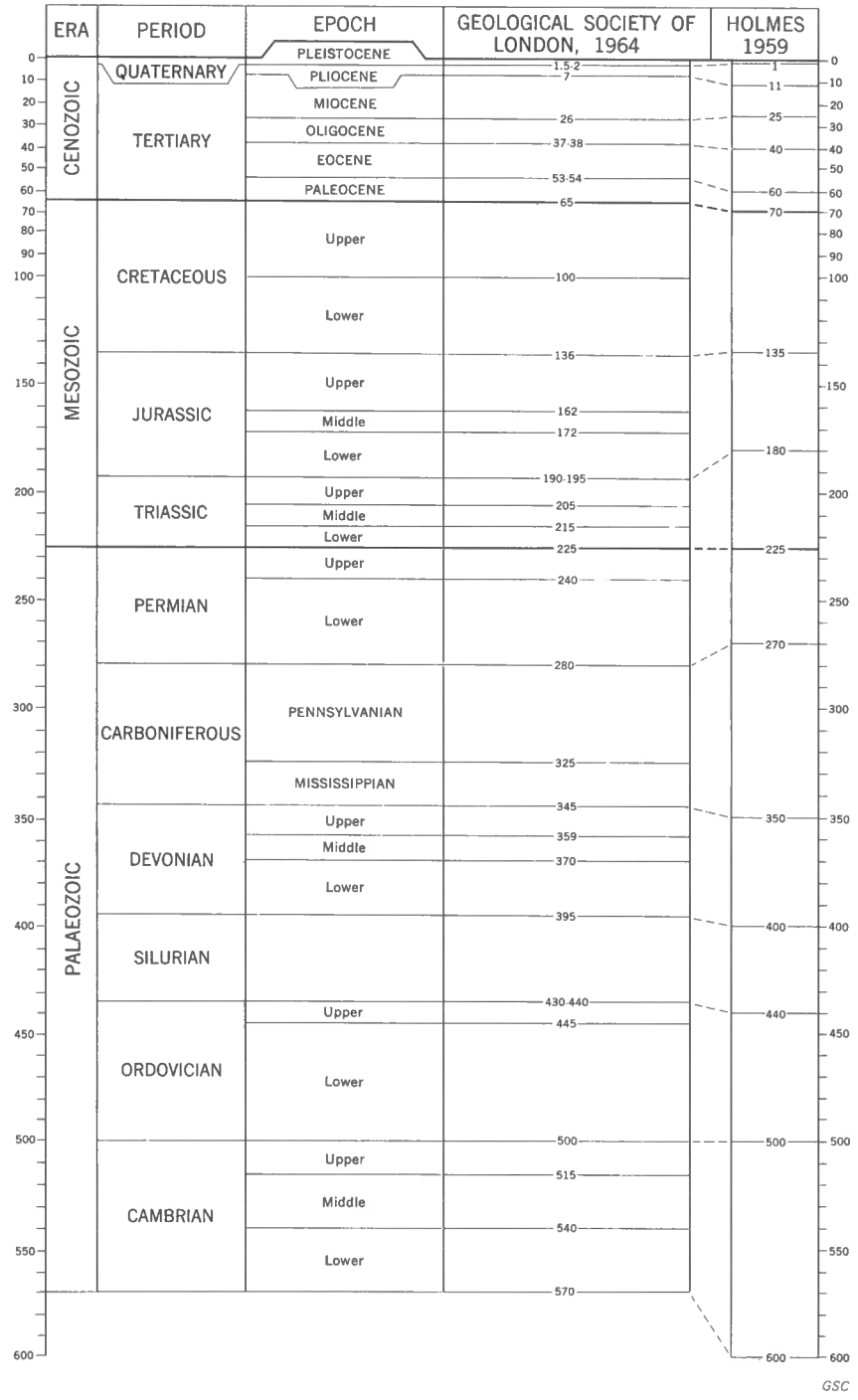

Table II. Phanerozoic time-scale.

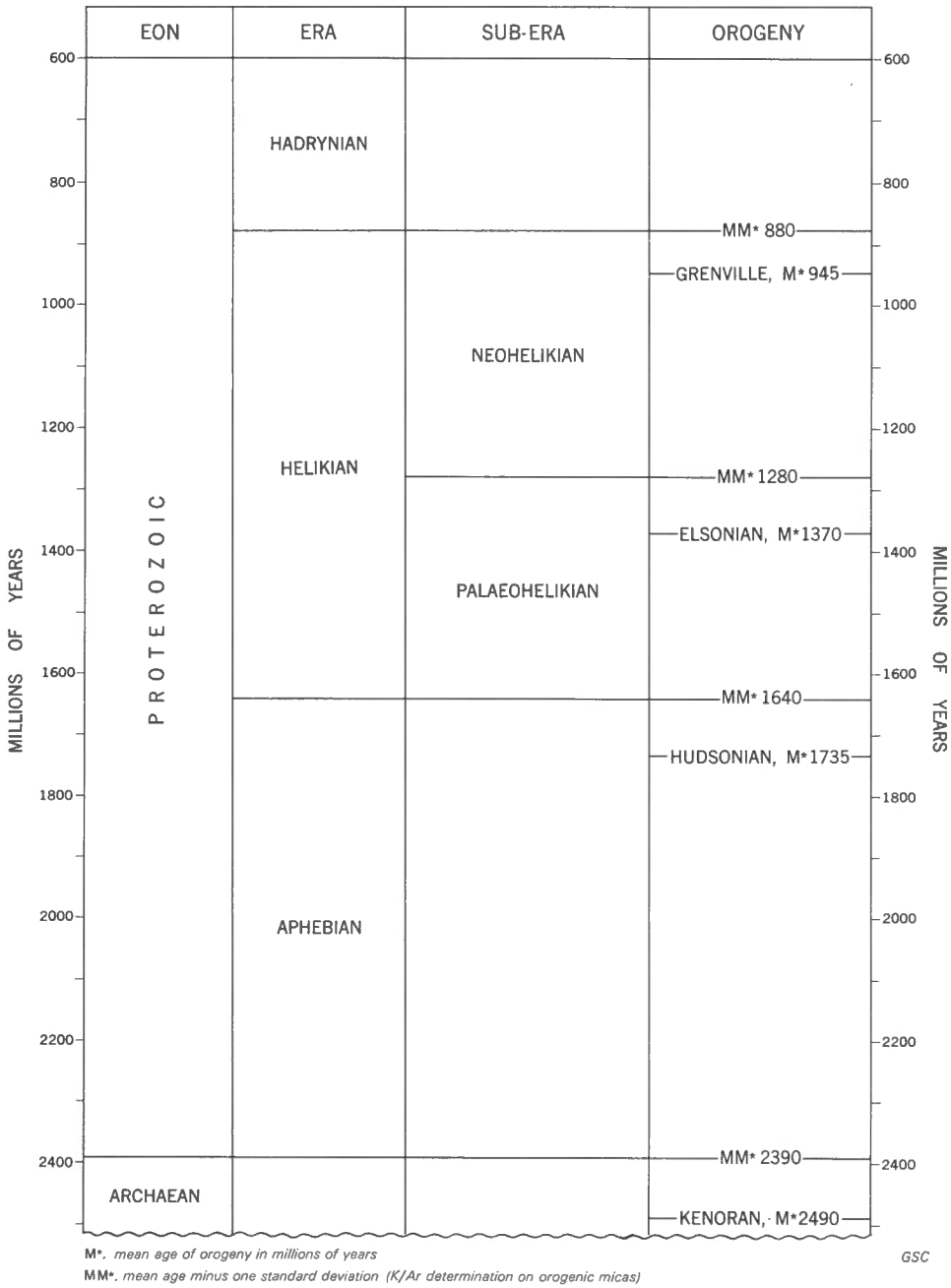

Table III. Precambrian time-scale for the Canadian Shield (after Stockwell, 1964).

BRITISH COLUMBIA

GSC 65-1 BIOTITE, K-AR AGE 460 + OR - 20 M.Y.

K=6.07 PERCENT, AR40/K40=0.0307, RADIOGENIC AR=94 PERCENT.

CONCENTRATE- IMPURE CONCENTRATE OF BROWN BIOTITE. IMPURITIES CONSIST MAINLY OF CHLORITE, SOME QUARTZ, OPAQUE GRAINS, AND A FEW FLAKES OF MUSCOVITE. TOTAL CHLORITE CONTENT 30 PERCENT.

FROM QUARTZITE
(82 G) JUNCTION OF HIGHWAY 3 AND LUMBERTON ROAD, 8 MILES SW OF CRANBROOK, BRITISH COLUMBIA, 49-25-32 N, 115-52-16 W. MAP-UNIT 2, GSC MAP 11-1960 (FERNIE, WEST HALF). SAMPLE LD-ML-18, COLLECTED AND INTERPRETED BY G. B. LEECH.

FOR DESCRIPTION AND INTERPRETATION SEE GSC 65-6.

GSC 65-2 MUSCOVITE, K-AR AGE 615 + OR - 55 M.Y.

K=3.62 PERCENT, AR40/K40=0.0426, RADIOGENIC AR=86 PERCENT.

CONCENTRATE- IMPURE CONCENTRATE OF MUSCOVITE. MOST OF THE MUSCOVITE FLAKES ARE INTERGROWN WITH QUARTZ, FELDSPAR, BIOTITE, CHLORITE, AND CARBONATE. TOTAL CHLORITE CONTENT 5 PERCENT.

FROM QUARTZITE
(82 G) JUNCTION OF HIGHWAY 3 AND LUMBERTON ROAD, 8 MILES SW OF CRANBROOK, BRITISH COLUMBIA, 49-25-32 N, 115-52-16 W. MAP-UNIT 2, GSC MAP 11-1960 (FERNIE, WEST HALF). SAMPLE LD-ML-18, COLLECTED AND INTERPRETED BY G. B. LEECH.

FOR DESCRIPTION AND INTERPRETATION SEE GSC 65-6.

GSC 65-3 BIOTITE, K-AR AGE 985 + OR - 33 M.Y.

K=7.22 PERCENT, AR40/K40=0.0757, RADIOGENIC AR=96 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF BROWN BIOTITE. THE BIOTITE FLAKES CONTAIN SMALL INCLUSIONS OF QUARTZ. MINOR IMPURITIES CONSIST OF A FEW FELDSPAR FRAGMENTS, OPAQUE GRAINS, AND A FEW FLAKES OF CHLORITE AND MUSCOVITE. TOTAL CHLORITE CONTENT 2 PERCENT.

FROM SILTSTONE-ARGILLITE
(82 G) HIGHWAY 3, 0.5 MILES SW OF MIDWAY MINE AND 20 MILES SOUTHWESTERLY FROM CRANBROOK, BRITISH COLUMBIA, 49-13-45 N, 115-53-49 W. MAP-UNIT 2, GSC MAP 11-1960 (FERNIE, WEST HALF). SAMPLE LD-ML-17, COLLECTED AND INTERPRETED BY G. B. LEECH.

FOR DESCRIPTION AND INTERPRETATION SEE GSC 65-6.

GSC 65-4 MUSCOVITE, K-AR AGE 456 + OR - 40 M.Y.

K=4.40 PERCENT, AR40/K40=0.0302, RADIOGENIC AR=96 PERCENT.

CONCENTRATE- IMPURE CONCENTRATE OF MUSCOVITE. MOST OF THE MUSCOVITE FLAKES ARE INTERGROWN WITH QUARTZ AND CONTAIN A FEW ATTACHED SPECKS OF BIOTITE.

FROM SILTSTONE-ARGILLITE
(82 G) HIGHWAY 3, 0.5 MILES SW OF MIDWAY MINE AND 20 MILES SOUTHWESTERLY FROM CRANBROOK, BRITISH COLUMBIA, 49-13-45 N, 115-53-49 W. MAP-UNIT 2, GSC MAP 11-1960 (FERNIE, WEST HALF). SAMPLE LD-ML-17, COLLECTED AND INTERPRETED BY G. B. LEECH.

FOR DESCRIPTION AND INTERPRETATION SEE GSC 65-6.

GSC 65-5 BIOTITE, K-AR AGE 457 + OR - 18 M.Y.

K=5.21 PERCENT, AR40/K40=0.0303, RADIOGENIC AR=88 PERCENT.

CONCENTRATE- IMPURE CONCENTRATE OF ORANGE-BROWN BIOTITE. IMPURITIES CONSIST MAINLY OF OPAQUE GRAINS, ABOUT 10 PERCENT FELDSPAR AND QUARTZ, CHLORITE, A FEW FLAKES OF MUSCOVITE AND A FEW

BRITISH COLUMBIA

GRAINS OF ZIRCON. TOTAL CHLORITE CONTENT 25 PERCENT.

FROM QUARTZITE
(82 G) HIGHWAY 3, 0.5 MILES SW OF MIDWAY MINE AND 20 MILES SOUTHWESTERLY FROM CRANBROOK, BRITISH COLUMBIA, 49-13-45 N, 115-53-49 W. MAP UNIT 2, GSC MAP 11-1960 (FERNIE, WEST HALF). SAMPLE LD-ML-17-1, COLLECTED AND INTERPRETED BY G. B. LEECH.

FOR DESCRIPTION AND INTERPRETATION SEE GSC 65-6.

GSC 65-6 MUSCOVITE, K-AR AGE 687 + OR - 28 M.Y.

K=6.84 PERCENT, AR40/K40=0.0485, RADIOGENIC AR=86 PERCENT.

CONCENTRATE- RELATIVELY CLEAN UNALTERED MUSCOVITE. ABOUT 5 PERCENT OF THE FLAKES CONTAIN BLEBS OF QUARTZ AND 1 PERCENT CONTAIN OPAQUE INCLUSIONS. THERE IS LESS THAN 1 PERCENT ATTACHED BIOTITE, AND OTHER IMPURITIES ARE MADE UP OF 5 PERCENT FREE QUARTZ AND LESS THAN 1 PERCENT FREE OPAQUES.

FROM QUARTZITE
(82 G) HIGHWAY 3, 0.5 MILES SW OF MIDWAY MINE AND 20 MILES SOUTHWESTERLY FROM CRANBROOK, BRITISH COLUMBIA, 49-13-45 N, 115-53-49 W. MAP-UNIT 2, GSC MAP 11-1960 (FERNIE, WEST HALF). SAMPLE LD-ML-17-1, COLLECTED AND INTERPRETED BY G. B. LEECH.

THE MIDDLE DIVISION OF THE ALDRIDGE FORMATION OF THE PURCELL SEDIMENTARY SEQUENCE (PROTEROZOIC AGE) CONSISTS OF QUARTZITE WITH INTERBEDDED SILTSTONE AND ARGILLITE, IN THE GREENSCHIST FACIES OF REGIONAL METAMORPHISM. THE ANALYSES REPORTED HERE ARE OF MICAS FROM TYPICAL QUARTZITES AND LAMINATED SILTSTONE-ARGILLITE. GSC 65-6 AND 5 ARE A MUSCOVITE-BIOTITE PAIR FROM QUARTZITE (SAMPLE LD-ML-17-1) AND GSC 65-4 AND 3 ARE A MUSCOVITE BIOTITE PAIR FROM SILTSTONE-ARGILLITE (SAMPLE LD-ML-17) THAT IS INTERBEDDED WITH THIS QUARTZITE IN THE SAME OUTCROP. THEY ARE FROM THE FAULT BLOCK EAST OF THE MOYIE FAULT. GSC 65-2 AND 1 ARE A MUSCOVITE-BIOTITE PAIR FROM SIMILAR QUARTZITE (SAMPLE LD-ML-18) WEST OF THE MOYIE FAULT.

THE K-AR AGES OF MUSCOVITE AND BIOTITE FROM QUARTZITE

LD-ML-17-1 ARE 687 + OR - 28 M.Y. AND 467 + OR - 18 M.Y. RESPECTIVELY, WHEREAS THE K-AR AGES OF MUSCOVITE AND BIOTITE FROM THE SILTSTONE-ARGILLITE INTERBEDDED WITH IT ARE 456 + OR - 40 M.Y. AND 985 + OR - 33 M.Y. THE MICAS IN THE QUARTZITE WEST OF THE MOYIE FAULT YIELDED K-AR AGES OF 615 + OR - 55 M.Y. (MUSCOVITE) AND 460 + OR - 20 M.Y. (BIOTITE), MORE LIKE THOSE OF THE OTHER QUARTZITE.

THESE ARE HYBRID AGES THAT REFLECT CONDITIONS OF SEDIMENTATION, TIMES OF METAMORPHISM, AND (IN THE CASES OF THE MUSCOVITE AGES OF 615 M.Y. AND 456 M.Y. ESPECIALLY) THE PURITY OF THE ANALYSED CONCENTRATE.

GSC 65-7 BIOTITE, K-AR AGE 710 + OR - 30 M.Y.

K=6.62 PERCENT, AR40/K40=0.0504, RADIOGENIC AR=94 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF ORANGE-BROWNISH BIOTITE. BIOTITE FLAKES ARE POIKILITIC AND CONTAIN NUMEROUS INCLUSIONS OF QUARTZ. A FEW FLAKES ARE SLIGHTLY ALTERED TO CHLORITE.

FROM LAMINATED SILTSTONE
(82 G) 2 MILES SW OF MT. OLSON AND 29 MILES SOUTHERLY FROM CRANBROOK, BRITISH COLUMBIA, 49-06-22 N, 115-50-45 W. MAP-UNIT 2, GSC MAP 11-1960 (FERNIE, WEST HALF). SAMPLE LD-ML-19, COLLECTED AND INTERPRETED BY G. B. LEECH.

THE SAMPLE REPRESENTS A LOCAL OCCURRENCE OF A GRADE OF METAMORPHISM HIGHER THAN THE USUAL LEVEL IN GREENSCHIST FACIES THAT CHARACTERIZES THE REGION. THE ROCK SAMPLE IS FINELY LAMINATED SILTSTONE (LAMINAE VARY FROM FINE QUARTZITE TO ARGILLITE) TYPICAL OF THE UPPER UNIT OF THE ALDRIDGE FORMATION. THIS UNIT COMMONLY CONTAINS TINY CRYSTALS OF BIOTITE BUT IN THIS LOCALITY THEY ARE MORE ABUNDANT AND LARGER THAN USUAL AND CERTAIN BEDS CONTAIN PORPHYOBLASTS OF AMPHIBOLE AND GARNET IN ADDITION TO OR INSTEAD OF BIOTITE. MICROSCOPIC EXAMINATION SHOWS THAT THE PORPHYROBLASTS OF BIOTITE, AMPHIBOLE AND GARNET HAVE IRREGULAR OUTLINES AND ARE CROWDED WITH INCLUSIONS (QUARTZ AND MUSCOVITE IN THE BIOTITE, AND CHIEFLY QUARTZ IN THE AMPHIBOLE AND GARNET).

THE SAMPLE USED FOR AGE DETERMINATION WAS CHOSEN FOR ITS ABUNDANT BIOTITE AND IT LACKS AMPHIBOLE AND GARNET, THOUGH THESE MINERALS, WITH GRAIN SIZES UP TO AT LEAST 8 MM. AND 4 MM. RESPECTIVELY, OCCUR IN THE SAME GROUP OF OUTCROPS. THE

COMMON SIZE OF THE BIOTITE GRAINS IN THE ROCK SAMPLE IS FROM 0.2 MM. TO 0.5 MM. AND THE ANALYZED CONCENTRATE CONSISTED OF FRAGMENTS 0.3 TO 0.4 MM. IN SIZE. THIS BIOTITE IS PLEOCHROIC FROM RED-BROWN TO TAN AND HAS INCLUSIONS OF QUARTZ AND MUSCOVITE. THIS ROCK UNIT ELSEWHERE NORMALLY CONSISTS CHIEFLY OF QUARTZ AND FINE-GRAINED BIOTITE AND MUSCOVITE BUT AT THIS OCCURRENCE THE FINE-GRAINED MUSCOVITE (0.04 TO 0.08 MM. IS THE COMMON SIZE) IS ACCOMPANIED BY LITTLE OR NO COMPARABLY SIZED BIOTITE, SO THE BIOTITE PORPHYROBLASTS WOULD APPEAR TO HAVE GROWN AT THE EXPENSE OF THE FINER BIOTITE. SIMILARLY, INCREASES OF AMPHIBOLE AND GARNET ARE COUPLED WITH DECREASES OF MICAS. THE PETROGRAPHIC UNIFORMITY OF THE BIOTITE IN THE PORPHYROBLASTS AND THEIR RELATIVELY LARGE SIZE SUGGEST THAT ANY EARLIER BIOTITE WAS SO THOROUGHLY RECONSTITUTED THAT IT WOULD NOT AFFECT THEIR K-AR AGE, BUT THE SMALL INCLUSIONS OF MUSCOVITE WOULD INCREASE THE K-AR AGE OF THE SAMPLE SLIGHTLY, IF THEY ARE SIGNIFICANTLY OLDER.

THE PORPHYROBLASTS OF BIOTITE, AMPHIBOLE, AND GARNET ARE NO OLDER THAN THE MAIN REGIONAL METAMORPHISM. THIS IS INDICATED BY THEIR UNALTERED CONDITION AND THE EVIDENCE THAT THEY DEVELOPED PARTLY AT THE EXPENSE OF THE MICAS THAT CHARACTERIZE THE REGIONAL GREENSCHIST FACIES. THEY COULD BE DUE EITHER TO A LOCAL CULMINATION OF REGIONAL METAMORPHIC CONDITIONS OR TO A LATER AND PERHAPS UNRELATED LOCAL INFLUX OF HEAT.

THE OCCURRENCES OF CONSPICUOUS PORPHYROBLASTS OF AMPHIBOLE AND GARNET WERE SEEN IN THE UPPER UNIT OF THE ALDRIDGE FORMATION. THEY ARE AT THE SAME STRATIGRAPHIC LEVEL AND 3.5 MILES STRIKE-DISTANCE APART, ON A RIDGE TOP. THEIR LATERAL EXTENT WAS NOT DETERMINED DURING RECONNAISSANCE MAPPING BUT THERE SEEMS TO BE NOTHING DISTINCTIVELY UNUSUAL ABOUT EITHER THE ARGILLACEOUS FORMATION ABOVE THE NORTHERN OCCURRENCE, FROM WHICH THE SAMPLE CAME, OR THE QUARTZITIC 3,000 FOOT STRATIGRAPHIC SECTION BELOW THE SOUTHERN OCCURRENCE. THE NEAREST EXPOSED GRANITIC INTRUSION IS 26 MILES AWAY IN A DIFFERENT MAJOR FAULT BLOCK. SILLS OF THE GABBROIC MOYIE INTRUSIONS (PROTEROZOIC) OCCUR IN THE AREA BUT THEY ARE OLDER THAN THE REGIONAL METAMORPHISM AND THE NEAREST LARGE ONE IS APPARENTLY MORE THAN 3,000 FEET STRATIGRAPHICALLY BELOW THE METAMORPHIC OCCURRENCES. FOR THESE REASONS THE METAMORPHIC OCCURRENCES SEEM LIKELY TO BE DUE TO THE COMBINATION OF CHEMICALLY FAVOURABLE STRATA AND A LOCAL CULMINATION OF REGIONAL METAMORPHISM, BUT THE POSSIBILITY THAT THEY ARE DUE TO A HIDDEN INTRUSION NO OLDER THAN THE REGIONAL METAMORPHISM IS NOT DISPROVED. IT IS DIFFICULT TO RECONCILE THE K-AR AGE OF 710 M.Y. WITH EITHER INTERPRETATION IF THE MAIN PERIOD OF REGIONAL METAMORPHISM WAS, AS HAS GENERALLY BEEN SUPPOSED, MESOZOIC.

BRITISH COLUMBIA

GSC 65-8 BIOTITE, K-AR AGE 39 + OR - 4 M.Y.

K=7.84 PERCENT, AR40/K40=0.0023, RADIOGENIC AR=52 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF SOMEWHAT ALTERED OLIVE-GREEN BIOTITE. THE FLAKES HAVE 5 PERCENT CHLORITE ALTERATION ON THE EDGES, AND ABOUT 5 PERCENT OF THE GRAINS CONTAIN APATITE INCLUSIONS, AND A FEW ARE BLISTERED. HORNBLENDE AMOUNTS TO ABOUT 3 PERCENT.

FROM GRANITE
(92 H) RAILWAY CUT, COQUIHALLA RAILROAD, NORTH OF MOUTH OF CARRY CREEK AND ABOUT 1 MILE SOUTH OF IAGO, BRITISH COLUMBIA, 49-30-30 N, 121-10 W. MAP UNIT 25, GSC MAP 737A (1944). SAMPLE CU-337, COLLECTED AND INTERPRETED BY J. A. COATES.

THE ROCK IS A MEDIUM-GRAINED, FAINTLY PORPHYRITIC BIOTITE GRANITE CONSISTING OF WHITE, MICROPERTHITIC ORTHOCLASE, QUARTZ, ZONED OLIGOCLASE AND BIOTITE, WITH ACCESSORY HORNBLENDE, MAGNETITE, APATITE AND SPHENE. ALTERATION OF SOME BIOTITE HAS PRODUCED TRACES OF CHLORITE AND EPIDOTE. SERICITIC ALTERATION OF PLAGIOCLASE IS MODERATELY ADVANCED. MYRMEKITE HAS DEVELOPED AT PLAGIOCLASE-ORTHOCLASE CONTACTS. FURTHER PETROGRAPHIC INFORMATION IS GIVEN BY CAIRNES (1924, PP. 98-100).

THE SAMPLE WAS TAKEN FROM A DISCORDANT BATHOLITH OF GRANITE AND GRANODIORITE, ABOUT 100 SQUARE MILES IN AREA, IN THE COQUIHALLA DISTRICT OF THE CASCADE MOUNTAINS. THE BATHOLITH INTRUDES LATE LOWER CRETACEOUS STRATA AND IS REPORTED BY CAIRNES (1924, P. 102) TO BE UNCONFORMABLY OVERLAIN BY THE VOLCANIC ROCKS OF THE COQUIHALLA GROUP, WHICH CAIRNES (1944) CONSIDERED TO BE POST-EOCENE. THE K-AR DATE OF 39 + OR - 4 M.Y., LATE EOCENE OR EARLY OLIGOCENE, IS THUS IN AGREEMENT WITH FIELD RELATIONS.

REFERENCES-

CAIRNES, C.E.
1924 COQUIHALLA AREA, BRITISH COLUMBIA. GEOL. SURV., CANADA, MEM. 139, PP. 98-103.

CAIRNES, C. E.
1944 GEOL. SURV., CANADA, MAP 737A, HOPE.

BRITISH COLUMBIA

GSC 65-9 BIOTITE, K-AR AGE 98 + OR - 6 M.Y.

K=7.34 PERCENT, AR40/K40=0.0059, RADIOGENIC AR=79 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF SLIGHTLY ALTERED OLIVE-GREEN BIOTITE. LESS THAN 1 PERCENT OF THE FLAKES CONTAIN OPAQUE BLEBS AND FINE RUTILE NEEDLES. ABOUT 5-10 PERCENT OF THE FLAKES ARE ALTERED TO CHLORITE ON THE EDGES. IMPURITIES OF HORNBLENDE (5 PERCENT) AND QUARTZ-FELDSPAR (1 PERCENT) ARE PRESENT.

FROM GRANODIORITE
(92 H) ON HOPE-PRINCETON HIGHWAY, JUST EAST OF GOODFELLOW CREEK, BRITISH COLUMBIA, 49-16-45 N, 120-46 W. MAP UNIT 5, GSC MAP 888A. SAMPLE CU 336, COLLECTED AND INTERPRETED BY J. A. COATS.

THE ROCK IS A MEDIUM-GREY BIOTITE-HORNBLENDE-QUARTZ-DIORITE OF MEDIUM GRAIN SIZE AND FOLIATED GRANITIC STRUCTURE. MEGOSCOPICALLY VISIBLE CONSTITUENTS ARE PRISMS OF FRESH BLACK HORNBLENDE 1 TO 4 MM. LONG, LUSTROUS BLACK BIOTITE FLAKES MOSTLY LESS THAN 1 MM. IN DIAMETER, WHITE PLAGIOCLASE IN ANHEDRAL GRAINS MAINLY BETWEEN 1 AND 3 MM. IN DIAMETER, AND TRACES OF CHLORITE AND EPIDOTE ASSOCIATED WITH THE MAFIC MINERALS. QUARTZ IS NOT READILY VISIBLE.

THE **EAGLE GRANODIORITE** OF PRINCETON MAP SHEET IS PART OF A CONTINUOUS BELT OF PLUTONIC ROCKS TRENDING IN A NORTHWEST-SOUTHEAST DIRECTION FOR 115 MILES ACROSS THE ASHCROFT, HOPE AND PRINCETON MAP AREAS, AND CONTINUING SOUTHWARD INTO THE STATE OF WASHINGTON. IN THE PRINCETON MAP AREA THE BELT NARROWS CONSIDERABLY AND IS ONLY 2 MILES WIDE AT THE SAMPLING LOCALITY. THE **EAGLE GRANODIORITE** IS CHARACTERIZED BY GNEISSIC FOLIATION AND LOCALLY IT GRADES INTO GNEISS OR MIGMATITE. AT THE SAMPLING LOCALITY THE ROCK IS PLUTONIC IN CHARACTER, THOUGH WITH DISINCT FOLIATION. A SHORT DISTANCE EAST THE ROCK GRADES INTO QUARTZO-FELDSPATHIC AND AMPHIBOLITIC GNEISSES.

IN THE PRINCETON MAP AREA THE EAST MARGIN OF THE PLUTON IS CLEARLY INTRUSIVE INTO (OR DERIVED FROM) SEDIMENTARY AND VOLCANIC ROCKS ASSIGNED BY RICE (1947, P. 12) TO THE LATE TRIASSIC NICOLA GROUP AND FOLIATION IN THE PLUTONIC ROCKS IS CONFORMABLE WITH NICOLA GROUP STRUCTURES. ALSO AT THE EAST MARGIN, VOLCANIC AND SEDIMENTARY ROCKS OF TERTIARY AGE APPARENTLY OVERLIE THE **GRANODIORITE** 2.5 MILES NORTHWEST OF THE SAMPLING LOCALITY (RICE, 1947, MAP 888A). THE NATURE OF THE CONTACT IS NOT SPECIFIED. THUS NO INCONSISTENCY EXISTS WITH RESPECT TO THE K-AR DATE OF 98 + OR - 6 M.Y. AND

BRITISH COLUMBIA

RELATIONS AT THE EAST MARGIN OF THE PLUTON.

AT THE WEST MARGIN, EXCEPT FOR A SMALL AREA OF NICOLA GROUP ROCKS, THAT PORTION OF THE **EAGLE GRANODIORITE** IN THE PRINCETON MAP AREA IS IN CONTACT WITH ROCKS ASSIGNED TO THE PASAYTEN GROUP. ROCKS OF THIS GROUP ARE MAINLY CLASTIC SEDIMENTS THAT INCLUDE A HIGH PROPORTION OF ARKOSE IN THE LOWER PART OF THE SECTION. THE NATURE OF THE CONTACT BETWEEN THE PASAYTEN GROUP AND THE **EAGLE GRANODIORITE** HAS BEEN DESCRIBED BY DALY (1912, P. 481) AND RICE (1947, P. 19) AS AN UNCONFORMITY. EVIDENCE OF INTRUSION IS LACKING. PLANT FOSSILS COLLECTED BY RICE IN THE PASAYTEN GROUP FROM SEVERAL THOUSAND FEET ABOVE THE BASE OF THE SECTION WERE EXAMINED BY W. A. BELL WHO ASSIGNED A VERY LATE LOWER CRETACEOUS (ALBIAN) AGE TO THIS FLORA.

IF THE K-AR DATE OF 98 + OR - 6 M.Y. (EARLY UPPER CRETACEOUS) IS THE TRUE AGE OF BIOTITE IN THE **EAGLE GRANODIORITE** THEN EITHER THE PASAYTEN GROUP IS SOMEWHAT YOUNGER THAN ALBIAN OR THE UNCONFORMABLE RELATION WITH THE **GRANODIORITE** IS IN DOUBT. THE WRITER HAS EXAMINED THE WEST CONTACT AREA IN SEVERAL PLACES, INCLUDING THE AREA DESCRIBED BY DALY, AND CONCLUDES THAT THE OBSERVED EVIDENCE FAVOURS INTERPRETATION OF THIS CONTACT AS A FAULT. IF THE CONTACT IS A FAULT THAT BECAME ACTIVE IN POST LOWER CRETACEOUS TIME, THE K-AR DATE WOULD NOT BE INCOMPATIBLE WITH FIELD EVIDENCE.

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1912 NORTH AMERICAN CORDILLERA FORTY-NINTH PARALLEL. GEOL. SURV., CANADA, MEM. 38, PP. 479-506, MAP 14.

RICE H.M.A.
1947 GEOLOGY AND MINERAL RESOURCES OF THE PRINCETON MAP-AREA, BRITISH COLUMBIA. GEOL. SURV., CANADA, MEM. 243, PP. 19-24 AND PP. 35-36.

CAMSELL C.
1913 GEOLOGY AND MINERAL DEPOSITS OF THE TULAMEEN DISTRICT, B.C. GEOL. SURV., CANADA, MEM 26, PP. 76-82.

GSC 65-10 BIOTITE, K-AR AGE 84 + OR - 6 M.Y.

K=6.80 PERCENT, AR40/K40=0.0050, RADIOGENIC AR=81 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF LIGHT BROWN BIOTITE. ABOUT 5 PERCENT OF THE FLAKES ARE ALTERED TO CHLORITE ON THE EDGES, AND THERE IS ABOUT 5 PERCENT FREE CHLORITE IN THE SAMPLE. ABOUT 5 PERCENT OF THE FLAKES ARE BLISTERED. TOTAL CHLORITE CONTENT IS 10 PERCENT, AND HORNBLENDE (LESS THAN 5 PERCENT) IS PRESENT AS AN IMPURITY.

FROM GRANODIORITE.

(92 H) ROAD CUT ON HOPE-PRINCETON HIGHWAY AT BIG BEND NEAR JUNCTION OF SKAGIT RIVER AND SUMALLO RIVER, BRITISH COLUMBIA, 49-12-12 N, 121-05 W. MAP-UNIT 26, GSC MAP 737. SAMPLE CU 338, COLLECTED AND INTERPRETED BY J. A. COATES.

THE ROCK IS A LIGHT GREY, PORPHYRITIC QUARTZ-DIORITE WITH ABOUT 3 PERCENT DARK GREEN HORNBLENDE IN CRYSTALS 2-10 MM. LONG CONTRASTING WITH A FINE TO MEDIUM-GRAINED GROUNDMASS OF PLAGIOCLASE, QUARTZ AND BIOTITE.

THE SAMPLE WAS OBTAINED FROM ONE OF A GROUP OF CLOSELY SIMILAR, SMALL, DISCORDANT INTRUSIONS THAT PENETRATE UPPER JURASSIC(Q) AND LOWER CRETACEOUS STRATA OF THE DEWDNEY CREEK GROUP. A TERTIARY AGE WAS TENTATIVELY ASSIGNED TO THE SAMPLED INTRUSION BY CAMSELL (1911) BUT CAIRNES (1924 P. 105) LATER GROUPED THIS INTRUSION WITH OTHERS IN THE AREA AND ASSIGNED A LATE CRETACEOUS AGE TO THE GROUP. THIS AGE IS IN ACCORD WITH THE K-AR DATE OF 84 + OR - 6 M.Y.

THE DATED INTRUSION IS SIGNIFICANTLY LOCATED AT THE CONTACT BETWEEN THE DEWDNEY CREEK GROUP AND THE HOZAMEEN GROUP OF **LATE PALEOZOIC** AGE. THIS CONTACT IS APPARENTLY A FAULT BUT OUTCROPS OF THE INTRUSIVE ROCK SHOW NO EVIDENCE OF HAVING BEEN DISTURBED BY MOVEMENT ALONG THIS FAULT.

REFERENCES-

CAIRNES, C.E.
1924 COQUIHALLA AREA, BRITISH COLUMBIA, GEOL. SURV. CANADA, MEM. 139, PP. 104-105.

CAMSELL, C.
1911 GEOLOGY OF SKAGIT VALLEY, YALE DISTRICT, B.C. GEOL. SURV. CANADA, SUM. REPT., 1911 PP.115-123.

BRITISH COLUMBIA

GSC 65-11 BIOTITE, K-AR AGE 48 + OR - 12 M.Y.

K=7.35 PERCENT, AR40/K40=0.0029, RADIOGENIC AR=73 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF PALE OLIVE-GREEN BIOTITE. A FEW FLAKES ARE ALTERED TO CHLORITE ON THEIR EDGES AND SOME CONTAIN COLOURLESS INCLUSIONS. MINOR IMPURITIES CONSIST OF LESS THAN 1 PERCENT QUARTZ, FELDSPAR AND HORNBLENDE.

FROM QUARTZ DIORITE

(92 F) EAST SIDE OF CATFACE PENINSULA, IN ROADCUT ON EAST BOUNDARY OF IR 18, BRITISH COLUMBIA, 49-14-35 N, 125-57-00 W. NO GEOLOGICAL MAP. SAMPLE CT-J-4-6-64, COLLECTED AND INTERPRETED BY D. J. T. CARSON.

THE ROCK IS VERY FINE TO MEDIUM GRAINED HYPIDIOMORPHIC-GRANULAR, SERIATE, GREY, UNALTERED HORNBLENDE BIOTITE QUARTZ DIORITE. IT CONTAINS 50.5 PERCENT EUHEDRAL TO SUBHEDRAL OSCILLATORY-ZONED PLAGIOCLASE RANGING IN COMPOSITION FROM ANDESINE TO OLIGOCLASE, 4.8 PERCENT CLOUDED POTASH FELDSPAR, 8.1 PERCENT SUBHEDRAL BIOTITE PLEOCHROIC FROM DARK BROWN TO LIGHT YELLOWISH-BROWN, 5.8 PERCENT EUHEDRAL TO SUBHEDRAL POIKILITIC HORNBLENDE PLEOCHROIC FROM DARK GREEN TO YELLOWISH-BROWN, 30.3 PERCENT ANHEDRAL QUARTZ, 0.4 PERCENT OPAQUE MINERALS AND 0.2 PERCENT APATITE.

BIOTITE, LIKE ALL OTHER ESSENTIAL MINERALS, VARIES CONSIDERABLY IN GRAIN SIZE. MOST GRAINS ARE DISCRETE, BUT SOME FINE BIOTITE OCCURS IN CLUSTERS WITH SIMILAR-SIZED HORNBLENDE AND AS INCLUSIONS WITH PLAGIOCLASE IN LARGE POIKILITIC HORNBLENDE CRYSTALS. A FEW BIOTITE GRAINS ARE PARTLY CHLORITIZED.

THE QUARTZ DIORITE UNDERLIES MUCH OF CATFACE PENINSULA AND AT SOME LOCALITIES HAS INTRUDED VOLCANIC ROCKS OF PROBABLE LATE TRIASSIC AGE. IT APPEARS TO BE RELATED TO IRREGULARLY-SHAPED BODIES OF QUARTZ DIORITE PORPHYRY WHICH INTRUDE HIGHLY ALTERED QUARTZ MONZONITE IN THE CENTRAL PORTIONS OF THE PENINSULA. THESE PORPHYRY BODIES AND THE QUARTZ DIORITE ARE PETROGRAPHICALLY SIMILAR AND BOTH ARE RELATIVELY UNALTERED. DISSEMINATED AND FRACTURE-FILLING DEPOSITS CONTAINING CHALCOPYRITE, BORNITE, AND MOLYBDENITE ARE ASSOCIATED WITH THE PORPHYRIES.

SUPPORT FOR THE TERTIARY AGE OF THE QUARTZ DIORITE-QUARTZ DIORITE PORPHYRY INTRUSIVE COMPLEX AND ASSOCIATED COPPER MINERALIZATION AT CATFACE IS FOUND IN THE OCCURRENCE OF PETROGRAPHICALLY SIMILAR COMPLEXES ELSEWHERE ON VANCOUVER ISLAND, ONE OF WHICH IS AT MT. WASHINGTON WHERE IT INTRUDES

BRITISH COLUMBIA

LATE CRETACEOUS SEDIMENTARY ROCKS. ADDITIONAL SUPPORT IS GIVEN BY THE TERTIARY AGES OF SIMILAR QUARTZ DIORITES FROM ZEBALLOS (GSC 65-12 AT 38 + OR - 14 M.Y.) AND SOOKE (GSC 65-13 AT 39 + OR - 10 M.Y.).

GSC 65-12 BIOTITE, K-AR AGE 38 + OR - 14 M.Y.

K=7.28 PERCENT, AR40/K40=0.0022, RADIOGENIC AR=56 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF RELATIVELY FRESH BIOTITE. LESS THAN 5 PERCENT OF THE GRAINS SHOW SLIGHT ALTERATION TO CHLORITE. THE BIOTITE FLAKES ARE PALE OLIVE-GREEN AND CONTAIN A FEW COLOURLESS INCLUSIONS. MINOR IMPURITIES CONSIST OF QUARTZ, FELDSPAR AND A TRACE OF HORNBLENDE.

FROM QUARTZ DIORITE
(92 L) CENTRAL ZEBALLOS MINE, NO 9 LEVEL CROSS-CUT, 2200 FT FROM PORTAL, BRITISH COLUMBIA, 50-02-07 N, 126-47-04 W. MAP-UNIT 6, B.C. DEPT. MINES BULL 27, FIG. 2. SAMPLE CT-B-21-6-64, COLLECTED AND INTERPRETED BY D. J. T. CARSON.

THE ROCK IS FINE TO MEDIUM GRAINED HYPIDIOMORPHIC-GRANULAR GREY FRESH HORNBLENDE BIOTITE QUARTZ DIORITE. IT CONTAINS 54.8 PERCENT SUBHEDRAL OSCILLATORY-ZONED PLAGIOCLASE RANGING IN COMPOSITION FROM ANDESINE TO OLIGOCLASE, 11.0 PERCENT ANHEDRAL BIOTITE PLEOCHROIC FROM DARK BROWN TO LIGHT YELLOW-BROWN, 5.0 PERCENT SUBHEDRAL TO ANHEDRAL AMPHIBOLE PLEOCHROIC FROM DARK GREEN TO MEDIUM GREENISH-BROWN, 28.6 PERCENT ANHEDRAL QUARTZ, 0.6 PERCENT APATITE, LESS THAN 1 PERCENT CHLORITE INTERGROWN WITH BIOTITE, AND LESS THAN 1 PERCENT MAGNETITE.

THE SAMPLE WAS TAKEN 700 FEET FROM THE CONTACT OF THE QUARTZ DIORITE WITH BORDER ZONE GRANODIORITE AND IS TYPICAL OF THE QUARTZ DIORITE PHASE OF THE ZEBALLOS BATHOLITH. THIS QUARTZ DIORITE IS THE YOUNGEST MAJOR PHASE OF THE BATHOLITH AND OCCURS AS A MASS APPROXIMATELY EIGHT MILES LONG AND TWO MILES WIDE. IT INTRUDES GRANODIORITE WHICH INTRUDES GABBRO AND DIORITE PHASES. ROCKS OF LATE TRIASSIC AND EARLY JURASSIC(Q) AGES ARE CUT BY ALL THESE PHASES. ACCORDING TO STEVENSON (1950) THE QUARTZ DIORITE APPEARS TO HAVE BEEN FORCIBLY INTRUDED WITH DEVELOPMENT OF CONTACT BRECCIAS, BUT DOES NOT SHOW ANY SIGN OF GRANULATION OR RECRYSTALLIZATION.

REGARDING THE GOLD-QUARTZ VEINS OF THE ZEBALLOS MINING CAMP, STEVENSON STATES (P. 33) **THEY ARE YOUNGER THAN THE

QUARTZ DIORITE AND HAVE ALSO A CLOSE SPATIAL RELATIONSHIP TO IT, AND IT IS PROBABLE THAT, THOUGH THE VEIN MATTER MAY NOT HAVE COME FROM THE QUARTZ DIORITE, IT MAY BE GENETICALLY RELATED IN COMING FROM THE SAME DEEP SOURCE**.

ALTHOUGH THE STRATIGRAPHIC EVIDENCE FOR THE AGE OF THE QUARTZ DIORITE IS LIMITED, THE K-AR AGE OF 38 + OR - 14 M.Y. IS RELATIVELY CLOSE TO THOSE OF SIMILAR QUARTZ DIORITES FROM CATFACE PENINSULA (GSC 65-11 AT 48 + OR - 12 M.Y.) AND SOOKE (GSC 65-13 AT 39 + OR - 10 M.Y.).

REFERENCE-

STEVENSON, J.S.
1950 GEOLOGY AND MINERAL DEPOSITS OF THE ZEBALLOS MINING CAMP, BRITISH COLUMBIA, BRITISH COLUMBIA DEPT. OF MINES, BULL. NO. 27.

GSC 65-13 BIOTITE, K-AR AGE 39 + OR - 10 M.Y.

K=5.70 PERCENT, AR40/K40=0.0023, RADIOGENIC AR=25 PERCENT.

CONCENTRATE- RELATIVELY IMPURE CONCENTRATE OF DARK OLIVE-GREEN BIOTITE. ABOUT 10 PERCENT OF THE FLAKES ARE ALTERED TO CHLORITE ON THE EDGES. THE CONCENTRATE ALSO CONTAINS ABOUT 10 PERCENT FREE CHLORITE, 5 PERCENT HORNBLENDE, AND 1 PERCENT QUARTZ-FELDSPAR AND OPAQUES.

FROM GRANITE.
(92 B) SOUTHERN VANCOUVER ISLAND, BRITISH COLUMBIA, 48-26-55 N, 124-00-00 W. MAP-UNIT 14, GSC MAP 44A. SAMPLE CT-X-1, COLLECTED BY P. HENRY (MACSAN EXPLORATION LTD.) AND INTERPRETED BY D. J. T. CARSON.

THE ROCK IS MEDIUM GRAINED, GREY, FRESH, HYPIDIOMORPHIC-GRANULAR BIOTITE QUARTZ DIORITE. IT CONTAINS 63.9 PERCENT SUBHEDRAL OSCILLATORY-ZONED OLIGOCLASE-ANDESINE, MOST OF WHICH IS SLIGHTLY CLOUDED, 25.5 PERCENT ANHEDRAL QUARTZ, 9.4 PERCENT ANHEDRAL TO SUBHEDRAL BIOTITE, SOME OF WHICH CONTAINS REMNANTS OF HORNBLENDE, 0.3 PERCENT INTERSTITIAL POTASH FELDSPAR, 0.6 PERCENT ACCESSORIES SPHENE, APATITE, AND EPIDOTE, AND 0.3 PERCENT OPAQUE MINERALS.

MOST OF THE BIOTITE GRAINS ARE PLEOCHROIC FROM LIGHT BROWNISH-YELLOW TO DARK BROWN AND HAVE RAGGED OUTLINES. THEY

ARE LARGELY UNALTERED BUT SOME CONTAIN STREAKS OF IRON OXIDE AND CHLORITE PARALLEL TO THEIR CLEAVAGES. INCLUSIONS OF EUHEDRAL PALE GREEN UNALTERED HORNBLENDE ARE ENCLOSED IN SOME OF THESE BIOTITE GRAINS. THE REMAINDER OF THE BIOTITE IS PLEOCHROIC FROM DEEP GREEN TO BROWNISH-YELLOW AND OCCURS IN ELONGATED POIKILITIC ZONES WITH EPIDOTE, SPHENE, AND REMNANTS OF HORNBLENDE. THIS LATTER TYPE OF BIOTITE IS BELIEVED TO BE THE PRODUCT OF LATE MAGMATIC REPLACEMENT OF HORNBLENDE.

THE SAMPLE IS FROM THE LARGEST (APPROXIMATELY 1.5 X .75 MI.) OF SEVERAL **GRANITIC** PLUGS WHICH INTRUDE THE LATE EOCENE METCHOSIN VOLCANICS AND ARE OVERLAIN UNCONFORMABLY BY LATE OLIGOCENE SEDIMENTS. THE DATE OF 39 + OR - 10 M.Y. THEREFORE SUPPORTS THE STRATIGRAPHIC DATA. WITHIN THE LIMITS OF EXPERIMENTAL ERROR IT ALSO AGREES WITH TWO OTHER DATES FROM UNALTERED QUARTZ DIORITES ELSEWHERE ON VANCOUVER ISLAND (GSC 65-11 AND 12). THESE DATES, AND THE OCCURRENCE OF POST-LATE CRETACEOUS QUARTZ DIORITE IN THE MT. WASHINGTON AREA SUGGESTS THAT THERE WAS A MID-EARLY TERITIARY OROGENY WHICH INVOLVED THE INTRUSION OF APPRECIABLE QUANTITIES OF QUARTZ DIORITE.

REFERENCE-

CLAPP, C.H.
1917 SOOKE AND DUNCAN MAP AREAS, VANCOUVER ISLAND, G.S.C. MEMOIR 96.

GSC 65-14 BIOTITE, K-AR AGE 151 + OR - 14 M.Y.

K=5.23 PERCENT, AR40/K40=0.0092, RADIOGENIC AR=74 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF TWO VARIETIES OF BIOTITE. ONE IS OLIVE-GREEN AND UNALTERED, THE OTHER IS OLIVE-GREEN, ALTERED AND BLEACHED IN PLACES. IN THIS SECOND VARIETY THE CHLORITE ALTERATION VARIES FROM SLIGHT TO COMPLETE, AND MOST OF THE FLAKES CONTAIN FINE HAIR-LIKE INCLUSIONS AND TINY OPAQUE BLEBS. TOTAL CHLORITE CONTENT IS ABOUT 30 PERCENT, HORNBLENDE LESS THAN 5 PERCENT.

FROM QUARTZ MONZONITE
(92 L) ROADCUT NEAR RAILWAY CROSSING, BRITISH COLUMBIA, 50-16-35 N, 126-51-21 W. MAP-UNIT 4, GSC MAP 1029 A. SAMPLE CT-A-25/7/64, COLLECTED AND INTERPRETED BY D. J. T. CARSON.

BRITISH COLUMBIA

FOR DESCRIPTION AND INTERPRETATION SEE GSC 65-15.

GSC 65-15 HORNBLENDE, K-AR AGE 143 + OR - 60 M.Y.

K=0.36 PERCENT, AR40/K40=0.0087 RADIOGENIC AR=24 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF SOMEWHAT ALTERED DARK GREEN HORNBLENDE. THE GRAINS CONTAIN FINE OPAQUE BLEBS (5 PERCENT) AND COLOURLESS BLEBS (1 PERCENT). THERE IS SOME ATTACHED BIOTITE (1 PERCENT).

FROM QUARTZ MONZONITE
(92 L) ROADCUT NEAR RAILWAY CROSSING, BRITISH COLUMBIA, 50-16-35 N, 126-51-21 W. MAP-UNIT 4, GSC MAP 1029 A. SAMPLE CT-A-25/7/64, COLLECTED AND INTERPRETED BY D. J. T. CARSON.

THIS HORNBLENDE AND THE BIOTITE OF GSC 65-14 ARE BOTH FROM THE SAME ROCK, A MEDIUM TO COARSE GRAINED, PALE PINK, HYPIDIOMORPHIC-GRANULAR BIOTITE-HORNBLENDE GRANODIORITE. IT CONTAINS 38.9 PERCENT SUBHEDRAL OSCILLATORY ZONED CLOUDED PLAGIOCLASE RANGING IN COMPOSITION FROM ALBITE TO SODIC ANDESINE, 18.8 PERCENT ANHEDRAL STRONGLY CLOUDED INTERSTITIAL POTASH FELDSPAR, 31.8 PERCENT ANHEDRAL MODERATELY STRAINED QUARTZ, 3.7 PERCENT ANHEDRAL TO EUHEDRAL PLEOCHROIC PALE YELLOWISH-BROWN TO DEEP BROWN BIOTITE, 4.6 PERCENT SUBHEDRAL TO EUHEDRAL POIKILITIC HORNBLENDE PLEOCHROIC FROM PALE YELLOWISH-BROWN TO DEEP GREENISH-BROWN, 0.6 PERCENT CHLORITE AFTER BIOTITE, 1.3 PERCENT IRON OXIDES, AND 0.3 PERCENT APATITE AND SPHENE. SOME QUARTZ AND HORNBLENDE CRYSTALS ARE UP TO 9 MM. IN DIAMETER AND LENGTH.

MOST BIOTITE GRAINS CONTAIN LESS THAN 10 PERCENT CHLORITE WHICH OCCURS AS STREAKS PARALLEL TO CLEAVAGE OR IN STYLOLITIC ARRANGEMENT ACROSS THE CLEAVAGE, BUT A FEW GRAINS ARE ALMOST ENTIRELY CHLORITIZED. SOME ARE BENT AND TORN ACROSS THEIR CLEAVAGE PLANES. IRON OXIDE STREAKS ARE COMMON IN THE BIOTITE AND SOME GRAINS CONTAIN EUHEDRAL INCLUSIONS OF APATITE AND UNALTERED HORNBLENDE.

HORNBLENDE CRYSTALS ARE MAINLY UNALTERED BUT CONTAIN NUMEROUS INCLUSIONS OF ALL OTHER MINERALS PRESENT IN THE ROCK. SOME HAVE THIN DISCONTINUOUS RIMS OF BIOTITE.

THIS MEDIUM TO COARSE GRAINED GRANODIORITE AND A MEDIUM GRAINED GRANODIORITE WHICH CONTAINS LESS POTASH FELDSPAR, FORM THE TWO MAJOR PHASES OF THE NIMPKISH BATHOLITH. THEY

INTRUDE ROCKS AS YOUNG AS LATE NORIAN. THE MEDIUM TO COARSE PHASE IS VERY COMMON IN THE VICINITY OF THE CONTACT METASOMATIC IRON DEPOSIT AT NIMPKISH IRON MINE AND IS CONSIDERED BY SANGSTER (1964) TO BE THE IMMEDIATE SOURCE OF THE IRON. THE SAMPLE WAS TAKEN FROM A LOCATION APPROXIMATELY ONE MILE NORTH OF THE MINE.

THE K-AR AGES ON BIOTITE (GSC 65-14) AND HORNBLENDE (GSC 65-15) ARE IN CLOSE AGREEMENT AND INDICATE A MID JURASSIC AGE FOR THE GRANODIORITE AND THE IRON DEPOSIT. THIS IS IN ACCORD WITH K-AR AGES FROM ANOTHER IRON DEPOSIT ON VANCOUVER ISLAND (BRYNNOR) AT WHICH PRE-ORE GRANODIORITE IS 167 + OR - 10 M.Y. AND A POST-ORE DYKE IS 121 + OR - 35 M.Y. (GSC 64-2 AND GSC 64-3).

REFERENCES-

GUNNING, H.C.
1930 GEOLOGY AND MINERAL DEPOSITS OF THE QUATSINO-NIMPKISH AREA, VANCOUVER ISLAND, BRITISH COLUMBIA. GSC SUMM. REPT. 1930 PT. A, PP. 94-143.

HOADLEY, J.W.
1954 GEOLOGY AND MINERAL DEPOSITS OF THE ZEBALLOS-NIMPKISH AREA, VANCOUVER ISLAND, B.C. GSC MEM. 272.

SANGSTER, D.F.
1964 THE CONTACT-METASOMATIC DEPOSITS OF SOUTHWESTERN B.C. PH.D. THESIS, UNIV. OF B.C. (SUBMITTED FOR PUBLICATION AS GSC BULLETIN).

BRITISH COLUMBIA

GSC 65-17 BIOTITE, K-AR AGE 162 + OR - 9 M.Y.

K=6.91 PERCENT, AR40/K40=0.0099, RADIOGENIC AR=79 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF SLIGHTLY ALTERED, OLIVE GREEN BIOTITE. THE FLAKES CONTAIN FINE, NEEDLE-LIKE, ORIENTATED INCLUSIONS, AND CHLORITE ALTERATION IS MAINLY ON THE EDGES OF THE FLAKES. IMPURITIES CONSIST OF HORNBLENDE (1 PERCENT) AND CHLORITE (10 PERCENT).

FROM GRANODIORITE
(92 F) ROADCUT ALONG HEBER RIVER, VANCOUVER ISLAND, BRITISH COLUMBIA, 49-49-15 N, 125-58-25 W. MAP-UNIT 8, GSC SUMM. REPT. 1930, PT. A (ALBERNIE NW QUARTER, H. C. GUNNING). SAMPLE MEKA 64-1, COLLECTED AND INTERPRETED BY J. E. MULLER.

THE ROCK IS MEDIUM GRAINED, PINK-GREY, EQUIGRANULAR HORNBLENDE BIOTITE QUARTZ MONZONITE, CONSISTING OF QUARTZ 33.5 PERCENT, K-FELDSPAR 20.8 PERCENT, PLAGIOCLASE 38.7 PERCENT, BIOTITE 1.7 PERCENT, HORNBLENDE 1.8 PERCENT, CHLORITE, EPIDOTE, MAGNETITE, APATITE 2.5 PERCENT.

TAKEN FROM THE CENTRAL VANCOUVER ISLAND BATHOLITH. FOR DISCUSSION SEE GSC 65-18.

BRITISH COLUMBIA

GSC 65-18 BIOTITE, K-AR AGE 166 + OR - 8 M.Y.

K=5.83 PERCENT, AR40/K40=0.0102, RADIOGENIC AR=77 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF ALTERED LIGHT-BROWN BIOTITE. THE CHLORITE ALTERTION IS IN CRACKS IN THE FLAKES AND AROUND THEIR EDGES. ALTERATION VARIES FROM SLIGHT TO INTENSE. HORNBLENDE CONTAMINATION AMOUNTS TO 3 PERCENT. TOTAL CHLORITE CONTENT IS 15 PERCENT.

FROM GRANODIORITE.

(92 F) LOGGING ROAD SOUTH OF UCONA RIVER, BETWEEN KUNLIN AND DONNER LAKES, VANCOUVER ISLAND, BRITISH COLUBIA, 49-43-30 N, 125-56-25 W. GSC MAP IN PREPARATION. SAMPLE MEKA 64-2, COLLECTED AND INTERPRETED BY J. E. MULLER.

THE ROCK IS MEDIUM-GRAINED, PINKISH-GREY, EQUIGRANULAR HORNBLENDE-BIOTITE GRANODIORITE CONSISTING OF QUARTZ(20.7 PERCENT), PLAGIOCLASE(49.7 PERCENT), BIOTITE(4.8 PERCENT), HORNBLENDE(1.8 PERCENT), MAGNETITE(1.1 PERCENT). IT WAS COLLECTED FROM THE CENTRAL VANCOUVER ISLAND BATHOLITH.

BOTH GSC 65-17 AND GSC 65-18 WERE COLLECTED AT DISTANCES BETWEEN ONE HALF MILE AND THREE MILES FROM CONTACTS OF THE BATHOLITH WITH KARMUTSEN (TRIASSIC) VOLCANIC ROCKS AND ARE PROBABLY WITHIN A FEW THOUSAND FEET FROM THE ERODED

BATHOLITH ROOF. THEY ARE IN CLOSE AGREEMENT WITH ONE ANOTHER AND WITH GSC 64-2 FROM THE KENNEDY LAKE AREA (167 M.Y.). THE DATE AGREES REMARKABLY WELL WITH THE MIDDLE JURASSIC AGE, DETERMINED BY JELETSKY (1954) BY STRATIGRAPHIC MEANS, FOR INTRUSIONS OF THE WEST COAST OF VANCOUVER ISLAND. IN THE ESPERANZA-KYUQUOT AREA HE FOUND THAT GRANITIC ROCKS HAD INTRUDED FOSSILIFEROUS STRATA OF EARLY JURASSIC AGE, BUT WERE PROBABLY OLDER THAN UPPER JURASSIC SEDIMENTS.

IN ADDITION, SEVERAL GRANITIC STOCKS OF TERTIARY AGE, DATED BY STRATIGRAPHIC RELATIONSHIPS AND/OR ISOTOPIC AGES, ARE ALSO KNOWN ON THE ISLAND.

GSC 65-19 BIOTITE, K-AR AGE 47 + OR - 5 M.Y.

K=8.14 PERCENT, AR40/K40=0.0028, RADIOGENIC AR=46 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED, OLIVE-GREEN BIOTITE WITH LESS THAN 1 PERCENT APATITE INCLUSIONS. THERE IS ABOUT 2 PERCENT CHLORITE ALTERATION ON FLAKE EDGES. CONTAMINATION CONSISTS OF 1 PERCENT HORNBLENDE AND 1 PERCENT MUSCOVITE AND QUARTZ.

FROM GRANITE
(93 D) NORTHEAST OF NOOSKULLA PEAK AT ELEVATION 5500 FT., BRITISH COLUMBIA, 52-49 N, 126-38 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE BT-31-03-64, COLLECTED AND INTERPRETED BY A. J. BAER.

THE ROCK IS A COARSE-GRAINED, LEUCOCRATIC GRANODIORITE CONTAINING ABOUT 35 PERCENT QUARTZ, 20 PERCENT FELDSPAR (2-INCH LONG MICROCLINE PORPHYROBLASTS), ABOUT 40 PERCENT ZONED PLAGIOCLASE (AN25) AND 5 PERCENT BIOTITE.

THE SAMPLE IS FROM A MASSIVE PLUTON THAT APPEARS TO BE THE YOUNGEST INTRUSIVE ROCK IN THE AREA. ITS AGE CORRESPONDS VERY WELL WITH THAT OF FIVE OTHER SAMPLES FROM THE COAST MOUNTAINS (43 M.Y.,GSC 65-29, 44 M.Y., GSC 65-30, 45 M.Y., GSC 64-9, 46 M.Y., GSC 65-32, 48 M.Y., GSC 64-12). THIS PERIOD PROBABLY REPRESENTS A TIME OF WIDESPREAD INTRUSION DURING EOCENE TIME.

BRITISH COLUMBIA

GSC 65-20 MUSCOVITE, K-AR AGE 55 + OR - 8 M.Y.

K=3.57 PERCENT, AR40/K40=0.0033, RADIOGENIC AR=51 PERCENT.

CONCENTRATE- IMPURE CONCENTRATE OF VERY FINE MUSCOVITE (35 PERCENT), QUARTZ (30 PERCENT), CHLORITE (20-30 PERCENT), FELDSPARS (5 PERCENT), AND MINOR OPAQUES. MOST GRAINS CONSIST OF INTERGROWN MUSCOVITE, QUARTZ AND CHLORITE.

FROM SCHIST
(82 N) AT ELEVATION 7,200 FT., 0.75 MILES NORTHEAST OF MOBERLY PASS, BRITISH COLUMBIA, 51-48 N, 117-58 W. MAP-UNIT 1A, GSC MAP 43-1962 (ROGERS PASS). SAMPLE WB-64-158-6, COLLECTED AND INTERPRETED BY J. O. WHEELER.

THE ROCK IS A GARNET-STAUROLITE-QUARTZ-MICA SCHIST COMPOSED MAINLY OF FINELY DIVIDED QUARTZ, PLAGIOCLASE AND MUSCOVITE. IT CONTAINS POIKILOBLASTS OF GARNET, STAUROLITE AND BIOTITE, AND BLACK, OPAQUE MINERALS ARE SCATTERED THROUGHOUT THE ROCK.

SEE GSC 65-21 (BIOTITE FROM THE SAME ROCK) FOR A GEOLOGICAL DISCUSSION OF THE AGES OBTAINED.

GSC 65-21 BIOTITE, K-AR AGE 96 + OR - 16 M.Y.

K=4.24 PERCENT, AR40/K40=0.0058, RADIOGENIC AR=45 PERCENT.

CONCENTRATE- IMPURE CONCENTRATE OF LIGHT BROWN, BLEACHED BIOTITE. BIOTITE FLAKES CONTAIN ABOUT 5 PERCENT COLOURLESS BLEBS AND LESS THAN 1 PERCENT OPAQUE INCLUSIONS. FLAKES ARE ALTERED TO CHLORITE ON THE EDGES, AND THE CONCENTRATE IS CONTAMINATED WITH INDIVIDUAL GRAINS OF CHLORITE AND SOME (5 PERCENT) QUARTZ AND FELDSPAR. TOTAL CHLORITE CONTENT IS 65 PERCENT.

FROM SCHIST
(82 N) AT ELEVATION 7,200 FT., 0.75 MILES NORTHEAST OF MOBERLY PASS, BRITISH COLUMBIA, 51-48 N, 117-58 W. MAP-UNIT 1A, GSC MAP 43-1962 (ROGERS PASS). SAMPLE WB-64-158-6, COLLECTED AND INTERPRETED BY

BRITISH COLUMBIA

J. O. WHEELER.

THE MUSCOVITE (GSC 65-20) OCCURS WITHIN THE GROUNDMASS, WHILE THE BIOTITE (GSC 65-21) OCCURS AS POIKILOBLASTS WITHIN A QUARTZ-PLAGIOCLASE-GARNET-STAUROLITE-MUSCOVITE SCHIST OF THE PROTEROZOIC HORSETHIEF CREEK GROUP ON THE WESTERN EDGE OF THE NORTHERN SELKIRK METAMORPHIC BELT. FROM SIMILAR POIKILOBLASTIC SCHISTS ON THE EAST SIDE OF THE BELT BIOTITE MEGACRYSTS GAVE AN AGE OF 146 M.Y. (GSC 62-53) WHEREAS MUSCOVITE IN THE MATRIX WAS DATED AT 205 M.Y. (GSC 62-54).

THE SAMPLE WAS CHOSEN TO SEE IF SIMILAR ROCKS ON THE WESTERN EDGE OF THE METAMORPHIC BELT MIGHT GIVE SUCH AN OLD AGE. FROM THIS POINT OF VIEW THE AGES ARE YOUNGER THAN EXPECTED. THE HIGHLY CHLORITIC NATURE OF BOTH THE BIOTITE AND MUSCOVITE, HOWEVER, IMPLY SUBSEQUENT ALTERATION WITH RESULTANT LOSS OF ARGON. IT SEEMS UNLIKELY THAT A LATER SUPERIMPOSED THERMAL EVENT WAS RESPONSIBLE FOR THE YOUNG AGES BECAUSE UPON HEATING BIOTITE WOULD LOSE ARGON MORE READILY THAN MUSCOVITE AND PRODUCE A YOUNGER AGE THAN THE LATTER. HENCE THE AGES PROBABLY DO NOT REFLECT REAL EVENTS.

GSC 65-22 BIOTITE, K-AR AGE 140 + OR - 9 M.Y.

K=6.87 PERCENT, AR40/K40=0.0085, RADIOGENIC AR=60 PERCENT.

CONCENTRATE- SLIGHTLY ALTERED KHAKI BIOTITE WITH ABOUT 5 PERCENT CHLORITE ALTERATION ON THE FLAKE EDGES. HORNBLENDE CONTAMINATION AMOUNTS TO ABOUT 2 PERCENT.

FROM QUARTZ MONZONITE

(92 P) WEST BANK OF CLEARWATER RIVER, 1 MILE SOUTH OF MOUTH OF MOUL CREEK, BRITISH COLUMBIA, 51-49-00 N, 120-03-30 W. MAP-UNIT 8A, GSC PAPER 65-1, P.69. SAMPLE 64-CA1B-3A, COLLECTED BY B. E. LOWES, INTERPRETED BY R. B. CAMPBELL.

FOR DESCRIPTION AND INTERPRETATION SEE GSC 65-23.

BRITISH COLUMBIA

GSC 65-23 BIOTITE, K-AR AGE 105 + OR - 9 M.Y.

K=7.55 PERCENT, AR40/K40=0.0063, RADIOGENIC AR=59 PERCENT.

CONCENTRATE- SLIGHTLY ALTERED AND BLISTERED DARK BROWN BIOTITE WITH ABOUT 1 PERCENT CHLORITE AND 2-3 PERCENT HORNBLENDE.
FROM QUARTZ MONZONITE
(92 P) 5 MILES NORTHWEST OF CLEARWATER STATION, BRITISH COLUMBIA, 51-41-20 N, 120-07-25 W. MAP-UNIT 8A, GSC PAPER 65-1, P. 69. SAMPLE 58-CASB-1, COLLECTED BY M. A. SMITH, INTERPRETED BY R. B. CAMPBELL.

BOTH ROCKS (GSC 65-22 AND 23) ARE PORPHYRITIC, MEDIUM TO COARSE-GRAINED, UNFOLIATED BIOTITE QUARTZ MONZONITES WITH MINOR HORNBLENDE. IRREGULAR TO ROUGHLY RECTANGULAR PHENOCRYSTS OF PERTHITIC ORTHOCLASE UP TO 10 MM. IN LENGTH ARE SET IN A MEDIUM-GRAINED MATRIX OF PLAGIOCLASE (ABOUT AN30), QUARTZ, AND BIOTITE WITH MINOR FINE-GRAINED HORNBLENDE, SPHENE, APATITE, AND OPAQUES.

THE SAMPLES WERE TAKEN FROM A BATHOLITH THAT IS SIMILAR IN TEXTURE, COMPOSITION AND TREND OF THE LONGEST DIMENSION TO A BATHOLITH ABOUT 20 MILES TO THE SOUTHEAST FROM WHICH K-AR AGES ON BIOTITE OF 96 + OR - 5 M.Y. (GSC 64-15) AND 80 + OR - 5 M.Y. (GSC 64-16) HAVE BEEN OBTAINED (GSC PAPER 65-17, 1966). THESE TWO AGES TOGETHER WITH ONE REPORTED HERE AT 105 + OR - 9 M.Y. MAY REFLECT THE AGE OF AN IMPORTANT PLUTONIC EVENT ABOUT 100 M.Y. AGO (LATE EARLY OR EARLY LATE CRETACEOUS), AN EVENT WELL REPRESENTED BY RADIOGENIC AGES FROM MANY PARTS OF THE WESTERN CORDILLERA. THE SECOND AGE REPORTED HERE AT 140 + OR - 9 M.Y. (LATE LATE JURASSIC) SEEMS ANOMALOUS AND NO EXPLANATION IS OFFERED FOR IT. IT MAY REPRESENT AN OLDER EVENT BUT NO FIELD OBSERVATIONS SUPPORT THIS POSSIBILITY.

SEE ALSO GSC 65-22.

GSC 65-24 BIOTITE, K-AR AGE 72 + OR - 5 M.Y.

K=7.33 PERCENT, AR40/K40=0.0043, RADIOGENIC AR=45 PERCENT.

CONCENTRATE- RELATIVELY CLEAN KHAKI BIOTITE. ABOUT 40 PERCENT OF THE FLAKES CONTAIN RAGGED,

COLOURLESS BLEBS, AND 5 PERCENT CONTAIN TINY OPAQUE INCLUSIONS. THERE IS SLIGHT CHLORITE ALTERATION ON THE EDGES OF MOST FLAKES, BUT TOTAL CHLORITE CONTENT AMOUNTS TO ONLY A TRACE. HORNBLENDE (LESS THAN 5 PERCENT) IS THE ONLY OTHER IMPURITY.

FROM GNEISS

(83 D) ONE MILE NORTH OF BULLDOG CREEK, ON EAST SIDE OF CANOE RIVER VALLEY, BRITISH COLUMBIA, 52-38 N, 118-59 W. MAP-UNIT A, GSC PAPER 6-1, P. 120. SAMPLE 3-CAHC-1, COLLECTED BY A. D. HEINE FOR R. B. CAMPBELL, INTERPRETED BY R. B. CAMPBELL.

THE ROCK IS A FINE-GRAINED, WELL-FOLIATED AND LINEATED, QUARTZO-FELDSPATHIC BIOTITIC GNEISS. QUARTZ, MICROCLINE, AND PLAGIOCLASE (ABOUT AN20) EACH COMPRISE ABOUT 30 PERCENT OF THE ROCK. VERY FINE BIOTITE, GARNET, ALLANITE, ZIRCON, AND OPAQUES MAKE UP THE REMAINDER.

THE GNEISS, WHICH OUTCROPS ON BOTH SIDES OF THE ROCKY MOUNTAIN TRENCH, IS DIFFERENT IN COMPOSITION AND GENERAL APPEARANCE FROM THE SURROUNDING METAMORPHOSED STRATA OF WINDERMERE AND EARLY PALEOZOIC AGES (SEE GSC PAPERS 65-1, P. 43, 65-2, P. 47, AND 66-1, P. 51 AND 116) IN THE CARIBOO, MONASHEE, AND ROCKY MOUNTAINS. THE BODY OF GNEISS IS APPARENTLY BOUNDED ON ALL SIDES BY FAULTS. THE GNEISS COULD REPRESENT A SEGMENT OF AN OLD CRYSTALLINE **BASEMENT**, BUT IF THIS IS SO, SUBSEQUENT THERMAL EVENTS HAVE MASKED THE AGE, AT LEAST INSOFAR AS K/AR AGE DETERMINATIONS ON BIOTITE IN THE SAMPLE COLLECTED ARE CONCERNED.

THE K/AR AGE ON THE BIOTITE OF 72 + OR - 5 M.Y. CORRESPONDS CLOSELY TO AGES OBTAINED FOR A BIOTITE-MUSCOVITE PAIR FROM METAMORPHOSED WINDERMERE ROCKS COLLECTED BY WHEELER FROM THE NORTHERN SELKIRK MOUNTAINS ABOUT 75 MILES TO THE SOUTHEAST (SEE GSC PAPER 63-17, PP. 34-36). AS WHEELER COMMENTS, RADIOGENIC AGE DATA ARE YET TOO FEW TO PERMIT ANY REALISTIC DETERMINATION OF THE SEQUENCE OF TECTONIC EVENTS. THE AGES OF ABOUT 72 M.Y. MAY DATE AN IMPORTANT TECTONIC AND METAMORPHIC EPISODE IN THE LATE CRETACEOUS NEAR THE ROCKY MOUNTAIN TRENCH, OR THEY MAY BE RELATED TO THE TIME THE ROCKS COOLED BELOW A CERTAIN CRITICAL TEMPERATURE PERHAPS THROUGH STRIPPING OF OVERLYING MATERIAL OR DEPRESSION OF GEOISOTHERMS.

BRITISH COLUMBIA

GSC 65-25 BIOTITE, K-AR AGE 166 + OR - 11 M.Y.

K=5.43 PERCENT, AR40/K40=0.0101, RADIOGENIC AR=67 PERCENT.

CONCENTRATE- CLEAN, MODERATELY ALTERED BIOTITE. ALL OF THE FLAKES ARE BLISTERED, SOME VERY HEAVILY. CHLORITE ALTERATION IS PRESENT ON THE EDGES OF MOST FLAKES, AND SOME FREE CHLORITE OCCURS AS AN IMPURITY. TOTAL CHLORITE CONTENT IS ABOUT 30 PERCENT.

FROM QUARTZ DIORITE

(92 P) NORTH SIDE OF YOUNG LAKE, BRITISH COLUMBIA, 51-15 N, 120-58 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE 4-4TD, COLLECTED AND INTERPRETED BY H. W. TIPPER.

THE SAMPLE WAS OBTAINED FROM A FRESH, COARSE-GRAINED BIOTITE GRANITE BATHOLITH. THE FIELD RELATIONS INDICATE THE GRANITE IS YOUNGER THAN TRIASSIC, POSSIBLY YOUNGER THAN LOWER JURASSIC, AND OLDER THAN TERTIARY.

THE K-AR AGE (166 + OR - 11 M.Y.) SUGGESTS THAT THIS BATHOLITH IS OF MIDDLE JURASSIC AGE. IN CENTRAL BRITISH COLUMBIA GRANITIC MASSES OF BATHONIAN (Q) AGE HAVE BEEN RECOGNIZED FROM STRATIGRAPHIC EVIDENCE. THE K-AR AGE OBTAINED FOR THIS MASS SUGGESTS THAT IT IS A BATHONIAN GRANITE.

GSC 65-26 BIOTITE, K-AR AGE 40 + OR - 5 M.Y.

K=7.55 PERCENT, AR40/K40=0.0024, RADIOGENIC AR=50 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF UNALTERED OLIVE-GREEN BIOTITE. ABOUT 5 PERCENT OF THE FLAKES ARE BLISTERED, AND MOST CONTAIN COLOURLESS PRISMATIC INCLUSIONS. CONTAMINATION WITH HORNBLENDE AMOUNTS TO 3 PERCENT.

FROM PORPHYRITIC DACITE

(92 P) RAYFIELD RIVER, BRITISH COLUMBIA, 51-23 N, 120-58 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE 2A-5TD, COLLECTED AND INTERPRETED BY H. W. TIPPER.

THIS SAMPLE IS FROM A PORPHYRITIC DACITE FLOW AND IS TYPICAL OF MANY FLOWS, DYKES, AND SILLS RELATED TO THE EARLY

BRITISH COLUMBIA

TERTIARY VOLCANIC ERUPTIONS OF CENTRAL BRITISH COLUMBIA. CORRELATIVES OF THIS FLOW OVERLIE EOCENE SEDIMENTS ELSEWHERE. THESE VOLCANIC ROCKS ARE OVERLAIN BY LATE MIOCENE OR PLIOCENE VOLCANIC FLOWS.

THE K-AR AGE (40 + OR - 5 M.Y.) OF THIS FLOW INDICATES IT IS LATE EOCENE OR EARLY OLIGOCENE AND THUS CONFIRMS THE STRATIGRAPHIC EVIDENCE.

GSC 65-27 BIOTITE, K-AR AGE 100 + OR - 6 M.Y.

K=7.62 PERCENT, AR40/K40=0.0060, RADIOGENIC AR=74 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF UNALTERED OLIVE-GREEN BIOTITE. MOST OF THE FLAKES ARE SLIGHTLY BLISTERED. HORNBLENDE CONTAMINATION AMOUNTS TO LESS THAN 2 PERCENT.

FROM QUARTZ DIORITE
(92 O) HILL NORTH OF POISON MTN., BRITISH COLUMBIA, 51-11 N, 122-35 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE 10PM-BO-TD, COLLECTED AND INTERPRETED BY H. W. TIPPER.

THE SAMPLE IS FROM A COARSE GRAINED BIOTITE GRANITE BOULDER IN A CONGLOMERATE OF APTIAN AGE. THE BOULDER IS DEEPLY WEATHERED AND THE CONGLOMERATE IS POORLY CONSOLIDATED. THE CONGLOMERATE SHOWS NO METAMORPHIC EFFECTS AND IS NOT NEAR ANY KNOWN YOUNGER IGNEOUS BODY EITHER VOLCANIC OR PLUTONIC. THE AGE OF THE CONGLOMERATE IS DATED AS APTIAN FROM FOSSIL FLORA. THE SOURCE OF THE GRANITIC BOULDER IS BELIEVED TO BE A NEARBY GRANITIC BATHOLITH OF PROBABLE BATHONIAN AGE.

THE BIOTITE FROM THE BOULDER INDICATES AN AGE WHICH IS TOO LOW SINCE THE CONGLOMERATE AGE IS KNOWN TO BE 106-112 M.Y. (APTIAN), AND THE CONTAINED BOULDERS MUST BE AT LEAST THIS OLD. FIELD EVIDENCE INDICATES THAT THE GRANITIC MASS FROM WHICH THIS BOULDER WAS DERIVED WAS BATHONIAN OR OLDER (162-167 M.Y. OR OLDER).

THE LOW K-AR BIOTITE AGE MAY POSSIBLY BE RELATED TO THE DEEPLY WEATHERED NATURE OF THE BOULDER.

BRITISH COLUMBIA

GSC 65-28 BIOTITE, K-AR AGE 70 + OR - 14 M.Y.

K=7.91 PERCENT, AR40/K40=0.0042, RADIOGENIC AR=60 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF COARSE, UNALTERED, OLIVE-GREEN TO DARK BROWN BIOTITE. A FEW OF THE FLAKES CONTAIN COARSE, COLOURLESS, PRISMATIC INCLUSIONS OF APATITE. ABOUT 3 PERCENT HORNBLENDE IS PRESENT.

FROM GRANODIORITE
(93 D) NORTH SIDE OF WAR DRUM GLACIER AT 6000 FT. ELEVATION, BRITISH COLUMBIA, 52-07 N, 126-18 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE HS-40-06-64, COLLECTED BY W. W. HUTCHISON, INTERPRETED BY A. J. BAER.

THE ROCK IS A MEDIUM-GRAINED, LIGHT GREY, UNFOLIATED BIOTITE HORNBLENDE GRANODIORITE CONTAINING ABOUT 25 PERCENT QUARTZ, 10 PERCENT K-FELDSPAR, 50 PERCENT PLAGIOCLASE (AN25-30), 10 PERCENT BIOTITE AND 5 PERCENT HORNBLENDE.

WITHIN LIMITS OF EXPERIMENTAL ERROR, THE AGE INDICATED HERE IS SIMILAR TO THOSE FOUND PREVIOUSLY FOR LABOUCHERE PLUTON (57 M.Y., GSC 64-10) AND ELLERSLIE LAKE PLUTON (77 M. Y., GSC 64-7 AND 8) OF THE BELLA COOLA AND LAREDO SOUND MAP -AREAS. FROM FIELD EVIDENCE, HOWEVER, THE SYNTECTONIC ELLERS-LIE LAKE PLUTON APPEARS TO BE OLDER THAN THE LATE- OR POST-TECTONIC LABOUCHERE AND WAR DRUM PLUTONS. ONE POSSIBLE EXPLANATION IS THAT THE THERMAL EVENT THAT AFFECTED THE REGION TOWARDS THE END OF CRETACEOUS TIME CAUSED A LOSS OF ARGON IN THE OLDER ELLERSLIE LAKE PLUTON. IN FACT THIS PLUTON CONTAINS TWO GENERATIONS OF BIOTITE THAT HAVE YIELDED THE SAME RADIOGENIC AGE, THUS SUGGESTING THAT THE OLDER BIOTITE LOST SOME OF ITS ARGON WHEN THE YOUNGER ONE CRYSTALLIZED (SEE GSC 64-7 AND 8). ANOTHER POSSIBILITY TO BE CONSIDERED IS THAT THE 70 M.Y. AGE OF THE WAR DRUM PLUTON IS A MIXED AGE AND DOES NOT CORRESPOND TO THE TIME OF EMPLACEMENT.

GSC 65-29 BIOTITE, K-AR AGE 43 + OR - 5 M.Y.

K=7.89 PERCENT, AR40/K40=0.0025, RADIOGENIC AR=59 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF LIGHT-BROWN BIOTITE. THE FLAKES CONTAIN LESS

THAN 5 PERCENT APATITE INCLUSIONS. HORNBLENDE CONTAMINATION AMOUNTS TO ABOUT 5 PERCENT.

FROM FOLIATED QUARTZ DIORITE.

(103 I) ROCK QUARRY EAST OF RAILWAY TUNNEL ON HIGHWAY 16, BRITISH COLUMBIA, 54-17-23 N, 129-24-36 W. MAP-UNIT 9B, GSC MAP 3-1965. SAMPLE BT-15-9-64, COLLECTED BY A. J. BAER, INTERPRETED BY W. W. HUTCHISON.

A COARSE-GRAINED, WELL-FOLIATED QUARTZ-DIORITE. THE TEXTURE IS GRANOBLASTIC BUT THE MAFIC MINERALS ARE PARTLY AGGREGATED IN STREAKS WHICH GIVE THE ROCK A SLIGHTLY GNEISSIC CHARACTER. THE PLAGIOCLASE CRYSTALS (AN 38) ARE NOT ZONED. QUARTZ FORMS COARSE, CLEAN CRYSTALS WITH UNIFORM EXTINCTION. NEITHER PLAGIOCLASE NOR QUARTZ SHOWS EVIDENCE OF SHEARING OR BENDING. THE MAFIC MINERALS COMPRISE BIOTITE AND HORNBLENDE.

THIS ROCK IS PART OF A MASS OF QUARTZ DIORITE AND GNEISSIC QUARTZ DIORITE THAT GRADES INTO AND DISPLAYS A COMPLEX INTERFINGERING WITH THE ENVELOPING GNEISS COMPLEX. THIS BODY APPEARS TO HAVE BEEN INVOLVED IN THE METAMORPHISM AND DEFORMATION OF THE SURROUNDING GNEISSES, DURING WHICH IT BEHAVED IN A PLASTIC MANNER. SOME FIELD EVIDENCE SUGGESTS THAT THE METAMORPHISM AND MOVEMENT OF THIS QUARTZ DIORITE TOOK PLACE PRIOR TO THE EMPLACEMENT OF THE ECSTALL PLUTON, YET THE K-AR DATE FOR THIS QUARTZ DIORITE IS 43 M.Y. AS OPPOSED TO THE 64 M.Y. DATE (GSC 65-31) OBTAINED FROM THE ECSTALL. EITHER THE GEOLOGICAL FIELD EVIDENCE HAS BEEN MISINTERPRETED OR SOME THERMAL EVENT HAS OCCURRED SINCE THE ORIGINAL CRYSTALLIZATION OF THE BIOTITE. SUPPORT FOR THE LATTER POSSIBILITY IS THE OCCURRENCE, LESS THAN 25 MILES NORTHEAST AND SOUTHEAST OF THE SAME LOCALITY, OF LARGE AREAS UNDERLAIN BY PLUTONIC ROCKS THAT HAVE YIELDED DATES OF 46 M.Y. (GSC 65-32) AND 44 M.Y. (GSC 65-30).

IT IS THEREFORE CONSIDERED UNLIKELY THAT THE 43 M.Y. AGE INDICATES THE TRUE AGE OF THE FORMATION AND/OR MOVEMENT OF THIS QUARTZ DIORITE. INSTEAD THIS AGE MAY BE RELATED TO A RISE IN TEMPERATURE CAUSED BY THE EMPLACEMENT OF LARGE BODIES OF PLUTONIC ROCK DATED AS EARLY TERTIARY.

GSC 65-30 BIOTITE, K-AR AGE 44 + OR - 4 M.Y.

K=7.18 PERCENT, AR40/K40=0.0026, RADIOGENIC AR=59 PERCENT.

CONCENTRATE- SOMEWHAT CONTAMINATED CONCENTRATE OF

OLIVE-GREEN BIOTITE. THE FLAKES ARE SLIGHTLY ALTERED TO CHLORITE AND CONTAIN LESS THAN 1 PERCENT COLOURLESS INCLUSIONS. ABOUT 1 PERCENT OF THE FLAKES ARE BLISTERED, AND HORNBLENDE AMOUNTS TO LESS THAN 10 PERCENT.

(103 I) FROM GRANODIORITE SOUTH OF SKEENA RIVER, BRITISH COLUMBIA, 54-04-38 N, 129-01-04 W. MAP-UNIT 10A, GSC MAP 3-1965. SAMPLE HS-46-10-64, COLLECTED AND INTERPRETED BY W. W. HUTCHISON.

A HOMOGENEOUS, POORLY FOLIATED, COARSE-GRAINED, GREY GRANODIORITE. PLAGIOCLASE CRYSTALS (AN33) ARE NOT ZONED BUT ARE COMMONLY BENT. POTASH FELDSPAR OCCURS BOTH AS PART OF THE QUARTZ-FELDSPAR INTERGRANULAR AGGREGATE AND AS COARSE PORPHYROBLASTIC CRYSTALS THAT LOCALLY EMBAY PLAGIOCLASE. QUARTZ CRYSTALS ARE COARSE AND ANHEDRAL. HORNBLENDE IS SLIGHTLY ALTERED TO EPIDOTE. BIOTITE IS PRESENT AS COARSE FLAKES FORMING APPROXIMATELY 7 PERCENT OF THE ROCK.

THE GRANODIORITE SAMPLE IS PART OF THE ALASTAIR LAKE PLUTON WHICH GRADES INTO AND IN PLACES OVERRIDES GNEISSES OF UNKNOWN AGE TO THE WEST, AND INTRUDES METAVOLCANIC ROCKS OF POSSIBLE MIDDLE JURASSIC (HAZELTON) AGE TO THE EAST. THE 44 M.Y. AGE IS NOT AT VARIANCE WITH THE KNOWN GEOLOGIC FEILD EVIDENCE AND MAY THEREFORE TRULY REPRESENT THE AGE OF THE BIOTITE OF THIS ROCK. A COMPARABLE AGE (46 M.Y. FOR GSC 65-32) OBTAINED FROM THE EXSTEW PLUTON WAS EXPECTED BECAUSE OF SIMILARITIES IN SOME STRUCTURAL AND PETROGRAPHIC FEATURES.

GSC 65-31 BIOTITE, K-AR AGE 64 + OR - 8 M.Y.

K=7.99 PERCENT, AR40/K40=0.0038, RADIOGENIC AR=67 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF OLIVE-GREEN BIOTITE. ABOUT 1 PERCENT OF THE FLAKES ARE BLISTERED, AND LESS THAN 1 PERCENT CONTAIN FINE COLOURLESS INCLUSIONS. HORNBLENDE (3 PERCENT) IS THE ONLY IMPURITY DETECTED.

(103 J) FROM QUARTZ DIORITE ON HIGHWAY 16 AT FIRST CORNER APPROXIMATELY 0.5 MILES EAST OF RAINBOW LAKE LODGE, BRITISH COLUMBIA, 54-13-53 N, 130-04-01 W. MAP-UNIT 9A, GSC MAP 3-1965. SAMPLE HS-01-5-64, COLLECTED AND INTERPRETED BY W. W. HUTCHISON.

BRITISH COLUMBIA

A LIGHT GREY, COARSE GRAINED, POORLY FOLIATED QUARTZ DIORITE WHICH IS TYPICALLY HOMOGENEOUS AND DEVOID OF INCLUSIONS THE HYPIDIOMORPHIC TEXTURE IS DEFINED BY COARSE CRYSTALS OF PLAGIOCLASE AND QUARTZ AND FINER CRYSTALS OF HORNBLENDE, BIOTITE AND EPIDOTE. THE PLAGIOCLASE CRYSTALS (AN38) EXHIBIT SLIGHT NORMAL ZONING, THEY ARE NEITHER STRAINED OR SHEARED. THE EPIDOTE FORMS ISOLATED, SUBHEDRAL CRYSTALS THAT DO NOT APPEAR TO BE PSEUDOMORPHS OR ALTERATIONS OF OTHER MINERALS.

THE QUARTZ DIORITE IS PART OF THE **HEAD** OF THE ECSTALL PLUTON (APPROXIMATELY 70 BY 15 MILES) WHICH WAS FORCIBLY INTRUDED NORTHWARDS INTO METASEDIMENTS OF UNKNOWN AGE SOUTHEAST OF PRINCE RUPERT. THE METAMORPHISM OF THESE SEDIMENTS PRE-DATES THE EMPLACEMENT OF THIS PLUTON. THE BIOTITE AGE DOES NOT CONTRADICT ANY KNOWN GEOLOGICAL INFORMATION, ACCORDINGLY IT IS TENTATIVELY ACCEPTED AS A MINIMUM AGE FOR THIS PART OF THE ECSTALL PLUTON.

GSC 65-32 BIOTITE, K-AR AGE 46 + OR - 10 M.Y.

K=7.88 PERCENT, AR40/K40=0.0028, RADIOGENIC AR=59 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF UN-ALTERED OLIVE-GREEN BIOTITE. THE FLAKES CONTAIN 1 PERCENT FINE COLOURLESS, PRISMATIC INCLUSIONS. IMPURITIES ARE HORNBLENDE (2 PERCENT), QUARTZ-FELDSPAR (LESS THAN 5 PERCENT).

FROM GRANODIORITE.

(103 I) BRITISH COLUMBIA, 54-38-24 N, 129-02-04 W. MAP-UNIT 10A, GSC MAP 3-1965. SAMPLE HS-46-27-64, COLLECTED AND INTERPRETED BY W. W. HUTCHISON.

A MASSIVE, COARSE-GRAINED, PALE BUFF-WEATHERING GRANO-DIORITE WHICH IS QUITE HOMOGENEOUS AND DEVOID OF INCLUSIONS. POTASH FELDSPAR PORPHYROBLASTS AND BIOTITE CRYSTALS ARE SLIGHTLY COARSER THAN THE EQUIGRANULAR TEXTURE OF MOST OF THE ROCK. ONLY SOME OF THE PLAGIOCLASE CRYSTALS (AVERAGE COMPOSITION AN28) EXHIBIT A POORLY DEFINED OSCILLATORY ZONING. MOST PLAGIOCLASE CRYSTALS ARE EMBAYED AND/OR ENVELOPED BY POTASH FELDSPAR, AND MYRMEKITE IS COMMONLY PRESENT AT THE CONACTS BETWEEN THESE FELDSPARS. QUARTZ FORMS COARSE, ANHEDRAL CRYSTALS WITH UNIFORM EXTINCTION. BIOTITE AND HORNBLENDE, ALONG WITH ACCESSORY MAGNETITE, SPHENE AND APATITE, FORM THE MAFIC CONSTITUENTS.

THIS SPECIMEN WAS COLLECTED LESS THAN A QUARTER MILE FROM THE EASTERN CONACT OF THE EXSTEW PLUTON WHERE UPPER JURASSIC-

BRITISH COLUMBIA

LOWER CRETACEOUS (BOWSER GROUP) SEDIMENTS ARE INTRUDED BY GRANODIORITE. THE EARLY TERTIARY K-AR DATE IS IN AGREEMENT WITH THE LATE CRETACEOUS-EARLY TERTIARY AGE INDICATED BY THE FIELD EVIDENCE FOR THE EMPLACEMENT OF THIS PLUTON.

GSC 65-33 WHOLE ROCK, K-AR AGE 153 + OR - 16 M.Y.

K=3.90 PERCENT, AR40/K40=0.0093, RADIOGENIC AR=88 PERCENT.
CONCENTRATE- CRUSHED WHOLE ROCK.

(82 G) FROM MICROADAMELLITE PEBBLE 13 MILES SOUTHEAST OF FERNIE, BRITISH COLUMBIA, 49-23 N, 114-52 W. MAP-UNIT **BLAIRMORE GROUP**, GSC MAP 35-1961 (FERNIE, EAST HALF) AND GSC MAP 11-1960 (FERNIE, WEST HALF). SAMPLE M-17, COLLECTED BY D. K. NORRIS, DESCRIBED BY R. D. STEVENS.

THE ROCK IS A MICROADAMELLITE PEBBLE FROM THE MCDOUGALL-SEGUR CONGLOMERATE. IT CONSISTS OF 30 PERCENT QUARTZ, 40 PERCENT PLAGIOCLASE, 25 PERCENT ORTHOCLASE, AND 5 PERCENT HIGHLY ALTERED FERROMAGNESIAN MINERALS AND IRON OXIDES. AVERAGE GRAIN SIZE IS ABOUT 1 MM.

SEE GSC 65-93 FOR A GEOLOGICAL INTERPRETATION OF THE AGE OBTAINED.

YUKON TERRITORY

GSC 65-34 BIOTITE, K-AR AGE 90 + OR - 6 M.Y.

K=7.33 PERCENT, AR40/K40=0.0054, RADIOGENIC AR=65 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF REDDISH-BROWN BIOTITE. MOST FLAKES CONTAIN COLOURLESS PRISMATIC INCLUSIONS WHICH ARE SURROUNDED BY PLEOCHROIC HALOS. THERE IS ABOUT 15 PERCENT CHLORITE ALTERATION ON FLAKE-EDGES, AND AND A FEW FLAKES ARE BLISTERED. MINOR IMPURITIES CONSIST OF 5 PERCENT ATTACHED QUARTZ-FELDSPAR AND 3 PERCENT HORNBLENDE. TOTAL CHLORITE CONTENT IS 15 PERCENT.

FROM QUARTZ MONZONITE
(105 F) TWO MILES SOUTHWEST OF THE SOUTHWEST END OF PLEASANT LAKE, YUKON TERRITORY, 61-35-30 N, 133-26-30 W. MAP-UNIT 9, GSC MAP 7-1960. SAMPLE RD64-1029B, COLLECTED AND INTERPRETED BY J. A. RODDICK.

THE ROCK IS A MEDIUM- TO COARSE-GRAINED, BIOTITE QUARTZ MONZONITE, COMPOSED OF ABOUT 40 PERCENT QUARTZ, 25 PERCENT PLAGIOCLASE, 25 PERCENT K-FELDSPAR, 10 PERCENT BIOTITE, AND MINOR MAGNETITE AND CHLORITE. K-FELDSPAR FORMS LARGE CRYSTALS THAT MAKE THE ESTIMATE OF ITS ABUNDANCE UNRELIABLE.

SEE DISCUSSION FOLLOWING GSC 65-35.

GSC 65-35 BIOTITE, K-AR AGE 90 + OR - 6 M.Y.

K=7.14 PERCENT, AR40/K40=0.0054, RADIOGENIC AR=65 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF GREENISH-BROWN BIOTITE. LESS THAN 5 PERCENT OF THE FLAKES CONTAIN COLOURLESS INCLUSIONS (PROBABLY APATITE), AND ABOUT 2 PERCENT ARE SLIGHTLY ALTERED TO CHLORITE ON THE EDGES. CHLORITE IS ALSO FOUND AS SEPARATE GRAINS. TOTAL CHLORITE CONTENT IS 5 PERCENT. OTHER IMPURITIES CONSIST OF LESS THAN 3 PERCENT QUARTZ-FELDSPAR AND HORNBLENDE.

FROM GRANITE.
(105 F) FIVE MILES SOUTHEAST OF MOUTH OF TWIN CREEK, YUKON TERRITORY, 61-46 N, 133-26-30 W. MAP-UNIT 9, GSC

MAP 7-1960. SAMPLE RD 64-1030A, COLLECTED AND INTERPRETED BY J. A. RODDICK.

THE ROCK IS A COARSE-GRAINED BIOTITE GRANITE, COMPOSED OF ABOUT 35 PERCENT QUARTZ, 40 PERCENT K-FELDSPAR, 18 PERCENT PLAGIOCLASE, 2 PERCENT BIOTITE. MOST OF THE PLAGIOCLASE IS ALTERED TO SERICITE AND CLAY MINERALS.

GSC 65-34 AND 35 ARE DETERMINATIONS MADE FROM TWO SAMPLES COLLECTED ABOUT 15 MILES APART IN THE NORTH BIG SALMON RIVER CRYSTALLINE BELT. THEY YIELDED IDENTICAL UPPER CRETACEOUS DATES OF 90 + OR - 6 M.Y. THIS AGE IS ESSENTIALLY THE SAME AS THAT OBTAINED FROM THE ANVIL BATHOLITH (SEE GSC 65-41 AND 43) WHICH LIES ON THE OPPOSITE SIDE (NORTHEAST) OF THE TINTINA TRENCH, AND SOMEWHAT YOUNGER THAN THAT OBTAINED FROM THE ITSI MOUNTAINS PLUTON (96 M.Y.) AND THE NORTHERN END OF THE CASSIAR BATHOLITH (98 M.Y. (2) AND 126 M.Y. (3)) BUT OLDER THAN THE MOUNT SELOUS PLUTON (ABOUT 79 M.Y.) THIS DOES NOT CONFLICT WITH ANY KNOWN GEOLOGICAL DATA.

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GSC 65-36 BIOTITE, K-AR AGE 91 + OR - 5 M.Y.

K=7.28 PERCENT, AR40/K40=0.0055, RADIOGENIC AR=71 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF SLIGHTLY ALTERED REDDISH-BROWN BIOTITE. THE FLAKES CONTAIN LESS THAN 5 PERCENT COLOURLESS INCLUSIONS WHICH ARE SURROUNDED BY WEAK PLEOCHROIC HALOS. MINOR IMPURITIES ARE HORNBLENDE (5 PERCENT), AND CHLORITE (2 PERCENT).

FROM BIOTITE-HORNBLENDE SCHIST.
(105 F) TWO MILES NORTHEAST OF NORTHEAST END OF PLEASANT LAKE, YUKON TERRITORY, 61-40 N, 133-20 W. MAP-UNIT C, GSC MAP 7-1960. SAMPLE RD 64-1029A, COLLECTED AND INTERPRETED BY J. A. RODDICK.

THE ROCK IS A QUARTZ-FELDSPAR-BIOTITE-HORNBLENDE SCHIST, COMPOSED OF ABOUT 30 PERCENT QUARTZ, 30 PERCENT PLAGIOCLASE, 20 PERCENT BIOTITE, 20 PERCENT HORNBLENDE, AND MINOR AMOUNTS OF SPHENE, MAGNETITE, AND APATITE. TEXTURE IS IRREGULAR, WITH BIOTITE PROVIDING MOST OF THE FOLIATION. THERE IS A SLIGHT SEGREGATION INTO MAFIC-RICH AND FELSIC-RICH BANDS. PLAGIOCLASE COMMONLY CONTAINS SMALL GRANULES OF QUARTZ.

THIS SCHIST IS CLOSELY ASSOCIATED WITH THE PLUTONIC ROCKS IN NORTH BIG SALMON RIVER AREA AND THE 91 M.Y. DATE IS ESSENTIALLY THE SAME AS FOR THE PLUTONIC ROCK (SEE GSC 65-34 AND 35). THE SCHISTS ARE CUT BY THE PLUTONIC ROCK. WHETHER THEY WERE METAMORPHOSED PREVIOUS TO INTRUSION IS NOT KNOWN BUT SEEMS PROBABLE. IF SO, RADIOGENIC EVIDENCE OF THE ORIGINAL METAMORPHISM HAS BEEN DESTROYED BY THE LATER THERMAL EVENT.

GSC 65-37 AMPHIBOLE, K-AR AGE 83 + OR - 26 M.Y.

K=0.29 PERCENT, AR40/K40=0.0050, RADIOGENIC AR=12 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF UNALTERED, BROWNISH-GREEN AMPHIBOLE OF THE TREMOLITE-ACTINOLITE SERIES.

FROM GNEISS
(105 F) TWO MILES EAST OF GAP BETWEEN PONY LAKES, YUKON TERRITORY, 61-41 N, 133-16 W. MAP-UNIT C, GSC MAP 7-1960. SAMPLE RD64-1030, COLLECTED AND INTERPRETED BY J. A. RODDICK.

THE ROCK IS A FINE- TO MEDIUM-GRAINED HORNBLENDE-PLAGIOCLASE GNEISS, COMPOSED OF ABOUT 50 PERCENT TREMOLITE-ACTINOLITE, 40 PERCENT PLAGIOCLASE, AND 10 PERCENT QUARTZ. NO BIOTITE IS PRESENT IN THE THIN SECTION.

THIS GNEISS IS IN THE NORTH BIG SALMON RIVER CRYSTALLINE BELT BUT FARTHER FROM EXPOSED PLUTONIC ROCK THAN GSC 65-36. AS THE 83 + OR - 26 M.Y. DATE HAS BROAD LIMITS OF ERROR, THE DISCREPANCY WITH THE 90 M.Y. DATE (SEE GSC 65-34 AND 35) OBTAINED FROM THE PLUTONIC ROCK IN THE BELT

IS PROBABLY NOT SIGNIFICANT.

GSC 65-38 BIOTITE, K-AR AGE 83 + OR - 7 M.Y.

K=6.85 PERCENT, AR40/K40=0.0050, RADIOGENIC AR=66 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF KHAKI BIOTITE WITH ABOUT 15 PERCENT CHLORITE ALTERATION ON THE EDGES OF THE FLAKES. ABOUT 5 PERCENT OF THE FLAKES CONTAIN FINE COLOURLESS INCLUSIONS SURROUNDED BY WEAK PLEOCHROIC HALOES. MINOR IMPURITIES CONSIST OF 5 PERCENT ATTACHED QUARTZ-FELDSPAR AND 3 PERCENT HORNBLENDE. TOTAL CHLORITE CONTENT IS 15 PERCENT.

FROM QUARTZ MONZONITE
(105 K) ON RIDGE SOUTH OF EAST END OF LAKE SOUTH OF MOUNT SELOUS, YUKON TERRITORY, 62-57 N, 132-30 W. MAP-UNIT 11, GSC MAP 13-1961. SAMPLE RD64-1025A, COLLECTED AND INTERPRETED BY J. A. RODDICK.

THE ROCK IS AN UNEVEN TEXTURED, MEDIUM TO COARSE-GRAINED BIOTITE QUARTZ MONZONITE. IT CONSISTS OF ABOUT 35 PERCENT QUARTZ, 35 PERCENT K-FELDSPAR, 20 PERCENT PLAGIOCLASE, AND MINOR AMOUNTS OF MUSCOVITE, CHLORITE, SERICITE, CLAY MINERALS, AND HORNBLENDE.

SEE DISCUSSION FOLLOWING GSC 65-40.

GSC 65-39 BIOTITE, K-AR AGE 81 + OR - 10 M.Y.

K=6.04 PERCENT, AR40/K40=0.0084, RADIOGENIC AR=57 PERCENT.

CONCENTRATE- LIGHT BROWN BIOTITE. ABOUT 5 PERCENT OF THE FLAKES ARE ALTERED TO CHLORITE ON THE EDGES AND ABOUT 1 PERCENT CONTAIN ROD-LIKE COLOURLESS INCLUSIONS. THE CONCENTRATE IS CONTAMINATED WITH 5 PERCENT HORNBLENDE, 1-5 PERCENT FREE CHLORITE, AND 5 PERCENT QUARTZ-FELDSPAR. TOTAL CHLORITE CONTENT IS 15 PERCENT.

FROM GRANODIORITE

YUKON TERRITORY

(105 K) ON RIDGE ABOUT 4.5 MILES NORTHWEST OF THE LAKE EAST-NORTHEAST OF THE MOUTH OF RIDDELL RIVER, YUKON TERRITORY, 62-54 N, 132-27 W. MAP UNIT 11, GSC MAP 13-1961. SAMPLE RD 64-1025C, COLLECTED AND INTERPRETED BY J. A. RODDICK.

THE ROCK IS A MEDIUM-GRAINED, BIOTITE-HORNBLENDE GRANODIORITE CONSISTING OF ABOUT 40 PERCENT PLAGIOCLASE, 30 PERCENT QUARTZ, 15 PERCENT K-FELDSPAR, 7 PERCENT BIOTITE, 5 PERCENT HORNBLENDE, AND 3 PERCENT CHLORITE. MINOR AMOUNTS OF APATITE, MAGNETITE AND **TOURMALINE** ARE PRESENT. ABOUT ONE QUARTER OF THE BIOTITE CRYSTALS ARE ALTERED TO CHLORITE.

SEE DISCUSSION FOLLOWING GSC 65-40.

GSC 65-40 BIOTITE, K-AR AGE 74 + OR - 7 M.Y.

K=6.20 PERCENT, AR40/K40=0.0044, RADIOGENIC AR=60 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF BLISTERED REDDISH-BROWN BIOTITE. ALMOST ALL OF THE FLAKES CONTAIN ROD-LIKE COLOURLESS INCLUSIONS APATITE(Q) WHICH ARE SURROUNDED BY PLEOCHROIC HALOS. ABOUT 10 PERCENT OF THE FLAKES CONTAIN HAIR-LIKE OPAQUE INCLUSIONS. ALMOST ALL MICA FLAKES SHOW SOME ALTERATION TO CHLORITE, AND GRAINS OF FREE CHLORITE ARE ALSO PRESENT. TOTAL CHLORITE CONTENT IS 20 PERCENT, AND HORNBLENDE CONTAMINATION AMOUNTS TO LESS THAN 3 PERCENT.

FROM QUARTZ MONZONITE

(105 K) RIDGE 2.5 MILES SOUTHEAST OF EAST END OF LAKE SOUTH OF MOUNT SELOUS, YUKON TERRITORY, 62-56 N, 132-27 W. MAP-UNIT 11, GSC MAP 13-1961. SAMPLE RD64-1025B, COLLECTED AND INTERPRETED BY J. A. RODDICK.

THE ROCK IS A MEDIUM TO COARSE-GRAINED BIOTITE QUARTZ MONZONITE CONSISTING OF ABOUT 30 PERCENT QUARTZ, 25 PERCENT PLAGIOCLASE, 40 PERCENT K-FELDSPAR, 5 PERCENT BIOTITE, AND MINOR MUSCOVITE, GARNET, AND CHLORITE. THE K-FELDSPAR FORMS LARGE CRYSTALS WHICH MAKE ITS ABUNDANCE DIFFICULT TO DETERMINE FROM A THIN SECTION.

GSC 65-38, 39, AND 40 WERE COLLECTED FROM THE MOUNT SELOUS PLUTON. THE THREE DATES, 83 + OR - 7 M.Y., 81 + OR -

10 M.Y. AND 74 + OR - 7 M.Y. INDICATE AN UPPER CRETACEOUS AGE. THIS IS SOMEWHAT YOUNGER THAN THE 96 M.Y. DATE OBTAINED FROM THE ITSI MOUNTAINS PLUTON ABOUT 90 MILES TO THE EAST. AS ONLY PALEOZOIC AND OLDER ROCKS ARE CUT BY THE MOUNT SELOUS PLUTON THE UPPER CRETACEOUS AGE DOES NOT CONFLICT WITH ANY KNOWN GEOLOGICAL DATA.

GSC 65-41 BIOTITE, K-AR AGE 90 + OR - 5 M.Y.

K=7.90 PERCENT, AR40/K40=0.0054, RADIOGENIC AR=71 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF DARK REDDISH-BROWN TO LIGHT REDDISH-BROWN BIOTITE. ALL FLAKES ARE SLIGHTLY BLISTERED, AND THERE IS SOME PATCHY CHLORITE ALTERATION. MOST FLAKES CONTAIN DARK PLEOCHROIC HALOS, MANY OF WHICH SURROUND APATITE INCLUSIONS. IMPURITIES CONSIST OF HORNBLENDE (5 PERCENT) AND CHLORITE (2 PERCENT).

FROM QUARTZ MONZONITE
(105 K) ANVIL BATHOLITH, YUKON TERRITORY, 62-27 N, 133-27-30 W. MAP UNIT 11, GSC MAP 13-1961. SAMPLE RD64-1003, COLLECTED AND INTERPRETED BY J. A. RODDICK.

THE ROCK IS A FINE- TO MEDIUM-GRAINED BIOTITE QUARTZ MONZONITE, COMPOSED OF ABOUT 30 PERCENT QUARTZ, 30 PERCENT PLAGIOCLASE, 30 PERCENT K- FELDSPAR, 7 PERCENT BIOTITE, SERICITE AND 3 PERCENT MINOR MINERALS. TEXTURE IS UNEVEN. SOME OF THE PLAGIOCLASE IS ALTERED TO SERICITE AND CLAY MINERALS, AND SOME OF THE BIOTITE TO CHLORITE.

SEE DISCUSSION FOLLOWING GSC 65-43.

GSC 65-42 MUSCOVITE, K-AR AGE 79 + OR - 6 M.Y.

K=8.49 PERCENT, AR40/K40=0.0047, RADIOGENIC AR=66 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF COARSE MUSCOVITE WITH OCCASIONAL BIOTITE INCLUSIONS BETWEEN MUSCOVITE PLATES. 10-15 PERCENT OF THE MUSCOVITE FLAKES CONTAIN HAIR-LIKE INCLUSIONS, AND ALL ARE

BLISTERED AND SLIGHTLY IRON-STAINED. MINOR IMPURITIES ARE BIOTITE 3 PERCENT, QUARTZ-FELDSPAR 1 PERCENT.

FROM QUARTZ MONZONITE
(105 K) ANVIL BATHOLITH NEAR MT. MYE, YUKON TERRITORY, 62-17 N, 133-03 W. MAP-UNIT 11, GSC MAP 13-1961. SAMPLE RD64-1011, COLLECTED AND INTERPRETED BY J. A. RODDICK.

THE ROCK IS A MEDIUM- TO COARSE-GRAINED MUSCOVITE-BIOTITE QUARTZ MONZONITE, COMPOSED OF ABOUT 50 PERCENT QUARTZ, 20 PERCENT K-FELDSPAR, 15 PERCENT PLAGIOCLASE, 10 PERCENT MUSCOVITE, 3 PERCENT BIOTITE, AND 2 PERCENT MINOR ITEMS. IT IS AN IRREGULAR TEXTURED ROCK WITH CONSIDERABLE FINE-GRAINED QUARTZ, AND A WEAK FOLIATION.

GSC 65-42 IS A MUSCOVITE FROM THE SAME SAMPLE THAT PROVIDED BIOTITE GSC 65-43. THE MUSCOVITE GAVE A YOUNGER DATE (79 + OR - 6 M.Y.) THAN THE BIOTITE (87 + OR - 5 M.Y.). THIS CONFORMS WITH THE APPARENT ORDER OF CRYSTALLIZATION AS SEEN IN THIN SECTION.

GSC 65-43 BIOTITE, K-AR AGE 87 + OR - 5 M.Y.

K=7.47 PERCENT, AR40/K40=0.0052, RADIOGENIC AR=71 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF COARSE REDDISH-BROWN BIOTITE. MOST OF THE FLAKES ARE BLISTERED AND CONTAIN VERY FINE OPAQUE BLEBS, AND ABOUT HALF CONTAIN PLEOCHROIC HALOS. ABOUT 5 PERCENT OF THE MICA IS ALTERED TO CHLORITE ON THE EDGES, AND HORNBLENDE CONSTITUTES 3 PERCENT OF THE CONCENTRATE. TOTAL CHLORITE CONTENT IS ABOUT 5 PERCENT.

FROM QUARTZ MONZONITE
(105 K) ANVIL BATHOLITH NEAR MT. MYE, YUKON TERRITORY, 62-17 N, 133-03 W. MAP-UNIT 11, GSC MAP 13-1961. SAMPLE RD64-1011, COLLECTED AND INTERPRETED BY J. A. RODDICK.

THE ROCK IS A MEDIUM- TO COARSE-GRAINED MUSCOVITE-BIOTITE QUARTZ MONZONITE, COMPOSED OF ABOUT 50 PERCENT QUARTZ, 20 PERCENT K-FELDSPAR, 15 PERCENT PLAGIOCLASE, 10 PERCENT MUSCOVITE, 3 PERCENT BIOTITE, AND 2 PERCENT MINOR MINERALS.

IT IS AN IRREGULAR TEXTURED ROCK WITH CONSIDERABLE FINE-GRAINED QUARTZ, AND A WEAK FOLIATION.

THE TWO AGE DETERMINATIONS MADE FROM BIOTITE IN THE QUARTZ MONZONITE OF THE ANVIL BATHOLITH (GSC 65-41, 90 + OR - 5 M.Y., GSC 65-43, 87 + OR - 5 M.Y.) ARE IN CLOSE AGREEMENT WITH EACH OTHER AND WITH THE DETERMINATIONS MADE FROM THE NORTH BIG SALMON RIVER PLUTONIC BELT SOUTHWEST OF TINTINA TRENCH. THE ANVIL BATHOLITH APPEARS TO BE SOMEWHAT YOUNGER THAN THE ITSI MOUNTAINS PLUTON (96 M.Y.) AND SOMEWHAT OLDER THAN THE MOUNT SELOUS PLUTON (ABOUT 79 M.Y., SEE GSC 65-40) BUT ALL ARE UPPER CRETACEOUS.

GSC 65-44 BIOTITE, K-AR AGE 86 + OR - 6 M.Y.

K=5.44 PERCENT, AR40/K40=0.0051, RADIOGENIC AR=61 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF DARK BROWN (ONE THIRD) AND YELLOW-BROWN (TWO THIRDS) BIOTITE. THE DARK BROWN VARIETY IS ALMOST UNALTERED AND CONTAINS COLOURLESS PRISMATIC INCLUSIONS WHICH ARE SURROUNDED BY PLEOCHROIC HALOS. THE YELLOW-BROWN VARIETY IS SOMEWHAT ALTERED. IMPURITIES CONSIST OF HORNBLENDE (3 PERCENT) AND CHLORITE (15 PERCENT).

FROM DACITE
(105 K) FROM NEAR BASE OF THE TAY FORMATION, YUKON TERRITORY, 62-15-30 N, 132-03-30 W. MAP-UNIT 14, GSC MAP 13-1961. SAMPLE RD64-1008C, COLLECTED AND INTERPRETED BY J. A. RODDICK.

THE ROCK IS A DACITIC QUARTZ-FELDSPAR-BIOTITE PORPHYRY, CONSISTING OF ABOUT 40 PERCENT PHENOCRYSTS AND 60 PERCENT MATRIX. THE PHENOCRYSTS ARE PLAGIOCLASE (20 PERCENT), QUARTZ (13 PERCENT), BIOTITE (7 PERCENT), AND MINOR SMALLER GRAINS OF KYANITE (Q). THE MATRIX IS EXTREMELY FINE-GRAINED FELSIC MATERIAL, LOCALLY WITH VAGUELY DEFINED LARGER GRANULAR PATCHES. QUARTZ PHENOCRYSTS ARE ROUNDED AND DEEPLY EMBAYED BY THE MATRIX. PLAGIOCLASE IS SIMILARILY AFFECTED, BUT MUCH LESS SO. QUARTZ PARTICULARILY IS HIGHLY FRACTURED, ALMOST CERTAINLY AS A RESULT OF HEATING. LARGE BIOTITE CRYSTALS ARE OF THE DEEP REDDISH-BROWN VARIETY SIMILAR TO THOSE IN THE MT. MYE FORMATION. NO K-FELDSPAR PHENOCRYSTS ARE PRESENT. THE ROCK IS APPARENTLY A PARTLY MELTED, COARSELY CRYSTALLINE METAMORPHIC ROCK. THE LACK OF K-FELDSPAR AND PRESENCE OF KYANITE INDICATE THAT THE ORIGINAL ROCK WAS PART

OF THE MT. MYE FORMATION RATHER THAN THE ANVIL BATHOLITH.

THE TAY FORMATION CONSISTS OF MORE THAN 5,000 FEET OF DACITIC AND ANDESITIC FLOWS. THE BASAL PART IS COARSE-GRAINED AND PRACTICALLY INDISTINGUISHABLE FROM ADJACENT PARTS OF THE ANVIL BATHOLITH. THE AGE OF 86 + OR - 6 M.Y. OBTAINED FROM THE BASAL PART OF THE TAY FORMATION IS ESSENTIALLY THE SAME AS THAT OBTAINED FROM THE ANVIL BATHOLITH (SEE GSC 65-41 AND 43). THE UPPER PARTS OF THE TAY FORMATION, HOWEVER, YIELDED DATES OF 100 AND 117 M.Y. THIS SUGGESTS THAT THE ANVIL BATHOLITH INTRUDES THE BASE OF THE TAY FORMATION AND HAS RESET THE RADIOGENIC **CLOCK** TO CONFORM WITH THAT OF THE PLUTONIC ROCK. FIELD WORK FAILED TO FIND ANY CROSS-CUTTING RELATIONS INVOLVING TAY FORMATION AND ANVIL PLUTONIC ROCKS, AND THE SLIGHT DEFORMATION OF THE TAY FORMATION LEFT THE IMPRESSION THAT IT WAS YOUNGER THAN THE BATHOLITH. THE ISOTOPIC AGE DETERMINATION SUGGESTS THAT THE REVERSE IS TRUE.

GSC 65-45 BIOTITE, K-AR AGE 99 + OR - 5 M.Y.

K=7.42 PERCENT, AR40/K40=0.0059, RADIOGENIC AR=72 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED LIGHT BROWN BIOTITE. THE FLAKES CONTAIN LESS THAN 5 PERCENT COLOURLESS INCLUSIONS WHICH ARE SURROUNDED BY PLEOCHROIC HALOS. HORNBLENDE (5 PERCENT) IS PRESENT IN THE SAMPLE.

FROM SCHIST.

(105 G) .75 MILE DUE EAST OF NORTH END OF LARGEST OF NORTH LAKES, AT ELEVATION 5500 FT., YUKON TERRITORY, 61-23 N, 130-33 W. MAP-UNIT A, GSC MAP 8-1960 (FINLAYSON LAKE). SAMPLE WB-64-207-2, COLLECTED AND INTERPRETED BY J. O. WHEELER.

THE BIOTITE OCCURS INTERLEAVED WITH HORNBLENDE IN A QUARTZ-PLAGIOCLASE-HORNBLENDE-BIOTITE SCHIST, COMPOSED OF ALTERNATING LAYERS OF HORNBLENDE-BIOTITE-PLAGIOCLASE (4-6 MM. THICK) AND PLAGIOCLASE (1-3 MM. THICK). FRESH BIOTITE MAKES UP 15-40 PERCENT OF THE MAFIC LAYERS. ACCESSORY MINERALS INCLUDE OPAQUES, SPHENE AND APATITE.

THE ROCK IS ASSOCIATED WITH QUARTZ-MICA SCHIST AND FELDSPATHIC, GRANITIC AND AUGEN GNEISSES NORTHEAST OF THE TINTINA LINEAMENT IN THE SOUTH-EASTERN PELLY MOUNTAINS, YUKON. THE METAMORPHIC ROCKS COMMONLY HAVE A FLATTISH FOLIATION. THE

YUKON TERRITORY

DATE CONFORMS TO THE MANY SIMILAR DATES ON BOTH GRANITIC PLUTONS AND METAMORPHIC ROCKS FROM THE PELLY MOUNTAIN CRYSTALLINE BELT AND THE SELWYN MOUNTAINS (BAADSGAARD ET AL, 1961, AND GSC 65-34, 35, 36, 38, 39, 40, 41, 43). THUS IT PROBABLY REPRESENTS THE CONSOLIDATION OF THE METAMORPHIC TERRAIN DURING A PLUTONIC EPISODE 90 TO 100 M.Y. AGO, OR LESS LIKELY THE COMPLETE OVERPRINT OF THE METAMORPHIC TERRAIN BY A THERMAL EVENT RELATED TO THIS PLUTONIC EPISODE.

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GSC 65-46 MUSCOVITE, K-AR AGE 84 + OR - 8 M.Y.

K=6.72 PERCENT, AR40/K40=0.0050, RADIOGENIC AR=64 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF MUSCOVITE. MOST FLAKES CONTAIN FROM 30 TO 40 PERCENT FINE, NEEDLE-LIKE, MATTED INCLUSIONS OF CHLORITE. THE SAMPLE IS CONTAMINATED WITH LESS THAN 5 PERCENT QUARTZ.

FROM CHLORITIC SERICITE SCHIST.
(105 M) 500 NOCASH ADIT, 800 FT. FROM PORTAL, GALENA HILL, YUKON TERRITORY, 63-55-15 N, 135-26 W. MAP-UNIT 1 (YUKON GP.-SCHIST), GSC MAP 1105-A. SAMPLE PB-15-64, COLLECTED AND INTERPRETED BY W. H. POOLE.

THE CHLORITE-SERICITE SCHIST (OR PHYLLITE) WAS COLLECTED FROM NEAR THE TOP OF THE **LOWER SCHIST** FORMATION (POOLE 1965). IT IS LIGHT GREEN, FINE-GRAINED AND THINLY FOLIATED. A THIN SECTION SHOWS AN ALTERNATION OF FOLIAE RICH IN FINE-GRAINED QUARTZ AND OF FOLIAE RICH IN INTERLEAVED CHLORITE AND SERICITE. THE MICA-RICH LAYERS ARE MINUTELY CRENULATED.

FOR INTERPRETATION SEE DETERMINATION GSC 65-48.

YUKON TERRITORY

GSC 65-47 IMPURE MUSCOVITE, K-AR AGE 93 + OR - 12 M.Y.

K=3.55 PERCENT, AR40/K40=0.0056, RADIOGENIC AR=56 PERCENT.

CONCENTRATE- THE CONCENTRATE IS A MIXTURE OF MUSCOVITE AND CHLORITE (TOTAL 50 PERCENT), QUARTZ (40 PERCENT), PLAGIOCLASE (10 PERCENT) AND A TRACE OF HORNBLENDE. THE MUSCOVITE FLAKES CONTAIN MATTED NEEDLE-LIKE INCLUSIONS OF CHLORITE. CHLORITE ALSO OCCURS AS YELLOW FLAKES. TOTAL CHLORITE CONTENT IS 20 PERCENT.

FROM SERICITE SCHIST

(106 D) RIDGE-CREST 4.75 MILES NORTHWEST OF THE NORTHEAST END OF MCQUESTEN LAKE, YUKON TERRITORY, 64-11 N, 135-21-30 W. MAP-UNIT 3 (YUKON GROUP), GSC MAP 8-1958 (GREEN). SAMPLE 1-48-4/PB, COLLECTED AND INTERPRETED BY W. H. POOLE.

THE SERICITE SCHIST (OR PHYLLITE) WAS COLLECTED FROM NEAR THE BASE OF THE **UPPER SCHIST** FORMATION (POOLE, 1965). IT IS BROWNISH GREEN, FINE GRAINED, AND THINLY FOLIATED. A THIN SECTION SHOWS VERY FINE-GRAINED QUARTZ FOLIAE ALTERNATING WITH QUARTZOSE FOLIAE RICH IN SERICITE AND CHLORITE. THE MICACEOUS LAYERS ARE CRENULATED.

FOR DESCRIPTION AND INTERPRETATION SEE GSC 65-48.

GSC 65-48 MUSCOVITE, K-AR AGE 101 + OR - 6 M.Y.

K=7.14 PERCENT, AR40/K40=0.0061, RADIOGENIC AR=66 PERCENT.

CONCENTRATE- IMPURE MUSCOVITE. ABOUT 1/3 OF THE GRAINS ARE STAINED WITH YELLOW-BROWN CHLORITE AND CONTAIN OPAQUES. OTHER FLAKES ARE QUITE CLEAN. IMPURITIES CONSIST OF CHLORITE (15 PERCENT), QUARTZ AND OPAQUES (5 PERCENT).

FROM SERICITE-QUARTZ SCHIST.

(105 M) FROM DUNCAN CREEK ROAD AT BRIDGE OVER FIELD CREEK, YUKON TERRITORY, 63-47-30 N, 135-41-45 W. MAP-UNIT **US**, ON FIGURE, PAGE 33, GSC PAPER 65-1. SAMPLE 1-57-1/PB, COLLECTED AND INTERPRETED BY W. H. POOLE.

YUKON TERRITORY

THE SERICITE-QUARTZ SCHIST (OR PHYLLITE) WAS COLLECTED FROM THE UPPER SCHIST FORMATION, WELL ABOVE THE **CENTRAL QUARTZITE** FORMATION (POOLE, 1965). IT IS LIGHT BROWN-GREY, FINE-GRAINED, AND THINLY FOLIATED. A THIN SECTION SHOWS A MOSAIC OF FINE-GRAINED QUARTZ AND LESS UNTWINNED FELDSPAR, PLUS A FEW PERCENT OF FINE MUSCOVITE AND CHLORITE.

THE SAMPLES WERE COLLECTED FROM THE GENERAL KENO HILL AREA. THE STRATA REPRESENTED BY THE THREE SCHIST SAMPLES WERE THOUGHT TO BE PRECAMBRIAN AND METAMORPHOSED IN THE PRECAMBRIAN UNTIL A FEW YEARS AGO. THEY ARE NOW BELIEVED TO BE PARTLY MESOZOIC, (**LOWER SCHIST**) AND PARTLY PRECAMBRAIN (UPPER PART OF ** UPPER SCHIST**) (GREEN AND RODDICK, 1962.. POOLE, 1965). THUS, METAMORPHISM AND DEFORMATION GIVING RISE TO THE SCHIST PROBABLY OCCURRED DURING A SINGLE EPISODE IN THE MESOZOIC, AND WAS FOLLOWED BY INTRUSION OF CRETACEOUS GRANITES.

THE THREE DATES FROM THE SCHISTS FALL WITHIN THE LATE CRETACEOUS (KULP, 1961). K-AR DATES OF THIS AGE ARE COMMON IN MANY PARTS OF YUKON, PARTICULARLY NORTHEAST OF TINTINA TRENCH (SEE GABRIELSE, IN PRESS). THE DATES OF THE GRANITES OF THE KENO HILL AREA (GSC 65-49, 50) ARE ALMOST THE SAME AS THOSE OF THE SCHISTS.

NO EXPLANATION IS APPARENT FOR THE RANGE IN DATES ON THE SCHISTS FROM 84 + OR - 8 TO 101 + OR - 6 MILLION YEARS, OTHER THAN POSSIBLE WEATHERING EFFECTS OR UNSUSPECTED ANALYTICAL ERROR.

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YUKON TERRITORY

GSC 65-49 BIOTITE, K-AR AGE 81 + OR - 5 M.Y.

K=6.88 PERCENT, AR40/K40=0.0048, RADIOGENIC AR=54 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, LIGHT-BROWN BIOTITE. THE FLAKES CONTAIN FINE, NEEDLE-LIKE, UNORIENTATED INCLUSIONS, OPAQUE BLEBS AND COLOURLESS BLEBS (TOTAL INCLUSIONS 5 PERCENT). THERE ARE ALSO LARGE, STRONG PLEOCHROIC HALOS IN MOST FLAKES, BUT THEY ARE NOT ASSOCIATED WITH THE INCLUSIONS. CHLORITE ALTERATION OCCURS MAINLY AT THE FLAKE EDGES, THOUGH THERE ARE SOME CHLORITE PATCHES. IMPURITIES ARE HORNBLENDE 3 PERCENT, CHLORITE 10 PERCENT.

FROM QUARTZ PORPHYRY
(105 M) MT. HALDANE, RIDGE 1 MILE SOUTHWEST OF PEAK, YUKON TERRITORY, 63-51-05 N, 135-51-20 W. MAP-UNIT 13, GSC MAP 890A. SAMPLE 1-10-2A/PB, COLLECTED AND INTERPRETED BY W. H. POOLE.

THE QUARTZ PORPHYRY (OR PORPHYRITIC FINE-GRAINED GRANITE) FORMS A SILL IN THE PROBABLE MESOZOIC **CENTRAL QUARTZITE** FORMATION IN THE KENO HILL AREA (POOLE, 1965). THE GROUNDMASS OF THE ROCK IS A FINE GRAINED MOSAIC OF QUARTZ AND FELDSPAR, MOSTLY PLAGIOCLASE. QUARTZ AND THIN PLATES OF BIOTITE FORM PHENOCRYSTS. A THIN SECTION SHOWS THAT BIOTITE AND MUSCOVITE, IN PART INTERGROWN, ARE UNDEFORMED, AND BIOTITE IS PARTLY ALTERED TO CHLORITE.

FOR INTERPRETATION SEE DETERMINATION GSC 65-50.

GSC 65-50 BIOTITE, K-AR AGE 85 + OR - 7 M.Y.

K=7.27 PERCENT, AR40/K40=0.0051, RADIOGENIC AR=68 PERCENT.

CONCENTRATE- UNALTERED, LIGHT-REDDISH BROWN BIOTITE. LESS THAN 1 PERCENT OF THE FLAKES CONTAIN COLOURLESS PRISMATIC INCLUSIONS OF APATITE WHICH ARE OCCASIONALLY ASSOCIATED WITH WEAK PLEOCHROIC HALOS. IMPURITIES CONSIST OF HORNBLENDE (5 PERCENT) AND CHLORITE (1 PERCENT).

FROM QUARTZ MONZONITE
(115 P) DAWSON ROAD, 1.5 MILES SOUTHEAST OF MOUTH OF MOOSE

CREEK, YUKON TERRITORY, 63-29 N, 136-58 W. MAP-UNIT 14, GSC MAP 1143A. SAMPLE 1-42-2/PB, COLLECTED AND INTERPRETED BY W. H. POOLE.

THE QUARTZ MONZONITE STOCK HAS INTRUDED PROBABLE PRECAMBRIAN SCHIST, A CORRELATIVE OF THE **UPPER SCHIST** FORMATION OF THE KENO HILL AREA (BOSTOCK, 1964). THE STOCK OUTCROPS ALONG THE NORTHEAST SIDE OF TINTINA TRENCH. THE ROCK IS COARSE GRAINED AND HAS LARGE WHITE POTASH FELDSPAR **PHENOCRYSTS**. IN THIN SECTION, THE ROCK IS GRANITIC AND UNDEFORMED. BIOTITE, ABOUT 6 PERCENT OF THE ROCK, IS PARTLY ALTERED TO CHLORITE ALONG CLEAVAGE PLANES.

THE DATES ON THE TWO GRANITES, AS WELL AS OTHERS ON THREE OTHER GRANITIC ROCKS, FIT WELL IN LATE CRETACEOUS ON THE TIME-SCALE OF KULP (1961), AND CONFIRM THE SUSPECTED CRETACEOUS AGE OF GRANITES IN THIS PART OF YUKON NORTHEAST OF TINTINA TRENCH.

GSC 65-49	MOUNT HALDANE	81 + OR - 5 M.Y.
GSC 65-50	TINTINA TRENCH	85 + OR - 7 M.Y.
GSC 62-78	HANSON LAKES	102 M.Y.
GSC 62-80	DUBLIN GULCH	106 M.Y.
GSC 62-81	WILSONS CABIN	81 M.Y.

(GSC 62-78, 80, 81 ARE FROM GSC PAPER 63-17, 1963).

THE DATES ON THE GRANITES ARE NEARLY THE SAME AS THOSE ON FINE-GRAINED SCHISTS IN THE SAME GENERAL AREA (SEE GSC 65-46, 47, AND 48).

NO EXPLANATION IS APPARENT FOR THE DISTINCT BIMODAL DISTRIBUTION OF THE GRANITE AGES. WITH NO EVIDENCE TO THE CONTRARY, ALL THE GRANITES ARE BELIEVED TO HAVE BEEN INTRUDED AT THE SAME TIME.

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YUKON TERRITORY

GSC 65-51 WHOLE ROCK, K-AR AGE 237 + OR - 47 M.Y.
253 + OR - 45 M.Y.

K=0.42 PERCENT, AR40/K40=0.0148, RADIOGENIC AR=18 PERCENT, K=0.47 PERCENT, AR40/K40=0.0159, RADIOGENIC AR=66 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM ALTERED BASALT
NEAR ALASKA-YUKON BOUNDARY, 8 MILES INSIDE THE STATE OF ALASKA. 69-01 N, 141-05 W. MAP-UNIT B, GSC MAP 10-1963. SAMPLE ZEX 93, COLLECTED BY THE CALIFORNIA STANDARD COMPANY, INTERPRETED BY D. K. NORRIS.

THE 237 + OR - 47 M.Y. DATE WAS DETERMINED ON THE TOTAL ROCK SAMPLE WITH A YIELD OF ONLY 18 PERCENT RADIOGENIC ARGON. THE 253 + OR - 45 M.Y. DATE WAS OBTAINED FROM A SECOND FRACTION OF THE SAME ROCK FROM WHICH MOST OF THE CARBONATE MINERALS HAD BEEN REMOVED BY COLD HYDROCHLORIC ACID LEACHING. AS A RESULT OF THIS TREATMENT THE SAMPLE GAVE A 66 PERCENT RADIOGENIC ARGON YIELD

THE SAMPLE IS FROM **BASALT** JUST BELOW ITS CONTACT WITH LIMESTONES OF THE MISSISSIPPIAN LISBURNE GROUP. THE ROCK IS A DARK GREENISH GREY, BEDDED, TABULAR UNIT RESTING ON HIGHLY DEFORMED SLATES AND QUARTZITES OF THE **PRECAMBRIAN** NERUOKPUK FORMATION. IN THIN-SECTION THE SAMPLE WAS OBSERVED TO CONTAIN, IN DECREASING ORDER OF ABUNDANCE, ALBITE, CHLORITE, MAGNETITE, CARBONATE AND VEIN QUARTZ. THE ORIGINAL PYROXENES ARE COMPLETELY ALTERED TO CHLORITE AND MAGNETITE OR REPLACED BY CARBONATES. THE ALBITE IS ALTERED TO SOME DEGREE AND IS COMMONLY BENT OR BROKEN.

ALTHOUGH A PRELIMINARY EXAMINATION OF THE FIELD RELATIONS OF THE ROCK OF MAP-UNIT B WOULD SUGGEST THAT IT IS OLDER THAN THE LISBURNE GROUP, THE PERMIAN RADIOGENIC AGE WOULD INDICATE THE POSSIBILITY THAT THE ROCK MAY IN FACT BE AN INTRUSION OR, MORE LIKELY, THAT THE AGE OBTAINED RELATES ONLY TO THE DATE OF ALTERATION OF THE BASALTIC ROCK.

DISTRICT OF FRANKLIN

GSC 65-52 BIOTITE, K-AR AGE 1580 + OR - 50 M.Y.

K=7.40 PERCENT, AR40/K40=0.1447, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF UNALTERED, REDDISH BROWN BIOTITE. MINOR IMPURITIES CONSIST OF LESS THAN 3 PERCENT HORNBLENDE AND OPAQUES. CHLORITE NOT DETECTED.

FROM GNEISS
(46 J) SOUTHERN MELVILLE PENINSULA, DISTRICT OF FRANKLIN, 66-39 N, 83-33 W. NO GEOLOGICAL MAP. SAMPLE JD372, COLLECTED BY G. D. JACKSON, DESCRIBED BY W. W. HEYWOOD.

THE BIOTITE WAS TAKEN FROM A WELL FOLIATED LEUCOCRATIC, MEDIUM-GRAINED GNEISS.

NO INTERPRETATION AVAILABLE.

GSC 65-53 BIOTITE, K-AR AGE 1615 + OR - 50 M.Y.

K=8.07 PERCENT, AR40/K40=0.1498, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- THE CONCENTRATE IS A MIXTURE OF TWO UNALTERED BIOTITES. ONE (60 PERCENT) IS BROWN AND THE OTHER (40 PERCENT) IS GREEN. NEITHER VARIETY CONTAINS VISIBLE INCLUSIONS, AND THERE IS NO APPARENT ALTERATION ALTHOUGH THE BROWN MICA IS SLIGHTLY BLISTERED. BOTH VARIETIES CONTAIN RARE PLEOCAROIC HALOS. TOTAL CHLORITE CONTENT IS 1 PERCENT.

FROM PARAGNEISS
(46 K) SOUTHERN MELVILLE PENINSULA, DISTRICT OF FRANKLIN, 66-46 N, 84-55 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE DF-323, COLLECTED BY J. A. DONALDSON, DESCRIBED BY W. W. HEYWOOD.

THIS SAMPLE IS FROM A LAYERED GREY PARAGNEISS THAT IS INTERBEDDED WITH SILICEOUS CRYSTALLINE LIMESTONE. THE PARAGNEISS IS MEDIUM TO COARSE GRAINED AND CONSISTS OF QUARTZ (40 PERCENT), PLAGIOCLASE (40 PERCENT), BIOTITE (15 PERCENT) AND MINOR AMOUNTS OF SPHENE AND APATITE. SOME BIOTITE IS

SLIGHTLY CHLORITIZED.

NO INTERPRETATION AVAILABLE.

GSC 65-54 BIOTITE, K-AR AGE 1640 + OR - 55 M.Y.

K=7.40 PERCENT, AR40/K40=0.1528, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF UNALTERED DARK OLIVE-GREEN BIOTITE. THE SAMPLE IS CONTAMINATED WITH ABOUT 1 PERCENT ATTACHED QUARTZ-FELDSPAR AND ABOUT 5 PERCENT FREE HORNBLENDE.

FROM GNEISS
(46 M) DISTRICT OF FRANKLIN, 67-12 N, 87-42-30 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE BL 137, COLLECTED BY W. R. A. BARAGER, SUBMITTED BY W. W. HEYWOOD.

NO INTERPRETATION AVAILABLE.

GSC 65-55 BIOTITE, K-AR AGE 1650 + OR - 50 M.Y.

K=7.63 PERCENT, AR40/K40=0.1546, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- DARK GREEN BIOTITE WITH NO INCLUSIONS, BUT ABOUT 5 PERCENT OF THE FLAKES CARRY ATTACHED QUARTZ-FELDSPAR. SOME OF THE FLAKES ARE BLISTERED AND SHOW CHLORITIZATION AROUND THE EDGES. MINOR IMPURITIES CONSIST OF FREE CHLORITE AND HORNBLENDE (3 PERCENT). TOTAL CHLORITE CONTENT 10 PERCENT.

FROM GRANITIC GNEISS
(46 N) DISTRICT OF FRANKLIN, 67-22 N, 85-30 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE BL-240, COLLECTED BY W. R. A. BARAGER, DESCRIBED BY W. W. HEYWOOD.

THE ROCK IS A PINK, FOLIATED, IN PART PORPHYROBLASTIC, GRANITIC GNEISS.

NO INTERPRETATION AVAILABLE.

DISTRICT OF FRANKLIN

GSC 65-56 BIOTITE, K-AR AGE 1690 + OR - 55 M.Y.

K=7.62 PERCENT, AR40/K40=0.1598, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF UNALTERED DARK GREEN BIOTITE. ABOUT 1 PERCENT OF THE FLAKES CONTAIN COLOURLESS PRISMATIC INCLUSIONS OF APATITE. THE MICA FLAKES CONTAIN VAGUE SMOKY PATCHES. LESS THAN 5 PERCENT HORNBLENDE IS THE ONLY IMPURITY.

FROM GNEISS
(47 B) WEST SIDE OF MELVILLE PENINSULA, DISTRICT OF FRANKLIN, 68-12-30 N, 84-35 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE DF-201, COLLECTED BY J. A. DONALDSON, DESCRIBED BY W. W. HEYWOOD.

THE ROCK IS A MEDIUM-GRAINED, GREYISH WHITE GRANITOID GNEISS COMPOSED OF QUARTZ, PLAGIOCLASE, HORNBLENDE AND ABOUT 3 PERCENT BIOTITE.

NO INTERPRETATION AVAILABLE.

GSC 65-57 WHOLE ROCK, K-AR AGE 1010 + OR - 135 M.Y.

K=0.44 PERCENT, AR40/K40=0.0784, RADIOGENIC AR=77 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM GABBRO.
(46 L) DISTRICT OF FRANKLIN, 66-19 N, 87-31 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE FA-650041, COLLECTED AND INTERPRETED BY W. F. FAHRIG.

THE ROCK IS A FINE-GRAINED, DARK GREY, OPHITIC GABBRO FROM A DIABASE DYKE. THE 1010 M.Y. DATE INDICATES THE APPROXIMATE AGE OF INTRUSION.

DISTRICT OF FRANKLIN

GSC 65-58 WHOLE ROCK, K-AR AGE 941 + OR - 100 M.Y.

K=0.84 PERCENT, AR40/K40=0.0714, RADIOGENIC AR=84 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM BASALT.
(46 M) DISTRICT OF FRANKLIN, 67-06 N, 87-58W. NO GEOLOGICAL MAP REFERENCE. SAMPLE FA-650021, COLLECTED AND INTERPRETED BY W. F. FAHRIG.

THE ROCK IS A FINE GRAINED, DARK GREY BASALT FROM A DIABASE DYKE. THE 941 M.Y. AGE INDICATES THE APPROXIMATE DATE OF INTRUSION. THE SAMPLE WAS OBTAINED FROM AN UNALTERED, CHILLED MARGIN OF THE DYKE.

GSC 65-59 WHOLE ROCK, K-AR AGE 606 + OR - 32 M.Y.

K=0.30 PERCENT, AR40/K40=0.0418, RADIOGENIC AR=60 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM GABBRO.
(46 N) DISTRICT OF FRANKLIN, 67-07 N, 84-47 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE FA-650052, COLLECTED AND INTERPRETED BY W. F. FAHRIG.

THE ROCK IS A DARK GREY, FINE GRAINED, OPHITIC GABBRO CONTAINING 2 MM. PHENOCRYSTS OF PLAGIOCLASE. THE SAMPLE WAS TAKEN FROM A DIABASE DYKE, AND THE 606 M.Y. DATE INDICATES THE APPROXIMATE AGE OF INTRUSION.

GSC 65-60 WHOLE ROCK, K-AR AGE 48 + OR - 11 M.Y.

K=1.56 PERCENT, AR40/K40=0.0028, RADIOGENIC AR=24 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM KERATOPHYRE

DISTRICT OF FRANKLIN

(68 H) .5 MILE WEST OF LAKE FEEDING A STREAM DRAINING TO THE SOUTH COAST OF BATHURST ISLAND, 4 MILES EAST OF BEDFORD BAY, DISTRICT OF FRANKLIN, 75-03-54 N, 98-13 W. MAP-UNIT 14, GSC MAP 1103-A. SAMPLE KL-64-103C, COLLECTED AND INTERPRETED BY J. W. KERR, DESCRIBED BY H. P. TRETTIN.

THE ROCK IS A DARK (BUT LIGHT GREENISH WEATHERING), MASSIVE TO SLIGHTLY VESICULAR KERATOPHYRE CONSISTING OF MICROPHENOCRYSTS OF CLINOPYROXENE IN A GROUNDMASS OF FELDSPARS, CLINOPYROXENE, IRON ORE, AND SOME QUARTZ. THERE IS SOME ALTERATION, BUT THIS IS CONSIDERED TO BE MAGMATIC TO EARLY POST-MAGMATIC AND THEREFORE SHOULD NOT INFLUENCE THE AGE DETERMINATION.

SEE GSC 65-61 FOR FURTHER DISCUSSION OF THIS ROCK AND ITS DETERMINED AGE.

GSC 65-61 WHOLE ROCK, K-AR AGE 47 + OR - 8 M.Y.

K=2.69 PERCENT, AR40/K40=0.0028, RADIOGENIC AR=67 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM KERATOPHYRE.

(68 H) IN CANYON .75 MILE SOUTHWEST OF A LAKE NORTHWEST OF THE HEAD OF FREEMANS COVE, SOUTHEASTERN BATHURST ISLAND, DISTRICT OF FRANKLIN, 75-10-48 N, 98-15 W. MAP-UNIT 14, GSC MAP 1103-A. SAMPLE KL-64-106H, COLLECTED AND INTERPRETED BY J. W. KERR, DESCRIBED BY H. P. TRETTIN.

THE ROCK IS A LIGHT GREENISH GREY KERATOPHYRE CONSISTING OF PHENOCRYSTS OF CLINOPYROXENE, IRON ORE, RED-BROWN OXY-HORNBLENDE, ORTHOPYROXENE AND **SANIDINE** IN A GROUNDMASS OF PLAGIOCLASE LATHS, CLINOPYROXENE, IRON ORE, POTASH FELDSPAR AND QUARTZ.

THE SPECIMENS (GSC 65-60, AND 61) ARE FROM A DYKE IN THE BATHURST ISLAND DYKE SWARM, THAT INTRUDES THE MIDDLE DEVONIAN DISAPPOINTMENT BAY AND OLDER FORMATIONS. THE AGE DETERMINATIONS OF 47 + OR - 8 AND 48 + OR - 11 M.Y. SUGGEST A TERTIARY (EOCENE) AGE. VOLCANIC FLOWS NEARBY, NORTH OF THE HEAD OF FREEMANS COVE, ARE INTERBEDDED WITH THE EUREKA SOUND FORMATION OF LATE CRETACEOUS AND/OR EARLY TERTIARY AGE. IT IS PROBABLE THAT THE DYKES AND FLOWS ARE PART OF THE SAME IGNEOUS EPISODE

THE AGE DETERMINATIONS CORROBORATE THE EVIDENCE OF LATE CRETACEOUS TO TERTIARY DEFORMATION WITH IGNEOUS ACTIVITY. THIS DEFORMATION WAS ONE OF NORMAL FAULTING AND GRABEN FORMATION ON THE BOOTHIA UPLIFT. THE AGE DETERMINATIONS ALSO CORROBORATE THE FIELD EVIDENCE THAT THE FORMATION OF DOMES ON EASTERN BATHURST ISLAND PRECEDED INTRUSION OF THE BATHURST ISLAND DYKE SWARM.

DISTRICT OF MACKENZIE

GSC 65-62 WHOLE ROCK, K-AR AGE 1425 + OR - 140 M.Y.

K=0.43 PERCENT, AR40/K40=0.1248, RADIOGENIC AR=82 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM BASALT
(75 D) DISTRICT OF MACKENZIE, 60-40 N, 111-50 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE FA-25-63-1, COLLECTED AND INTERPRETED BY W. F. FAHRIG.

THE ROCK IS A FINE-GRAINED,DARK GREY BASALT CONSISTING OF PLAGIOCLASE AND SUBOPHITIC PYROXENE WITH IRON ORES AND A TRACE OF BIOTITE. THE SAMPLE WAS TAKEN FROM A DIABASE DYKE AND THE 1425 M.Y. DATE INDICATES THE APPROXIMATE AGE OF INTRUSION.

GSC 65-63 WHOLE ROCK, K-AR AGE 1540 + OR - 165 M.Y.

K=0.61 PERCENT, AR40/K40=0.1394, RADIOGENIC AR=90 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM BASALT.
(75 E) DISTRICT OF MACKENZIE, 61-17 N; 111-47 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE FA-182-62-4, COLLECTED AND INTERPRETED BY W. F. FAHRIG

THE ROCK IS A FINE-GRAINED, DARK GREY BASALT CONSISTING OF MINUTE NEEDLES OF PLAGIOCLASE IN AN UNIDENTIFIABLY FINE MATRIX. THE SAMPLE WAS TAKEN FROM A DIABASE DYKE, AND THE 1540 M.Y. DATE INDICATES THE APPROXIMATE AGE OF INTRUSION.

GSC 65-64 MUSCOVITE, K-AR AGE 2660 + OR - 75 M.Y.

K=8.63 PERCENT, AR40/K40=0.3421, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- COARSE, CLEAR MUSCOVITE CONTAINING ABOUT 2 PERCENT OF OPAQUE INCLUSIONS AND A TRACE OF CHLORITE.

FROM QUARTZ MONZONITE BOULDER.
(86 H) EAST OF LARGE BAY ON SOUTH SHORE OF POINT LAKE, DISTRICT OF MACKENZIE, 65-14-30 N, 112-59 W. GSC MAP 18-1960 (J. A. FRASER). SAMPLE BK-64-621, COLLECTED AND INTERPRETED BY H. H. BOSTOCK.

THE ROCK IS A MEDIUM GRAINED GREY-GREEN EQUIGRANULAR QUARTZ MONZONITE BOULDER. MAFIC MINERALS FORM ABOUT 7 PERCENT OF THE ROCK AND ARE PRINCIPALLY CHLORITE-AMPHIBOLE WITH SOME EPIDOTE. A SMALL AMOUNT OF MUSCOVITE IS DISSEMINATED THROUGHOUT THE ROCK.

THE SAMPLE IS PART OF A LARGE ROUNDED BOULDER IN CONGLOMERATE INTERLENSED IN BASIC VOLCANIC ROCKS OF THE YELLOWKNIFE GROUP SOUTH OF POINT LAKE. THE LENS FROM WHICH THE SAMPLE WAS TAKEN IS THOUGHT TO LIE NEAR THE TOP OF THE VOLCANIC SECTION AND IS CLOSE TO THE CONTACT WITH SLATE, ARGILLITE AND GREYWACKE CONSIDERED TO BE LESS ALTERED EQUIVALENTS OF THE KNOTTED SCHIST (YELLOWKNIFE GROUP) FARTHER EAST.

THE AGE PROVIDES AN ESTIMATE OF THE AGE OF PRE-EXISTING GRANITIC ROCKS FROM WHICH THE BOULDER WAS DERIVED. IT IS OF INTEREST THAT THIS AGE IS SIGNIFICANTLY OLDER THAN ANY PREVIOUSLY DETERMINED AGES IN THIS PART OF THE SLAVE PROVINCE AND MAY BE SLIGHTLY OLDER THAN THE OLDEST SO FAR FOUND ALONG THE SOUTH AND EASTERN BOUNDARIES OF THE PROVINCE.

GSC 65-65 BIOTITE, K-AR AGE 2350 + OR - 80 M.Y.

K=7.23 PERCENT, AR40/K40=0.2729, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- SOMEWHAT ALTERED, DARK REDDISH-BROWN TO BLEACHED BIOTITE. MOST FLAKES CONTAIN LARGE, DARK PLEOCHROIC HALOS, AND ABOUT 1 PERCENT CONTAIN FINE, NEEDLE-LIKE INCLUSIONS. THERE IS ABOUT 10 PERCENT CHLORITE ALTERATION ON THE FLAKE EDGES. CONCENTRATE CONTAINS 1 PERCENT HORNBLENDE.

FROM SCHIST.
(86 H) WEST SHORE OF RIVER ABOVE NORTH ITCHEN LAKE, DISTRICT OF MACKENZIE, 65-41 N, 112-27 W. MAP-UNIT 2, GSC MAP 18-1960 (J. A. FRASER). SAMPLE BK-64-1065, COLLECTED AND INTERPRETED BY H. H. BOSTOCK.

DISTRICT OF MACKENZIE

THE ROCK IS A FINE GRAINED, GREY AND BROWN, KNOTTED CORDIERITE-BIOTITE SCHIST, AND IS TYPICAL OF KNOTTED SCHISTS BEARING LOCAL AMPHIBOLITE LENSES AND BELONGING TO THE YELLOWKNIFE GROUP NORTH OF ICHTEN LAKE. THE AGE PROVIDES AN ESTIMATE OF THE AGE OF METAMORPHISM IN THIS AREA WHERE FEW DATES ARE AVAILABLE.

GSC 65-66 BIOTITE, K-AR AGE 2075 + OR - 65 M.Y.

K=7.30 PERCENT, AR40/K40=0.2216, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- BROWNISH OLIVE BIOTITE WITH ABOUT 10 PERCENT CHLORITE ALTERATION ON FLAKE EDGES. 5-10 PERCENT OF THE FLAKES CONTAIN ORIENTED, NEEDLE-LIKE INCLUSIONS. CONCENTRATE CONTAINS ABOUT 5 PERCENT HORNBLENDE.

FROM GRANODIORITE.
(86 H) 2 MILES NORTHEAST OF SOUTHEAST CORNER OF LAKE, DISTRICT OF MACKENZIE, 65-43-30 N, 112-44 W. MAP UNIT 3, GSC MAP 18-1960 (J. A. FRASER). SAMPLE BK-64-1052, COLLECTED AND INTERPRETED BY H. H. BOSTOCK.

THE ROCK IS A COARSE GRAINED, SLIGHTLY PORPHYRITIC GRANODIORITE CONTAINING ABOUT 15 PERCENT BIOTITE AND HORNBLENDE.

THIS SAMPLE FORMS PART OF A LARGE MASS OF GRANODIORITE NORTHWEST OF ITCHEN LAKE. THE AGE PROVIDES AN ESTIMATE OF THE AGE OF CRYSTALLIZATION OF GRANITIC ROCKS IN AN AREA WHERE FEW DATES ARE AVAILABLE.

GSC 65-67 WHOLE ROCK, K-AR AGE 1600 + OR - 135 M.Y.

K=1.28 PERCENT, AR40/K40=0.1474, RADIOGENIC AR=94 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM PORPHYRITIC ANDESITE
(86 G) 12 MILES NORTH OF ROCKNEST LAKE, DISTRICT OF MACKENZIE, 65-46 N, 114-10 W. MAP-UNIT 5, GSC MAP 18-1960. SAMPLE FD-161-64, COLLECTED AND

DISTRICT OF MACKENZIE

INTERPRETED BY J. A. FRASER.

THE SAMPLE IS A DARK GREYISH GREEN, MASSIVE, FINE-GRAINED, PORPHYRITIC ANDESITE CONTAINING 50 PERCENT SUBHEDRAL PHENOCRYSTS OF WHITE-WEATHERING PLAGIOCLASE UP TO 1 CM. LONG. THE GROUNDMASS IS COMPOSED OF PLAGIOCLASE, CARBONATE, CHLORITE, MUSCOVITE, AND EPIDOTE, MINOR LEUCOXENE, AND A FEW SMALL ROUNDED GRAINS OF PYRITE. FELDSPAR PHENOCRYSTS AND FELDSPAR CRYSTALS IN THE GROUNDMASS HAVE BEEN EXTENSIVELY REPLACED BY MUSCOVITE AND CHLORITE.

THE ANDESITE WAS COLLECTED FROM ONE OF SEVERAL FLOWS INCLUDING PILLOWED, FRAGMENTAL, AND AMYGDALOIDAL VARIETIES THAT ARE INTERLAYERED WITH STRATA OF THE EPWORTH GROUP. EPWORTH SEDIMENTS ARE KNOWN TO OVERLIE ARCHAEAN GNEISSES UNCONFORMABLY AND TO BE METAMORPHOSED AGAINST HUDSONIAN GRANITE. SEDIMENTS AND FLOWS MUST, THEREFORE, HAVE BEEN LAID DOWN DURING THE APHEBIAN ERA. THE ISOTOPIC AGE (1,600 M.Y.) INDICATES THAT MODIFICATION OF THE POTASSIUM/ARGON RATIO IN THE ANDESITE TOOK PLACE DURING THE HUDSONIAN OROGENY.

GSC 65-68 WHOLE ROCK, K-AR AGE 1555 + OR - 135 M.Y.

K=1.59 PERCENT, AR40/K40=0.1416, RADIOGENIC AR=95 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM DIABASE

(86 H) BASE OF DIABASE SILL AT SOUTHEAST END OF LARGE LAKE NORTH OF ITCHEN LAKE, DISTRICT OF MACKENZIE, 65-51 N, 112-04 W. MAP-UNIT 18, GSC MAP 18-1960. SAMPLE BK-64-1074L, COLLECTED AND INTERPRETED BY H. H. BOSTOCK.

THE ROCK IS A FINE GRAINED, GREY-GREEN, EQUIGRANULAR ALTERED DIABASE CONSISTING OF 50 PERCENT ZONED AND ALTERED PLAGIOCLASE, 40 PERCENT CRUSHED AND ALTERED PYROXENE, AND 10 PERCENT CHLORITIZED BIOTITE, QUARTZ, AND OPAQUES.

THIS SAMPLE REPRESENTS A DIABASE SILL OVERLYING PROTEROZOIC SEDIMENTS IMMEDIATELY EAST OF ROCKINGHORSE LAKE. THESE SEDIMENTS ARE OF SIMILAR LITHOLOGY TO THE LOWER PART OF THE GOULBURN GROUP AT THE NORTH END OF CONTWOYTO LAKE DESCRIBED BY L. P. TREMBLAY, 1966. THE AGE PROVIDES A MINIMUM ESTIMATE OF THE AGE OF THE PROTEROZOIC ROCKS AT ROCKINGHORSE LAKE AND AN ESTIMATE OF THE AGE OF EMPLACEMENT OF DIABASE IN THIS REGION.

DISTRICT OF MACKENZIE

GSC 65-69 BIOTITE, K-AR AGE 2070 + OR - 65 M.Y.

K=7.56 PERCENT, AR40/K40=0.2207, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, GREENISH BROWN BIOTITE WITH ABOUT 3 PERCENT HORNBLENDE CONTAMINATION. MOST OF THE FLAKES ARE SLIGHTLY BLISTERED.

FROM QUARTZ DIORITE
(66 M) 40 MILES SOUTHWEST OF ATKINSON POINT, DISTRICT OF MACKENZIE, 67-19-30 N, 103-18 W. MAP UNIT 3, GSC MAP 45-1963. SAMPLE BK-121-62, COLLECTED BY H. H. BOSTOCK, INTERPRETED BY J. A. FRASER.

THE SAMPLE IS A DARK GREY, MEDIUM- TO FINE-GRAINED GNEISS COMPOSED OF ANDESINE (53 PERCENT), SLIGHTLY STRAINED QUARTZ (32 PERCENT), UNALTERED BIOTITE (14 PERCENT), AND TRACES OF POTASSIC FELDSPAR, APATITE, SPHENE, AND ZIRCON. SIMILAR GNEISSES, INCLUDING HORNBLENDE- AND PYROXENE-BEARING VARIETIES DERIVED FROM ARCHAEAN AND POSSIBLY EARLY PROTEROZOIC SEDIMENTARY AND VOLCANIC ROCKS ARE COMMON IN THE CHURCHILL STRUCTURAL PROVINCE EAST OF BATHURST INLET.

THE AGE OF THE BIOTITE (2,070 M.Y.), WHICH REPRESENTS A MINIMUM DATE FOR METAMORPHISM AT THIS LOCALITY, IS GREATER THAN MOST AGES REPORTED ON GNEISSIC ROCKS FROM THE CHURCHILL PROVINCE, INCLUDING FOUR COLLECTED WITHIN A RADIUS OF 60 MILES OF THE SAMPLE SITE. GRANODIORITE EXPOSED SOUTH OF CHESTER BAY, 30 MILES NORTHEAST OF THE SITE, YIELDS AN AGE OF 1,975 M.Y. COMPARABLE AGES HAVE ALSO BEEN OBTAINED FROM GNEISSES THAT OCCUR NEAR THE SLAVE-CHURCHILL BOUNDARY EAST OF BATHURST INLET. THE SAMPLE AGE MAY, THEREFORE, REFLECT THE EXTENSION OF THIS BOUNDARY INTO THE REGION LYING BETWEEN CHESTER AND LABYRINTH BAYS. ADDITIONAL AGE DETERMINATIONS ON MATERIAL FROM THIS AREA ARE REQUIRED TO TEST THIS HYPOTHESIS.

GSC 65-70 BIOTITE, K-AR AGE 1860 + OR - 60 M.Y.

K=7.11 PERCENT, AR40/K40=0.1852, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, BLISTERED KHAKI BIOTITE. MOST FLAKES CONTAIN FINE ORIENTED NEEDLE-LIKE INCLUSIONS. HORNBLENDE CONTAMINATION AMOUNTS TO ABOUT 3 PERCENT.

DISTRICT OF MACKENZIE

(66 M) FROM GNEISS
52 MILES NORTH NORTHWEST OF MCALPINE LAKE, DISTRICT OF MACKENZIE, 67-25 N, 103-39 W. MAP-UNIT 4, GSC MAP 45-1963. SAMPLE PB-103A-62, COLLECTED BY W. H. POOLE, INTERPRETED BY J. A. FRASER.

THE GNEISS IS A DARK GREYISH GREEN, FINE-GRAINED, STRONGLY FOLIATED ROCK, COMPOSED OF ANDESINE (50 PERCENT), QUARTZ (15 PERCENT), HORNBLENDE (15 PERCENT), BIOTITE (15 PERCENT), MINOR OPAQUE MINERALS, AND ACCESSORY SPHENE AND APATITE. THE BIOTITE FLAKES AND THIN LENSES OF FELDSPAR UP TO 1 CM. LONG PARALLEL THE FOLIATION. CHLORITE RIMS SOME OF THE HORNBLENDE CRYSTALS.

MIGMATITES AND ASSOCIATED GNEISSES CONTAINING PYROXENE, HORNBLENDE, OR BIOTITE, WHICH UNDERLIE LARGE AREAS OF THE CHURCHILL STRUCTURAL PROVINCE EAST OF BATHURST INLET ARE PROBABLY DERIVED FROM SEDIMENTS AND VOLCANIC ROCKS OF ARCHAEAN AND POSSIBLY EARLY PROTEROZOIC (APHEBIAN) AGE. THE SAMPLE AGE (1,860 M.Y.) MAY BE CONSIDERED A MINIMUM FOR METAMORPHISM IN THIS REGION.

DISTRICT OF KEEWATIN

GSC 65-71 MUSCOVITE, K-AR AGE 1665 + OR - 55 M.Y.

K=8.70 PERCENT, AR40/K40=0.1565, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF UNALTERED MUSCOVITE. ABOUT 1 PERCENT OF THE FLAKES HAVE OPAQUE INCLUSIONS AT AND NEAR THE EDGES. ABOUT 5 PERCENT HAVE A VERY PALE BROWNISH COLOUR, AND ABOUT 1 PERCENT HAVE ATTACHED QUARTZ AND FELDSPAR FRAGMENTS.

FROM GRANITE PEGMATITE.
(65 G) DISTRICT OF KEEWATIN. 61-35 N, 98-35 W. NO GEOLOGICAL MAP REFERENCE AVAILABLE. SAMPLE EA-256-64, COLLECTED AND INTERPRETED BY K. E. EADE.

FOR DESCRIPTION AND INTERPRETATION SEE GSC 65-72.

GSC 65-72 BIOTITE, K-AR AGE 1355 + OR - 50 M.Y.

K=7.49 PERCENT, AR40/K40=0.1160, RADIOGENIC AR=90 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF BUFF-BROWN BIOTITE. THERE IS NO APPARENT ALTERATION BUT CHLORITE DOES OCCUR AS SEPARATE GRAINS (ABOUT 5 PERCENT). OTHER IMPURITIES CONSIST OF ABOUT 3 PERCENT QUARTZ AND FELDSPAR.

FROM GRANITE PEGMATITE
(65 G) DISTRICT OF KEEWATIN, 61-35 N, 98-35 W. NO GEOLOGICAL MAP REFERENCE AVAILABLE. SAMPLE EA-256-64, COLLECTED AND INTERPRETED BY K. E. EADE.

THE MUSCOVITE OF GSC 65-71 AND THE BIOTITE OF GSC 65-72 ARE FROM A SAMPLE OF QUARTZ-FELDSPAR-BIOTITE-MUSCOVITE GRANITE PEGMATITE. FIELD EVIDENCE SUGGESTS THE PEGMATITE IS RELATED TO A GRANODIORITE INTRUSION RESPONSIBLE FOR CONTACT METAMORPHISM OF SEDIMENTARY ROCKS OF THE HURWITZ GROUP. THE MUSCOVITE GIVES THE EXPECTED AGE FOR THE HUDSONIAN OROGENY BUT THE BIOTITE AGE RESULTS FROM SOME YOUNGER AND AS YET UNKNOWN EVENT.

DISTRICT OF KEEWATIN

GSC 65-73 BIOTITE, K-AR AGE 1690 + OR - 60 M.Y.

K=6.50 PERCENT, AR40/K40=0.1599, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF UNALTERED BROWNISH-GREEN BIOTITE. MOST OF THE FLAKES ARE SLIGHTLY BLISTERED AND CONTAIN ABOUT 5 PERCENT FINE PRISMATIC, COLOURLESS INCLUSIONS, 5 PERCENT OPAQUE BLEBS, AND LESS THAN 1 PERCENT RUTILE. THE SAMPLE IS CONTAMINATED WITH 8-10 PERCENT FREE CHLORITE AND ABOUT 1 PERCENT QUARTZ-FELDSPAR.

FROM TRACHYTE
(55 M) SOUTHEAST SHORE OF KAZAN LAKE, DISTRICT OF KEEWATIN, 63-53-00 N, 95-36-30 W. ASSOCIATED WITH MAP-UNIT 4, GSC PAPER 64-20. SAMPLE DF-59A-64, COLLECTED AND INTERPRETED BY J. A. DONALDSON.

THE SAMPLE IS FROM A MASSIVE, DARK PURPLISH RED, VERY FINE-GRAINED TRACHYTE DYKE. MOST OF THE BIOTITE OCCURS AS RANDOMLY ORIENTED EUHEDRAL AND SUBHEDRAL PHENOCRYSTS LESS THAN I CM IN DIAMETER.

THE AGE AGREES CLOSELY WITH THAT OF A TRACHYTE DYKE OF SIMILAR COMPOSITION, DEMONSTRABLY A FEEDER TO THE CHRISTOPHER ISLAND FORMATION OF THE DUBAWNT GROUP (GSC 64-74, 1685 + OR - 60 M.Y.). BOTH DYKES CUT SANDSTONES OF THE KAZAN FORMATION. THE KAZAN AND SOUTH CHANNEL FORMATIONS COMPOSE A SEQUENCE OF PRIMARY REDBEDS THAT REST UNCONFORMABLY ON METAMORPHIC ROCKS DATED AT 1810 M.Y. (GSC 61-102). THE DATA THUS ESTABLISH A WELL DEFINED AND VERY GREAT AGE FOR A MAJOR NORTH AMERICAN REDBED SEQUENCE.

GSC 65-74 BIOTITE, K=AR AGE 1715 + OR - 80 M.Y.

K=5.98 PERCENT, AR40/K40=0.1634, RADIOGENIC AR=97 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF ALTERED DARK TO LIGHT BROWN BIOTITE. ABOUT 15 PERCENT OF THE FLAKES ARE FRESH, BUT THE REST ARE PARTLY TO COMPLETELY ALTERED TO CHLORITE. MOST FLAKES CONTAIN COLOURLESS BLEBS WHICH ARE SURROUNDED BY PLEOCHROIC HALOS. A MINOR AMOUNT OF HORNBLENDE IS PRESENT (2 PERCENT).

DISTRICT OF KEEWATIN

FROM PORPHYRITIC BIOTITE SYENITE
(55 M) HIGH HILL 3 MILES SOUTH OF GULL LAKE, DISTRICT OF KEEWATIN, 63-58-10 N, 95-58-00 W. MAP-UNIT 5, GSC PAPER 64-20. SAMPLE DF-A62-64, COLLECTED AND INTERPRETED BY J. A. DONALDSON.

THE BIOTITE COMES FROM A MASSIVE, DULL PINK, MEDIUM-GRAINED INTRUSION OF MARTELL SYENITE THAT CUTS REDBEDS OF THE KAZAN FORMATION OF THE DUBAWNT GROUP. THE DATED SAMPLE CONSISTS OF POTASH FELDSPAR, BIOTITE, HORNBLENDE, PYROXENE, PLAGIOCLASE, APATITE, AND OPAQUE IRON OXIDES. FIELD EVIDENCE SUGGESTS THAT OCCURRENCES OF MARTELL SYENITE ARE INTRUSIVE EQUIVALENTS OF VOLCANIC ROCKS BELONGING TO THE CHRISTOPHER ISLAND FORMATION. THE AGE SUPPORTS THIS INTERPRETATION (COMPARE GSC 64-74, GSC 65-73), AND PROVIDES ADDITIONAL SUBSTANTIATION FOR A KAZAN AGE GREATER THAN ABOUT 1700 M.Y.

RELATIONSHIP TO BASEMENT ROCKS POSES AN INTERESTING PROBLEM. GNEISSES, SCHISTS, AND GRANITES OF THE CHURCHILL PROVINCE SO FAR DATED HAVE AN AVERAGE AGE CLOSE TO THE 1700 M.Y. VALUE ABOUT WHICH THE ACCUMULATING DUBAWNT AGES ARE CLUSTERING. YET THE DUBAWNT GROUP OVERLIES THE BASEMENT WITH PROFOUND UNCONFORMITY, AND CONSTITUENT UNITS, INCLUDING THE BASAL KAZAN-SOUTH CHANNEL REDBED SEQUENCE, SHOW NO EVIDENCE OF REGIONAL METAMORPHISM, THE FOLLOWING ALTERNATIVE INTERPRETATIONS ARE SUGGESTED-

1-THE HUDSONIAN OROGENY, SUBSEQUENT EROSION, AND EVENTS OF DUBAWNT HISTORY UP TO AND INCLUDING CHRISTOPHER ISLAND VOLCANISM ALL OCCURRED IN A PERIOD OF TIME SUFFICIENTLY SHORT THAT RESOLUTION BY RADIOACTIVE DATING IS NOT POSSIBLE.

2-**RADIOACTIVE CLOCKS** IN THE BASEMENT ROCKS WERE RESET AT OR NEAR THE TIME OF CHRISTOPHER ISLAND VOLCANISM WITHOUT VISIBLE METAMORPHIC EFFECT ON DUBAWNT ROCKS EXISTING AT THAT TIME.

3- SOME DATED SAMPLES CONTRIBUTING TO THE BASEMENT AVERAGE INCLUDE SMALL GRANITE PLUTONS EMPLACED MORE RECENTLY THAN THE LATEST PRE-DUBAWNT OROGENY. GROUPING OF RELATIVELY YOUNG DATES IN PARTICULAR AREAS OF THE CHURCHILL PROVINCE SUGGESTS THE POSSIBILITY OF OROGENIC SUB-PROVINCES THAT DEVELOPED CONTEMPORARY WITH, OR EVEN LATER THAN, THE DUBAWNT GROUP.

GSC 65-75 WHOLE ROCK, K-AR AGE 899 + OR - 90 M.Y.

K=2.45 PERCENT, AR40/K40=0.0674, RADIOGENIC AR=95

PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM DIABASE DYKE
(66 A) SOUTH SHORE OF RIVER DRAINING EAST TO BAKER LAKE, DISTRICT OF KEEWATIN, 64-10-45 N, 96-29-30 W. MAP-UNIT 8 (DIABASE), GSC PAPER 64-20 (IN PRESS). SAMPLE DF-A225-64, COLLECTED AND INTERPRETED BY J. A. DONALDSON.

THE SAMPLE IS MASSIVE, APHANITIC, GREENISH GREY, AND CONTAINS UNALTERED MICROPHENOCRYSTS OF PLAGIOCLASE, BIOTITE, AND PYROXENE. IT WAS COLLECTED A FEW INCHES FROM A KNIFE-SHARP CONTACT OF A DIABASE DYKE THAT CUTS THE THELON FORMATION OF THE DUBAWNT GROUP. THE AGE IS MUCH LESS THAN THAT OF A PARALLEL DYKE (GSC 63-44, 1360 M.Y.), PRESUMABLY BELONGING TO THE SAME SWARM, BUT DATED ON THE BASIS OF BIOTITE ALONE. THE PREVIOUSLY DATED DIABASE WAS NOT OBSERVED IN DIRECT INTRUSIVE CONTACT WITH DUBAWNT ROCKS. THE PRESENTLY DATED DYKE THUS SERVES TO ELIMINATE THE POSSIBILITY THAT UPPER DUBAWNT SANDSTONES (UNCONFORMABLE ABOVE DUBAWNT VOLCANICS) ARE PALAEOZOIC.

GSC 65-76 BIOTITE, K-AR AGE 1605 + OR - 50 M.Y.

K=8.09 PERCENT, AR40/K40=0.1480, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF OLIVE-GREEN BIOTITE. HORNBLENDE (5 PERCENT) AND CHLORITE (1 PERCENT) ARE THE ONLY IMPURITIES.

FROM PEGMATITIC GRANITE
(56 B) NORTH OF CHESTERFIELD INLET, DISTRICT OF KEEWATIN, 64-39 N, 90-26 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE DF-5, COLLECTED BY J. A. DONALDSON, DESCRIBED BY W. W. HEYWOOD.

THIS ROCK IS A VERY COARSE GRAINED PINKISH WHITE GRANITE PEGMATITE COMPOSED OF QUARTZ, FELDSPAR AND BIOTITE

THE PEGMATITE INTRUDES THINLY LAYERED PARAGNEISS AND MAY BE RELATED TO THE WIDESPREAD COARSE GRAINED GRANITIC ROCKS IN THE VICINITY OF WAGER BAY.

DISTRICT OF KEEWATIN

GSC 65-77 BIOTITE, K-AR AGE 1605 + OR - 50 M.Y.

K=8.17 PERCENT, AR40/K40=0.1478, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- CLEAN, UNALTERED CONCENTRATE OF RED-BROWN BIOTITE. ABOUT 5 PERCENT OF THE FLAKES CONTAIN OPAQUE INCLUSIONS, AND ABOUT 1 PERCENT CONTAIN COLOURLESS INCLUSIONS. THE CONCENTRATE IS CONTAMINATED WITH LESS THAN 3 PERCENT HORNBLENDE.

FROM FOLIATED METASEDIMENT
(46 B) DISTRICT OF KEEWATIN, 64-46-30 N, 83-18 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE JD 383, COLLECTED BY G. D. JACKSON, INTERPRETED BY W. W. HEYWOOD.

THE ROCK IS A MEDIUM-GRAINED, WELL FOLIATED SEDIMENT COMPOSED OF 35 PERCENT QUARTZ, 30 PERCENT PLAGIOCLASE, 30 PERCENT BIOTITE, AND MINOR MUSCOVITE AND GRAPHITE. NO INTERPRETATION OF THE AGE DETERMINATION IS AVAILABLE

GSC 65-78 BIOTITE, K-AR AGE 1600 + OR - 50 M.Y.

K=8.04 PERCENT, AR40/K40=0.1471, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF SLIGHTLY ALTERED OLIVE-GREEN BIOTITE. ABOUT 50 PERCENT OF THE FLAKES ARE SLIGHTLY BLISTERED, AND ABOUT 5 PERCENT CONTAIN A FEW PLEOCHROIC HALOS. HORNBLENDE CONTAMINATION AMOUNTS TO LESS THAN 3 PERCENT. TOTAL CHLORITE CONTENT IS 1 PERCENT.

FROM GNEISSIC GRANITE.
(46 F) SMALL ISLAND SOUTH OF WHITE ISLAND, DISTRICT OF KEEWATIN, 65-31-30 N, 84-39 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE HF 220, COLLECTED AND INTERPRETED BY W. W. HEYWOOD.

THE ROCK IS A MEDIUM-GRAINED, EQUIGRANULAR PINK TO GREY GRANITE GNEISS CONSISTING OF QUARTZ (30 PERCENT) MICROCLINE (15 PERCENT), PLAGIOCLASE (36 PERCENT), BIOTITE (8 PERCENT), HORNBLENDE (9 PERCENT), AND MINOR MUSCOVITE, MAGNETITE, APATITE AND SPHENE.

DISTRICT OF KEEWATIN

THE DATE OF 1600 M.Y. PROBABLY REPRESENTS THE AGE OF GRANITE EMPLACEMENT OR METAMORPHISM AND IS TYPICAL OF ROCKS FROM THIS GENERAL AREA OF THE CHURCHILL PROVINCE.

GSC 65-79 BIOTITE, K-AR AGE 1640 + OR - 55 M.Y.

K=8.06 PERCENT, AR40/K40=0.1531, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF UNALTERED SMOKY BROWN BIOTITE. ABOUT 2 PERCENT OF THE GRAINS CONTAIN COARSE PRISMATIC INCLUSIONS OF APATITE SURROUNDED BY WEAK PLEOCHROIC HALOS. ABOUT 2 PERCENT OF THE FLAKES ARE BLISTERED. MINOR IMPURITIES CONSIST OF ABOUT 2 PERCENT CHLORITE WITH HAIR-LIKE INCLUSIONS, AND LESS THAN 5 PERCENT HORNBLENDE.

FROM PORPHYRITIC GRANITE
(46 E) WAGER BAY AREA, DISTRICT OF KEEWATIN, 65-47 N, 87-49 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE GC-43, COLLECTED BY C. I. GODWIN, DESCRIBED BY W. W. HEYWOOD.

THE ROCK IS A COARSE GRAINED MASSIVE GRANITE COMPOSED OF QUARTZ (30 PERCENT), PLAGIOCLASE (20 PERCENT), MICROCLINE (45 PERCENT), BIOTITE (4 PERCENT) AND ACCESSORY SPHENE, ZIRCON AND MAGNETITE.

THIS GRANITE IS POSSIBLY RELATED TO GSC 65-80.

GSC 65-80 BIOTITE, K-AR AGE 1630 + OR - 50 M.Y.

K=7.87 PERCENT, AR40/K40=0.1512, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF DARK OLIVE-GREEN, UNALTERED BIOTITE. THERE IS ABOUT 1 PERCENT FINE, COLOURLESS, PRISMATIC INCLUSIONS WHICH ARE SURROUNDED BY PLEOCHROIC HALOS. LESS THAN 1 PERCENT HORNBLENDE IS PRESENT.

FROM PORPHYRITIC GRANITE
(56 G) 10 MILES NORTH OF FORD LAKE, DISTRICT OF KEEWATIN,

DISTRICT OF KEEWATIN

65-58-30 N, 90-39 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE HF-38, COLLECTED AND INTERPRETED BY W. W. HEYWOOD.

THE GRANODIORITE FROM WHICH THIS BIOTITE WAS CONCENTRATED IS A MASSIVE MEDIUM GRAINED ROCK CONTAINING ABUNDANT MICROCLINE PHENOCRYSTS.

THIS PORPHYRITIC GRANODIORITE AND RELATED GRANITIC ROCKS INTRUDE GNEISS AND PARAGNEISS IN THE AREA AROUND WAGER BAY AND ARE POSSIBLY ASSOCIATED WITH THE LATE STAGES OF METAMORPHISM IN THIS PART OF THE CHURCHILL PROVINCE.

GSC 65-81 BIOTITE, K-AR AGE 1595 + OR - 50 M.Y.

K=8.14 PERCENT, AR40/K40=0.1469, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF OLIVE-GREEN BIOTITE. THERE IS A SMALL AMOUNT OF CHLORITE ALTERATION AT THE EDGES OF THE FLAKES. LESS THAN 5 PERCENT VERY FINE PRISMATIC INCLUSIONS SURROUNDED BY PLEOCHROIC HALOS. CONTAMINANTS ARE HORNBLENDE (3 PERCENT), MUSCOVITE (5 PERCENT), AND CHLORITE (1 PERCENT).

FROM GRANITE
(56 P) ELLICE HILLS, WEST SIDE OF COMMITTEE BAY, DISTRICT OF KEEWATIN, 67-55 N, 88-48 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE HF170, COLLECTED AND INTERPRETED BY W. W. HEYWOOD.

FOR DESCRIPTION AND INTERPRETATION SEE GSC 65-82.

GSC 65-82 MUSCOVITE, K-AR AGE 1610 + OR - 50 M.Y.

K=8.95 PERCENT, AR40/K40=0.1489, RADIOGENIC AR=97 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF MUSCOVITE.

FROM GRANITE
(56 P) ELLICE HILLS, WEST SIDE OF COMMITTEE BAY, DISTRICT

OF KEEWATIN, 67-55 N, 88-48 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE HF-170, COLLECTED AND INTERPRETED BY W. W. HEYWOOD.

SLIGHTLY FOLIATED MEDIUM GRAINED GREY TO PINK GRANITE COMPOSED OF QUARTZ, PLAGIOCLASE, MICROCLINE, BIOTITE AND MUSCOVITE IS EXPOSED OVER A WIDE AREA WEST OF COMMITTEE BAY WHERE IT INTRUDES OR REPLACES GNEISSES.

THE AGES DETERMINED FROM BIOTITE AND MUSCOVITE ARE IN CLOSE AGREEMENT AND PROBABLY REPRESENT THE AGE OF GRANITE EMPLACEMENT.

GSC 65-83 WHOLE ROCK, K-AR AGE 830 + OR - 110 M.Y.

K=0.79 PERCENT, AR40/K40=0.0610, RADIOGENIC AR=66 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM SPILITIC BASALT.
(34 M) 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-107A-59, COLLECTED AND INTERPRETED BY G. D. JACKSON.

THE SAMPLE IS FROM THE CHILLED MARGIN OF A PILLOW. THE ROCK IS LIGHT GREY, VERY FINE GRAINED, MASSIVE, AMYGDALOIDAL, AND HAS AN INTERGRANULAR TEXTURE. THE MAJOR CONSTITUENTS ARE- CLINOPYROXENE, SODIC PLAGIOCLASE, EPIDOTE, CALCITE, CHLORITE, AND SPHENE. A FEW TINY EPIDOTE VEINLETS ARE PRESENT.

FOR DESCRIPTION AND INTERPRETATION SEE GSC 65-87.

GSC 65-84 WHOLE ROCK, K-AR AGE 881 + OR - 80 M.Y.

K=1.20 PERCENT, AR40/K40=0.0658, RADIOGENIC AR=87 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM BASALTIC TRAP DYKE

DISTRICT OF KEEWATIN

(34 M) SOUTH END OF CHURCHILL SOUND, BELCHER ISLANDS, DISTRICT OF KEEWATIN, 55-55-28 N, 80-09-48 W. MAP-UNIT 14, GSC MAP 28-1960 (WITH PAPER 60-20). SAMPLE JD-227B-59, COLLECTED AND INTERPRETED BY G. D. JACKSON.

THE SAMPLE IS FROM A SMALL DYKE CUTTING A DIABASE SILL OF MAP-UNIT 14. THE ROCK IS VERY FINE GRAINED, DARK GREY, MASSIVE, AND SLIGHTLY PORPHYRITIC (MAGNETITE, PLAGIOCLASE). THE MAIN CONSTITUENTS ARE- CLINOPYROXENE, PLAGIOCLASE, HORNBLENDE, AND MAGNETITE.

FOR INTERPRETATION SEE GSC 65-87.

GSC 65-85 WHOLE ROCK, K-AR AGE 1625 + OR - 210 M.Y.

K=0.41 PERCENT, AR40/K40=0.1510, RADIOGENIC AR=69 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM SPILITIC BASALT

(34 D) WEST SIDE OF MOORE ISLAND, BELCHER ISLANDS, DISTRICT OF KEEWATIN, 56-24-02 N, 79-32-48 W. MAP UNIT 2, GSC MAP 28-1960 (WITH PAPER 60-20). SAMPLE JD-280D-59, COLLECTED AND INTERPRETED BY G. D. JACKSON.

THE SAMPLE IS FROM THE CENTRE OF A 2.5 FOOT PILLOW. THE ROCK IS MASSIVE, AMYGDALOIDAL, VERY FINE GRAINED, DARK GREENISH GREY, AND HAS INTERGRANULAR TEXTURE. THE MAJOR CONSTITUENTS ARE- ALTERED CLINOPYROXENE AND SODIC PLAGIOCLASE, CHLORITE AND MUSCOVITE.

FOR INTERPRETATION SEE GSC 65-87.

GSC 65-86 WHOLE ROCK, K-AR AGE 1010 + OR - 150 M.Y.

K=0.40 PERCENT, AR 40/K40=0.0783, RADIOGENIC AR= 68 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

DISTRICT OF KEEWATIN

FROM SPILITIC BASALT
(34 D) THREE MILES EAST OF COATS BAY, BELCHER ISLANDS, DISTRICT OF KEEWATIN, 56-20-12 N, 79-16-09 W. MAP-UNIT 2, GSC MAP 28-1960 (WITH PAPER 60-20). SAMPLE JD-58B-59, COLLECTED AND INTERPRETED BY G. D. JACKSON.

THE SAMPLE IS FROM THE CHILLED RIM OF THE SAME PILLOW THAT SAMPLE GSC 65-87 WAS TAKEN FROM. THE ROCK IS DARK GREY, VERY FINE GRAINED, MASSIVE, PORPHYRITIC, AND HAS INTER GRANULAR TEXTURE. THE MAJOR CONSTITUENTS ARE- CLINORYROXENE, SODIC PLAGIOCLASE, CHLORITE, MAGNETITE, HORNBLENDE, AND SPHENE.

FOR INTERPRETATION SEE GSC 65-87.

GSC 65-87 WHOLE ROCK, K-AR AGE 1693 + OR - 230 M.Y.

K=0.33 PERCENT, AR40/K40=0.1604, RADIOGENIC AR= 78 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM SPILITIC BASALT
(34 D) THREE MILES EAST OF COATS BAY, BELCHER ISLANDS, DISTRICT OF KEEWATIN, 56-20-12 N, 79-16-09 W. MAP UNIT 2, GSC MAP 28-1960 (WITH PAPER 60-20). SAMPLE JD-58A-59, COLLECTED AND INTERPRETED BY G. D. JACKSON.

THE SAMPLE IS FROM THE CORE OF THE SAME PILLOW THAT SAMPLE GSC 65-86 WAS TAKEN FROM. THE ROCK IS FINE GRAINED, DARK GREENISH BLACK, PORPHYRITIC, AND HAS AN INTERGRANULAR TEXTURE. THE MAJOR CONSTITUENTS ARE SODIC PLAGIOCLASE, CLINOPYROXENE, CHLORITE, EPIDOTE, MAGNETITE AND SPHENE. MINUTE EPIDOTE-RICH VEINLETS ARE PRESENT.

TO DATE, SIX WHOLE ROCK K-AR AGES HAVE BEEN DETERMINED FOR SAMPLES OF BASIC IGNEOUS ROCKS WITHIN THE BELCHER GROUP, AND THESE AGES MAY BE SEPARATED INTO AN OLDER AND A YOUNGER GROUP. TWO SAMPLES FROM PILLOW CORES GAVE AGES OF 1625 M.Y. (GSC 65-85, MAP UNIT 2) AND 1963 M.Y. (GSC 65-87, MAP-UNIT 13). THESE AGES ARE IN GOOD AGREEMENT WITH AN AGE OF 1620 M.Y. DETERMINED FOR A SAMPLE FROM A DIABASE SILL OF MAP-UNIT 14 AND DESCRIBED PREVIOUSLY (GSC 63-93, GSC PAPER 64-17 PT. 1). THESE AGES, BY THEMSELVES SUGGEST THAT THE SPILITIC FLOWS OF MAP-UNITS 2 AND 13, AND MOST OF THE BASIC INTRUSIONS OF MAP-UNIT 14 WERE EMPLACED AND/OR ALTERED AT

ABOUT THE SAME TIME. THEY ALSO INDICATE, ALONG WITH THE FIELD RELATIONS, THAT MOST OF THE INTRUSIONS OF MAP-UNIT 14 ARE PROBABLY RELATED TO THE VOLCANIC ACTIVITY RECORDED IN MAP-UNIT 13.

TWO SAMPLES FROM PILLOW RIMS GAVE AGES OF 1010 M.Y. (GSC 65-86, MAP UNIT 2) AND 830 M.Y. (GSC 65-83, MAP-UNIT 13). ROUGHLY, THESE AGES ARE COMPARABLE TO THE AGE OF 881 M.Y. (GSC 65-84) OBTAINED FOR A SAMPLE FROM A BASALTIC TRAP DYKE. THIS SAMPLE IS LESS ALTERED THAN THE OTHERS, AND ITS AGE MAY BE THE APPROXIMATE AGE OF INTRUSION OF THE SAMPLED DYKE AND SEVERAL ASSOCIATED TRAP DYKES.

SEVERAL POSSIBILITIES MAY BE SUGGESTED TO ACCOUNT FOR THE YOUNGER RIM AND OLDER CORE AGES, A RELATIONSHIP OPPOSITE TO THAT WHICH HAS BEEN OBSERVED BETWEEN THE CHILLED MARGINS AND CENTRES OF SOME PRECAMBRIAN DIABASE DYKES (W. F. FAHRIG, PERSONAL COMMUNICATION). THESE POSSIBILITIES DEPEND ON WHEN THE IGNEOUS ROCKS WERE EMPLACED AND/OR ALTERED, WHAT BEARING THEIR PARTIAL ALTERATION HAD ON THE AGE DETERMINATION RESULTS, AND WHEN THE BELCHER GROUP WAS FOLDED, ETC.

TWO OF THE MOST LIKELY POSSIBILITIES FOR THE OLDER GROUP OF AGES ARE THAT THE ALTERATION PRESENT IN THE FLOWS AND INTRUSIONS IS A RESULT OF DEUTERIC ACTION OR AUTOMETAMORPHISM, AND THAT THE ALTERATION OCCURED DURING FOLDING. IF THE ALTERATION OCCURRED AT ABOUT THE TIME THE BASIC FLOWS AND INTRUSIONS WERE EMPLACED, WHICH THEORY IS FAVOURED SLIGHTLY BY THE WRITER, THEN THE OLDER AGES PROBABLY APPROXIMATE THE AGE OF IGNEOUS ACTIVITY. THIS WOULD SUGGEST A LATE APHEBIAN OR AN EARLY HELIKIAN AGE FOR THE BELCHER GROUP. IF THE PARTIAL ALTERATION IS RELATED TO FOLDING, THE OLDER AGES MAY BE INTERMEDIATE BETWEEN THE AGE OF IGNEOUS ACTIVITY AND THAT OF FOLDING, AND THE BELCHER GROUP WOULD BE OF APHEBIAN AGE.

IN GENERAL THERE SEEMS TO BE NO SIGNIFICANT DIFFERENCE BETWEEN THE TEXTURES, MINERALOGY, AND DEGREE OF ALTERATION PRESENT IN PILLOW RIMS AND CORES OF THE SAME MAP-UNIT, MOREOVER, THE FLOWS OF MAP-UNIT 2 SEEM ONLY SLIGHTLY MORE ALTERED THAN THOSE OF MAP-UNIT 13. IT DOES NOT SEEM LIKELY THEREFORE THAT THE YOUNGER RIM EDGES ARE INDICATIVE OF THE AGE OF THE MAIN PERIOD OF FOLDING. MORE LIKELY THESE YOUNGER AGES REPRESENT AN EPISODE OF HYDROTHERMAL ACTIVITY AND/OR A MILD DISTURBANCE THAT COINCIDED WITH THE INTRUSION OF THE LATE BASALTIC TRAP DYKES.

REFERENCE-

WANLESS R.K., STEVENS R.D., LACHANCE G.R., AND RIMSAITE J.Y.H.
1965 AGE DETERMINATIONS AND GEOLOGICAL STUDIES, PART 1-ISOTOPIC AGES, REPORT 5. GSC PAPER 64-17

ALBERTA

GSC 65-88 WHOLE ROCK, K-AR AGE 142 + OR - 15 M.Y.

K=4.20 PERCENT, AR40/K40=0.0086, RADIOGENIC AR=90 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

(82 G) FROM MICROGRANODIORITE PEBBLE BESIDE GARBAGE DUMP AT THE TOWN LIMIT OF FRANK, ALBERTA, 49-36 N, 114-24 W. MAP-UNIT **BLAIRMORE GROUP**, GSC MAP 55-18 (BLAIRMORE). SAMPLE H-36-3, COLLECTED BY D. K. NORRIS, DESCRIBED BY R. D. STEVENS.

THE ROCK IS AN ANHEDRAL-GRANULAR MICROGRANODIORITE PEBBLE CONSISTING MAINLY OF QUARTZ (50 PERCENT), PLAGIOCLASE (40 PERCENT), ORTHOCLASE (8 PERCENT), AND CHLORITE AND IRON OXIDES (2 PERCENT). THE AVERAGE GRAIN SIZE IS ABOUT 2 MM.

SEE GSC 65-93 FOR A GEOLOGICAL INTERPRETATION OF THE AGE OBTAINED.

GSC 65-89 WHOLE ROCK, K-AR AGE 174 + OR - 22 M.Y.

K=2.50 PERCENT, AR40/K40=0.0106, RADIOGENIC AR=80 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

(82 G) FROM MICROGRANODIORITE PEBBLE BESIDE GARBAGE DUMP AT THE TOWN LIMIT OF FRANK, ALBERTA, 49-36 N, 114-24 W. MAP-UNIT **BLAIRMORE GROUP**, GSC MAP 55-18 (BLAIRMORE). SAMPLE H-36-1, COLLECTED BY D. K. NORRIS, DESCRIBED BY R. D. STEVENS.

THE ROCK IS A MICROGRANODIORITE PEBBLE CONSISTING OF ABOUT 40 PERCENT PLAGIOCLASE, 50 PERCENT QUARTZ-ORTHOCLASE MICROGRAPHIC INTERGROWTHS, AND 10 PERCENT CHLORITE, EPIDOTE AND IRON OXIDES. AVERAGE GRAIN SIZE IS 1.5-2 MM. AND THE ROCK HAS AN OVERALL GRANOPHYRIC TEXTURE.

SEE GSC 65-93 FOR A GEOLOGICAL INTERPRETATION OF THE AGE OBTAINED.

ALBERTA

GSC 65-90 WHOLE ROCK, K-AR AGE 113 + OR - 16 M.Y.

K=2.90 PERCENT, AR40/K40=0.0068, RADIOGENIC AR=65 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

(86 G) FROM DACITE PORPHYRY PEEBLE CREST OF GINGER HILL, ALBERTA, 49-29 N, 114-20 W. MAP-UNIT **BLAIRMORE GROUP**, GSC MAP 5-1959 (CARBONDALE RIVER). SAMPLE 74-NC, COLLECTED BY D. K. NORRIS, DESCRIBED BY R. D. STEVENS.

THE ROCK IS A DACITE PORPHYRY PEBBLE CONSISTING OF ABOUT 30 PERCENT 2-3 MM. PLAGIOCLASE PHENOCRYSTS AND 10 PERCENT 1-3 MM. QUARTZ PHENOCRYSTS IN A FINE (ABOUT 0.2 MM.) GROUNDMASS OF QUARTZ, MICROGRAPHIC QUARTZ-ORTHOCLASE INTERGROWTHS, AND A SMALL AMOUNT OF CHLORITE, MUSCOVITE, EPIDOTE, AND IRON OXIDES.

SEE GSC 65-93 FOR A GEOLOGICAL INTERPRETATION OF THE AGE OBTAINED.

GSC 65-91 WHOLE ROCK, K-AR AGE 158 + OR - 18 M.Y.

K=3.30 PERCENT, AR40-K40=0.0096, RADIOGENIC AR=84 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

(82 G) FROM DACITE PORPHYRY PEBBLE CREST OF GINGER HILL, ALBERTA, 49-29 N, 114-20 W. MAP-UNIT **BLAIRMORE GROUP**, GSC MAP 5-1959 (CARBONDALE RIVER). SAMPLE 74-NC-1, COLLECTED BY D. K. NORRIS, DESCRIBED BY R. D. STEVENS.

THE ROCK IS A DACITE PORPHYRY PEBBLE CONSISTING OF 2 MM. PLAGIOCLASE PHENOCRYSTS (10 PERCENT) IN A CRYPTOCRYSTALLINE, FELSIC GROUNDMASS. THE SECTION IS CUT BY NUMEROUS, VERY FINE QUARTZ VEINS.

SEE GSC 65-93 FOR A GEOLOGICAL INTERPRETATION OF THE AGE OBTAINED.

ALBERTA

GSC 65-92 WHOLE ROCK, K-AR AGE 145 + OR - 18 M.Y.

K=1.70 PERCENT, AR40/K40=0.0083, RADIOGENIC AR=69 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM RHYODACITE PORPHYRY PEBBLE
(82 G) CREST OF GINGER HILL, ALBERTA, 49-29 N, 114-20 W. MAP-UNIT **BLAIRMORE GROUP**, GSC MAP 5-1959, (CARBONDALE RIVER). SAMPLE NC-74-4, COLLECTED BY D. K. NORRIS, DESCRIBED BY R. D. STEVENS.

THE ROCK IS A RHYODACITE PORPHYRY PEBBLE CONSISTING OF PHENOCRYSTS OF PLAGIOCLASE (10 PERCENT), QUARTZ (25 PERCENT) AND ORTHOCLASE (20 PERCENT) IN A MICROCRYPTALLINE MOSAIC GROUNDMASS OF QUARTZ AND ORTHOCLASE.

SEE GSC 65-93 FOR A GEOLOGICAL INTERPRETATION OF THE AGE OBTAINED.

GSC 65-93 WHOLE ROCK, K-AR AGE 149 + OR - 17 M.Y.

K=3.20 PERCENT, AR40/K40=0.0091, RADIOGENIC AR=41 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM RHYODACITE PORPHYRY PEBBLE
(82 J) LEFT BANK OF LIVINGSTONE RIVER, 1/4 MILE SOUTH OF THE JUNCTION WITH BRUIN CREEK, ALBERTA, 50-01 N, 114-25 W. MAP-UNIT **BLAIRMORE GROUP**, GSC MAP 5-1958 (LIVINGSTONE RIVER). SAMPLE N-2273, COLLECTED BY D. K. NORRIS, DESCRIBED BY R. D. STEVENS.

THE ROCK IS A FINE RHYODACITE PORPHYRY PEBBLE CONSISTING OF 1 TO 1.5 MM. PHENOCRYSTS OF ALTERED PLAGIOCLASE (20 PERCENT) ALTERED ORTHOCLASE (20 PERCENT), AND QUARTZ (5 PERCENT) IN A VERY FINE, MICROCRYSTALLINE, ANHEDRAL-GRANULAR GROUNDMASS OF QUARTZ AND FELDSPAR.

THE IGNEOUS PEBBLES DESCRIBED ABOVE (GSC 65-33,88, 89, 90, 91, 92, 93) WERE TAKEN FROM THE LOWER CRETACEOUS MCDOUGALL-SEGUR CONGLOMERATE OF THE BLAIRMORE GROUP AND CROWSNEST FORMATION IN THE SOUTHEASTERN CANADIAN CORDILLERA.

THE STRATIGRAPHIC POSITION OF THE MCDOUGALL-SEGUR IN THE ALBIAN STAGE NECESSITATES A MINIMUM AGE OF 100 M.Y. FOR THE CONTAINED PEBBLES. THE TOTAL RANGE OF 113 TO 174 M.Y. FOR THE SEVEN DATED IGNEOUS PEBBLES IS THEREFORE COMPATIBLE WITH THE STRATIGRAPHIC POSITION OF THE CONGLOMERATE.

FOR A MORE DETAILED DESCRIPTION, INTERPRETATION AND STATEMENT OF THE GEOLOGICAL CONDITIONS SEE NORRIS, STEVENS AND WANLESS, 1965- **K-AR AGE OF IGNEOUS PEBBLES IN THE MCDOUGALL-SEGUR CONGLOMERATE, SOUTHEASTERN CANADIAN CORDILLERA**, GSC PAPER 65-26.

GSC 65-94 MUSCOVITE, K-AR AGE 1535 + OR - 50 M.Y.

K=8.39 PERCENT, AR40/K40=0.1384, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- MAINLY CLEAN, CLEAR MUSCOVITE, THOUGH ABOUT 5 PERCENT OF THE FLAKES ARE STAINED WITH YELLOW CHLORITE AND CONTAIN A FEW OPAQUE INCLUSIONS. TOTAL CHLORITE CONTENT IS 2 PERCENT.

FROM MICACEOUS SILTSTONE.
(83 D) IN CUT ON YELLOWHEAD PASS ROAD, 1.5 MILES WEST OF BANFF-JASPER HIGHWAY, ALBERTA, 52-52 N, 118-07 W. NO GEOLOGICAL MAP AVAILABLE. SAMPLE 64-PF-130, COLLECTED AND INTERPRETED BY R. A. PRICE.

THE MUSCOVITE OCCURS AS DETRITAL FLAKES UP TO 3 MM. IN DIAMETER ALONG PARTINGS IN SANDSTONES OF THE MIDDLE PART OF THE LATE PRECAMBRIAN (WINDERMERE) MIETTE GROUP.

THE AGE OF THE MUSCOVITE IS CONSISTENT WITH PALEOCURRENT DATA PRESENTED BY MOUNTJOY AND AITKEN (1) THAT INDICATE AN EASTERN OR NORTHEASTERN PROVENANCE FOR THE DETRITAL ROCKS OF THE MIETTE GROUP. MOREOVER IT SUGGESTS THAT THE SEDIMENT WAS DERIVED FROM THE HUDSONIAN BASEMENT THAT EXTENDS UNDER THE WESTERN PLAINS FROM THE CANADIAN SHIELD.

REFERENCES-

MOUNTJOY, E.W. AND AITKEN, J.D.
1963 EARLY CAMBRIAN AND LATE PRECAMBRIAN PALEOCURRENTS, BANFF AND JASPER NATIONAL PARKS. BULL. CAN. PETROL. GEOL., VOL. 11, PP. 161-168.

SASKATCHEWAN

GSC 65-95 BIOTITE, K-AR AGE 1835 + OR - 50 M.Y.

K=6.00 PERCENT, AR40/K40=0.1817, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF BROWN BIOTITE. MINOR IMPURITIES CONSIST OF A FEW GRAINS OF CHLORITE AND QUARTZ. TOTAL CHLORITE CONTENT LESS THAN 1 PERCENT.

FROM GABBRO

(74 N) SASKATCHEWAN, 59-42 N, 108-27 W. MAP-UNIT 9, GSC MAP 1015A. SAMPLE FA-27-63-2, COLLECTED AND INTERPRETED BY W. F. FAHRIG.

THE 1835 + OR - 50 M.Y. DATE REPRESENTS THE APPROXIMATE AGE OF INTRUSION OF THE DYKE FROM WHICH THIS DARK GREY GABBRO WAS TAKEN.

MANITOBA

GSC 65-96 HORNBLENDE, K-AR AGE 1805 + OR - 165 M.Y.

K=0.96 PERCENT, AR40/K40=0.1771, RADIOGENIC AR=96 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF VERY SLIGHTLY ALTERED BLUE-GREEN TO YELLOW-GREEN HORNBLENDE WITH LESS THAN 5 PERCENT CHLORITE.

FROM GNEISS
(63 J) ISOLATED OUTCROP SURROUNDED BY FLOATING BOG, 1.3 MILES NORTHEAST OF MINAGO RIVER, MANITOBA, 54-32-38 N, 98-35-13 W. WEKUSKO MAP IN PREPARATION. SAMPLE BA-G-17, COLLECTED AND INTERPRETED BY C. K. BELL.

MEDIUM-GRAINED, GREY GNEISS COMPOSED OF ALTERNATING PLAGIOCLASE (LABRADORITE) AND HORNBLENDE RICH LAYERS. THE LAYERING COULD BE EITHER PRIMARY OR METAMORPHIC.

THIS SAMPLE IS FROM AN ANORTHOSITE BODY THAT IS CLOSELY ASSOCIATED WITH GRANULITE FACIES ROCKS OF THE PIKWITONEI SUBPROVINCE OF THE SUPERIOR STRUCTURAL PROVINCE (GSC PAPER 66-1, P. 133). THE PARTICULAR HORNBLENDE ANORTHOSITE MASS FROM WHICH THIS SAMPLE WAS TAKEN LIES CLOSE TO THE CHURCHILL-SUPERIOR PROVINCE BOUNDARY AND WOULD BE INCLUDED IN THE RETROGRADE GNEISS ZONE DESCRIBED IN THE ABOVE PAPER. CLOSELY ASSOCIATED PORPHYRITIC HORNBLENDE ANORTHOSITE (SAMPLE GSC 64-83) LYING WITHIN THE PIKWITONEI SUBPROVINCE HAS A SUPERIOR DATE OF 2435 M.Y. SAMPLE GSC 65-96 THEREFORE REPRESENTS A REMNANT OF SUPERIOR PROVINCE ROCK THAT HAS BEEN MODIFIED BY THE HUDSONIAN OROGENY.

GSC 65-97 MUSCOVITE, K-AR AGE 1735 + OR - 55 M.Y.

K=7.79 PERCENT, AR40/K40=0.1663, RADIOGENIC AR=97 PERCENT.

CONCENTRATE- CLEAN, UNALTERED MUSCOVITE WITH 1 PERCENT QUARTZ CONTAMINATION.

FROM GRANITE PEGMATITE
(63 J) GREEN BAY MINING AND EXPLORATION CO., EAST OF CROWDUCK BAY, WEKUSKO LAKE, MANITOBA, 54-51 N, 99-38 W. GSC MAP 987A. SAMPLE MF56-110/113, COLLECTED AND INTERPRETED BY R. MULLIGAN.

THE PEGMATITE IS CRUDELY ZONED AND VARIABLE IN GRANULARITY, WITH ERRATIC APLITIC PHASES. IT CONSISTS OF ABOUT 45 PERCENT PARTLY ALTERED MICROCLINE MICROPERTHITE AND 20 PERCENT SPODUMENE IN CRYSTALS UP TO A FOOT OR MORE LONG, WITH INTERSTITIAL CLEAVELANDITE AND QUARTZ, ABOUT 5 PERCENT MUSCOVITE, 5 PERCENT TOURMALINE, AND A LITTLE BERYL.

THE LOCALITY IS THE WESTERNMOST OF A BELT OF LITHIUM-BEARING PEGMATITES THAT EXTENDS ACROSS NORTHERN MANITOBA FROM THE SUPERIOR TO THE CHURCHILL PROVINCE. IT IS THE ONLY KNOWN LITHIUM OCCURRENCE IN THE CHURCHILL PROVINCE. ITS INDICATED HUDSONIAN AGE CORRESPONDS WITH THAT OF OTHER PEGMATITES IN THE SAME AREA.

REFERENCES-

FRAREY, M.J.
1951 CROWDUCK BAY, MANITOBA. GEOL. SURV. CAN., MAP 987A.

MULLIGAN R.
1965 GEOLOGY OF CANADIAN LITHIUM DEPOSITS. GEOL. SURV. CAN., ECON. GEOL. REPT. NO. 21.

GSC 65-98 HORNBLENDE, K-AR AGE 2375 + OR - 165 M.Y.

K=1.50 PERCENT, AR40/K40=0.2786, RADIOGENIC AR=97 PERCENT.

CONCENTRATE- RELATIVELY CLEAN DARK GREEN HORNBLENDE WITH ABOUT 3 PERCENT QUARTZ CONTAMINATION.

FROM AMPHIBOLITE

(63 J) SOUTH SHORE OF SIPIWESK LAKE, EAST OF WHERE THE NELSON RIVER EMPTIES OUT OF DUCK LAKE, MANITOBA, 54-56-45 N, 98-06-22 W. WESKUKO MAP IN PREPARATION. SAMPLE BA-Z-101, COLLECTED AND INTERPRETED BY C. K. BELL.

THE SAMPLE WAS TAKEN FROM A DARK LAYER IN A STRIPED, BASIC GRANULITE CONSISTING OF A GNEISSIC AGGREGATE OF SODIC ANDESINE, HORNBLENDE, CLINOPYROXENE (AUGITE), AND MINOR MAGNETITE, AND HYPERSTHENE.

THIS ROCK IS FROM THE PIKWITONEI SUBPROVINCE (GSC PAPER 66-1, P. 133) OF THE SUPERIOR STRUCTURAL PROVINCE. IT MAY BE COMPARED WITH THE FOLLOWING COMPANION ROCK 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 ETAL., JOUR. GEOPHY, RESEARCH, VOL, 67, NO. 4, AND GSC AGE DETERMINATIONS GSC 60-83 (HYPERSTHENE GRANITE) AT 2400 M.Y., GSC 64-81 (GRANULITE) AT 2680 M.Y. AND GSC 64-83 (ANORTHOSITE) AT 2435 M.Y.

THE K-AR AGE OF 2375 + OR - 165 M.Y. ON THIS SAMPLE MAY BE CONSIDERED TO BE IN GOOD AGREEMENT WITHIN THE LIMITS ASSIGNED TO IT.

GSC 65-99 HORNBLENDE, K-AR AGE 1840 + OR - 160 M.Y.

K=1.30 PERCENT, AR40/K40=0.1826, RADIOGENIC AR=91 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED GREEN TO YELLOW-GREEN HORNBLENDE WITH LESS THAN 2 PERCENT QUARTZ CONTAMINATION.

FROM GNEISS
(63 O) SOUTHEAST SHORE OF PHILLIP LAKE, MANITOBA, 55-14-25 N, 98-17-37 W. MAP-UNIT 1, MAN. DEPT. MINES AND NAT. RESOURCES PRELIMINARY FIELD MAP HALFWAY LAKE W/2. SAMPLE BA-Q65-36, COLLECTED AND INTERPRETED BY C. K. BELL.

FOR DESCRIPTION AND INTERPRETATION SEE GSC 65-100.

GSC 65-100 BIOTITE, K-AR AGE 1850 + OR - 60 M.Y.

K=7.41 PERCENT, AR40/K40=0.1837, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED BROWN BIOTITE WITH ABOUT 5 PERCENT HORNBLENDE CONTAMINATION. THE FLAKES CONTAIN 1 PERCENT COLOURLESS PRISMATIC INCLUSIONS SURROUNDED BY STRONG PLEOCHROIC HALOS. TOTAL CHLORITE CONTENT IS LESS THAN 1 PERCENT.

FROM GNEISS
(63 O) SOUTHEAST SHORE OF PHILLIP LAKE, MANITOBA, 55-14-25 N, 98-17-37 W. MAP-UNIT 1, MAN. DEPT. MINES AND NAT. RESOURCES PRELIMINARY FIELD MAP HALFWAY

MANITOBA

LAKE W/2. SAMPLE BA-Q65-36, COLLECTED AND INTERPRETED BY C. K. BELL.

THIS SAMPLE AND GSC 65-99 WERE TAKEN FROM A GARNETIFEROUS QUARTZ-PLAGIOCLASE (ANDESINE)-BIOTITE-HORNBLENDE GNEISS CONTAINING ACCESSORY MAGNETITE AND APATITE, AND A TRACE OF SECONDARY CHLORITE.

IT WAS THOUGHT THAT THIS GNEISS REPRESENTED AN OUTLIER OF PIKWITONEI SUBPROVINCE GRANULITE LYING WEST OF THE MAIN GRANULITE MASS WITHIN THE RETROGRADE GNEISS ZONE (GSC PAPER 66-1, P. 135) OF THE CHURCHILL PROVINCE. WHATEVER ITS ORIGINAL STATE, IT HAS BEEN MODIFIED BY THE HUDSONIAN OROGENY. COMPARE WITH GSC 60-79 (HYPERSTHENE GRANITE GNEISS) DATED AT 1675 M.Y., FROM THE RETROGRADE GNEISS ZONE. THE BIOTITE AND HORNBLENDE FROM BOTH THESE SAMPLES IS PROBABLY SECONDARY. THE HORNBLENDE AND BIOTITE DATES ARE IN EXCELLENT AGREEMENT.

GSC 65-101 MUSCOVITE, K-AR AGE 2035 + OR - 70 M.Y.

K=8.88 PERCENT, AR40/K40=0.2145, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- CLEAN, SLIGHTLY BLISTERED MUSCOVITE WITH LESS THAN 1 PERCENT OPAQUE INCLUSIONS.

FROM PEGMATITE
(63 P) SOUTH WALL OF SMALL FLUX QUARRY NEAR NORTH END OF OSPWAGAN LAKE, 10 MILES SOUTH OF THOMPSON, MANITOBA, 55-37-00 N, 97-58-58 W. MAN. DEPT. MINES AND NAT. RESOURCES MAP 60-4. SAMPLE BA-Q-65-34, COLLECTED AND INTERPRETED BY C. K. BELL.

THE SAMPLE IS FROM A GARNETIFEROUS, MUSCOVITE-BIOTITE-QUARTZ-FELDSPAR PEGMATITE. THIS PEGMATITE IS PROBABLY AN OFFSHOOT OF THE LARGE MASS OF GRANITE AT OSPWAGAN LAKE. IT TRANSECTS QUARTZITE AND PARAGNEISS THAT IS TYPICAL OF THE THOMPSON-SETTING BELT AND APPEARS TO HAVE BEEN INTRUDED POST-FAULTING, ALTHOUGH IT IS SLIGHTLY SHEARED. THIS GRANITE IS THOUGHT TO BE RELATED TO A SERIES OF LENS-SHAPED GRANITE STOCKS THAT INTRUDE ALL THE ROCKS ALONG THE THOMPSON-SETTING BELT. THE DATE SHOULD BE COMPARED WITH GSC 63-105 (QUARTZ MONZONITE) AT 1785 M.Y., AND GSC 64-80 (BIOTITE-QUARTZ MONZONITE AT 1755 M.Y. THE DATE OF 2035 + OR - 70 M.Y., ASSUMING IT IS AN ACCURATE DATE OF THE LAST METAMORPHISM, IS PRE- OR EARLY-HUDSONIAN AND SUGGESTS THAT THE OSPWAGAN GRANITE WAS NOT

MODIFIED DURING THE LATE HUDSONIAN OROGENY. AS MORE DATING IS DONE, OLDER AGES ARE BOUND TO APPEAR IN THE CHURCHILL PROVINCE BECAUSE GEOLOGICAL EVIDENCE IS SHOWING THAT LARGE AREAS WITHIN THE CHURCHILL PROVINCE WERE ONCE ARCHAEAN TERRAIN. REFER TO GSC 62-99, GSC 63-104, AND MONEY, P.L. (ABSTRACT, CIMM AND GAC ANN. WEST. MEETING, WINNIPEG, OCT., 1965). THE OSPWAGAN GRANITE IS THEREFORE EARLY PROTEROZOIC (APHEBIAN) OR ARCHAEAN, AND THE DATE SUGGESTS THAT THE THOMPSON NICKEL BELT SEDIMENTS HAD BEEN FOLDED AND INTRUDED BY IGNEOUS MATERIAL BY THE EARLY APHEBIAN. HOWEVER, LARGE AREAS WERE MODIFIED BY LATE HUDSONIAN METAMORPHISM LEAVING UNAFFECTED ENCLAVES LIKE THE OSPWAGAN GRANITE. IT SHOULD BE NOTED THAT THIS DATE IS COMPARABLE TO THOSE IN THE CROSS LAKE SUBPROVINCE TO THE SOUTH.

GSC 65-102 WHOLE ROCK, K-AR AGE 1130 + OR - 135 M.Y.

K=0.85 PERCENT, AR40/K40=0.0908, RADIOGENIC AR=86 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM GABBRO
(63 P) EAST SHORE OF MYSTERY LAKE, MANITOBA, 55-51-25 N, 97-43-00 W. MAN. MINES BR. PUB. NO. 60-4. SAMPLE BA-Z-G81C, COLLECTED AND INTERPRETED BY C. K. BELL.

THE ROCK IS A DARK, GREEN-GREY, MEDIUM-GRAINED, MASSIVE GABBRO COMPOSED OF LATH-SHAPED, SLIGHTLY SERICITIZED PLAGIOCLASE WITH MYRMEKITIC AND GRAPHIC INTERGROWTHS, AND SLIGHTLY ALTERED INTERSTITIAL PYROXENE. THESE MAJOR CONSTITUENTS ARE ASSOCIATED WITH SECONDARY QUARTZ AND MINOR HORNBLENDE, AND ORIENTATED MAGNETITE INCLUSIONS.

THIS NW TRENDING DYKE INTRUDES ALL THE ROCKS IN THE THOMPSON AREA AND IS PLOTTED BY H. F. ZURBIGG (TRANS. C.I.M.M., VOL LXVI, 1963, PP. 227-236, FIG. 2). IT IS PART OF A VAST NORTHWEST TRENDING SWARM OF DYKES THAT STRETCH FROM LAKE SUPERIOR TO THE MACKENZIE RIVER. ITS AGE SHOULD BE COMPARED WITH THE AVERAGE K-AR DATES OF 1220 M.Y. AND 1315 M.Y. OF THE SUPERIOR AND MACKENZIE SWARMS RESPECTIVELY (FAHRIG W.H. AND WANLESS R.K., NATURE, VOL. 200, NO. 4910, PP. 934-937, DEC. 1963), AND WITH GSC 64-78(1105 M.Y.) IT IS INTERESTING TO NOTE THAT THIS SWARM TRAVERSES THE CHURCHILL PROVINCE ROCKS BUT BARELY PENETRATES THE SUPERIOR PROVINCE GRANULITIC FACIES ROCKS SOUTHEAST OF THOMPSON.

ONTARIO

GSC 65-103 PHLOGOPITE, K-AR AGE 1060 + OR - 40 M.Y.

K=7.60 PERCENT, AR40/K40=0.0830, RADIOGENIC AR=97 PERCENT.

CONCENTRATE- CLEAN, UNALTERED, COLOURLESS TO VERY PALE GREEN PHLOGOPITE. THE FLAKES ARE SLIGHTLY BLISTERED AND CRACKED AND CONTAIN LESS THAN 1 PERCENT OPAQUE INCLUSIONS. LESS THAN 1 PERCENT HORNBLENDE IS PRESENT AS AN IMPURITY.

FROM MICA PERIDOTITE
(53 A) BETWEEN BIG BEAVER HOUSE AND LAKE ASSINE, ONTARIO, 52-54 N, 89-54 W. MAP-UNIT 3A, GSC MAP 1-1962. SAMPLE JD-X27-1962, COLLECTED AND INTERPRETED BY G. D. JACKSON.

THE SAMPLE IS FROM A MICA-PERIDOTITE PHASE OF AN ULTRA-BASIC-CARBONATITE COMPLEX THAT UNDERLIES AN AREA ABOUT 3 MILES IN DIAMETER AS OUTLINED BY AN AEROMAGNETIC ANOMALY. SEVERAL PHASES OF ULTRABASIC ROCK ARE PRESENT IN THE COMPLEX.

THE ROCK SAMPLED IS MOTTLED WHITE AND GREENISH BLACK, COARSE GRAINED, PORPHYRITIC AND ALLOTRIOMORPHIC. THE MAIN CONSTITUENTS ARE CALCITE, PHLOGOPITE, MAGNETITE-ILMENITE, OLIVINE AND APATITE. SERPENTINE, PYRRHOTITE, LEUCOXENE, RUTILE, CLINOPYROXENE AND BIOTITE ARE ALSO PRESENT. THE CALCITE OCCURS MAINLY IN IRREGULAR SHAPES AND VEINLETS THAT SEEM TO INTRUDE THE PERIDOTITE. THE PHLOGOPITE PREDATES THE EMPLACEMENT OF THE CARBONATE AND IS PART OF THE PRIMARY MINERAL ASSEMBLAGE OF THE PERIDOTITE. THE DETERMINED AGE SHOULD DATE THE EMPLACEMENT OF THE PERIDOTITE, ALTHOUGH THE POSSIBLE EFFECTS OF CARBONATIZATION ARE UNCERTAIN.

GSC 65-104 BIOTITE, K-AR AGE 2495 + OR - 65 M.Y.

K=5.92 PERCENT, AR40/K40=0.3033, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- ALTERED KHAKI BIOTITE. CHLORITIZ-ATION, FROM SLIGHT TO INTENSE, BEGINS AT FLAKE EDGES AND EXTENDS INWARDS. IMPURITIES CONSIST OF HORNBLENDE (3 PERCENT) AND QUARTZ-FELDSPAR (2 PERCENT).

FROM GRANODIORITE.
(42 L) OGOKI LAKE, ONTARIO, 50-49 N, 87-11 W. NO

ONTARIO

GEOLOGICAL MAP REFERENCE. SAMPLE FA-55-63-15, COLLECTED AND INTERPRETED BY W. F. FAHRIG.

THE ROCK IS A MEDIUM TO COARSE GRAINED, GREY TO PINK, FOLIATED GRANODIORITE COMPOSED CHIEFLY OF SODIC PLAGIOCLASE, QUARTZ AND BROWN BIOTITE IN AN EQUIANGULAR AGGREGATE. THE BIOTITE IS MAINLY FRESH, BUT LOCALLY INTERLEAVED WITH CHLORITE.

THE GRANODIORITE SAMPLE LOCALITY IS 67 FT. FROM THE CONTACT OF A DIABASE DYKE 117 FT. IN WIDTH WHICH INTRUDES THE GRANODIORITE. THE 2495 M.Y. AGE OBTAINED IS THAT OF THE REGIONAL METAMORPHISM IN THE AREA AND INDICATES THAT NO SIGNIFICANT ARGON LOSS WAS CAUSED BY THE NEARBY INTRUSION OF THE YOUNGER BASALTIC MATERIAL.

GSC 65-105 WHOLE ROCK, K-AR AGE 915 + OR - 140 M.Y.

K=0.55 PERCENT, AR40/K40=0.0689, RADIOGENIC AR=76 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM PILLOWED BASALT
(41 K) FALLS NEAR MOUTH OF HARMONY RIVER, ONTARIO, 46-55-50 N, 84-25-30 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE 64RF11, COLLECTED P. E. GIBLIN AND S. M. ROSCOE, INTERPRETED BY S. M. ROSCOE.

THE SAMPLE IS FROM KEWEENAWAN PILLOWED BASALT CHILLED AGAINST GRANITE WHICH IT OVERLIES UNCONFORMABLY. THE AGE OF 915 + OR - 140 M.Y. CAN BE COMPARED WITH AN AGE OF 1080 M.Y. (GOLDICH, 1961) FOR DULUTH GABBRO INTRUSION INTO MIDDLE KEWEENAWAN ROCKS, AND 1055 + OR - 35 M.Y. FOR COARSE-GRAINED MUSCOVITE (GSC 64-84) IN THE NEARBY TRIBAG COPPER-BEARING BRECCIA PIPE DEPOSIT. THE PRESENT SAMPLE MAY HAVE LOST SOME ARGON, OR MAY REPRESENT A LATE PHASE OF KEWEENAWAN VOLCANISM BUT, WITH ITS BROAD LIMITS OF ERROR (+ OR - 140 M.Y. DUE MAINLY TO ITS LOW K CONTENT), IT CAN BE CONSIDERED CONSISTANT WITH A PREFERRED AGE OF ABOUT 1050 M.Y. FOR KEWEENAWAN ROCKS ALONG THE EAST SHORE OF LAKE SUPERIOR.

ONTARIO

GSC 65-106 WHOLE ROCK, K-AR AGE 830 + OR - 84 M.Y.

K=2.94 PERCENT, AR40/K40=0.0610, RADIOENIC AR=95 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM BRECCIA
(41 N) TRIBAG COPPER DEPOSIT, ONTARIO, 47-04 N, 84-31 W. NO GEOLOGICAL MAP AVAILABLE. SAMPLE 64RF-10A, COLLECTED BY P. E. GIBLIN AND S. M. ROSCOE, INTERPRETED BY S. M. ROSCOE.

THE ROCK WAS FROM A BRECCIA ORE PIPE IN WHICH FINE-GRAINED SERICITE AND CARBONATE REPLACE ROCK FRAGMENTS OF THE BRECCIA. THIS SAMPLE WAS TAKEN FROM THE SAME SPECIMEN AS MUSCOVITE GSC 64-84, WHICH YIELDED A K-AR AGE OF 1055 + OR - 55 M.Y. IN THIS CASE, EVEN THOUGH THE ROCK CONSISTS LARGELY OF SERICITE, IT WOULD APPEAR THAT THE WHOLE ROCK HAS SUFFERED A PARTIAL LOSS OF RADIOGENIC ARGON, SO YIELDING AN ANOMALOUSLY YOUNG AGE.

FOR FURTHER DISCUSSION SEE GSC 65-105.

GSC 65-107 BIOTITE, K-AR AGE 1530 + OR - 50 M.Y.

K=7.90 PERCENT, AR40/K40=0.1382, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- CLEAN, UNALTERED, OLIVE- GREEN BIOTITE WITH LESS THAN 2 PERCENT COLOURLESS INCLUSIONS. 4-5 PERCENT HORNBLENDE IS PRESENT AS AN IMPURITY.

FROM QUARTZ DIORITE
(41 J) NORTHWEST SHORE OF CROKER ISLAND, NORTH CHANNEL, LAKE HURON, ONTARIO, 46-05 N, 82-13 W. MAP-UNIT 1, BUREAU OF GEOLOGY AND TOPOGRAPHY MAP 351A, 1937. SAMPLE LE-1-56, COLLECTED AND INTERPRETED BY B. A. LIBERTY, DESCRIBED BY R. D. STEVENS.

THE ROCK IS A COARSE GRAINED, MASSIVE, GREY QUARTZ DIORITE COMPOSED MAINLY OF PLAGIOCLASE, BIOTITE, HORNBLENDE, QUARTZ, AND IRON OXIDES, WITH ACCESSORY SPHENE AND APATITE. ALL MINERALS ARE QUITE FRESH.

SEE GSC 65-108 FOR A DISCUSSION OF THE GEOLOGICAL CONDITIONS AND THE DETERMINED AGE.

ONTARIO

GSC 65-108 BIOTITE, K-AR AGE 1585 + OR - 50 M.Y.

K=7.47 PERCENT, AR40/K40=0.1450, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, DARK OLIVE-GREEN, UNALTERED BIOTITE. ABOUT 2 PERCENT OF THE FLAKES CONTAIN DARK RED INCLUSIONS OF HEMATITE (Q). CONCENTRATE CONTAINS 3 PERCENT HORNBLENDE.

FROM QUARTZ DIORITE.

(41 J) NORTHWEST SHORE OF CROCKER ISLAND, NORTH CHANNEL OF LAKE HURON, ONTARIO, 46-05 N, 82-13 W. MAP-UNIT 1, BUREAU OF GEOLOGY AND TOPOGRAPHY MAP 351 A, 1937. SAMPLE LE-2-56, COLLECTED AND INTERPRETED BY B. A. LIBERTY, DESCRIBED BY R. D. STEVENS.

THE ROCK IS A MEDIUM GRAINED, PORPYRITIC, DARK GREY TO BLACK QUARTZ DIORITE. BIOTITE PHENOCRYSTS ARE CLEARLY VISIBLE IN THE HAND SPECIMEN. IN THIN SECTION THE ROCK IS SEEN TO CONSIST OF PLAGIOCLASE, HORNBLENDE, BIOTITE, QUARTZ, AND IRON OXIDES, WITH ACCESSORY SPHENE AND APATITE. THE BIOTITE IS FRESH, BUT THE HORNBLENDE IS SOMEWHAT ALTERED.

THE SAMPLE LOCALITY FOR GSC 65-107 AND 108 IS ON PART OF THE CROCKER ISLAND PLUTON WHICH WAS AT ONE TIME OVERLAIN UNCONFORMABLY BY MIDDLE ORDOVICIAN LIMESTONES, SMALL PATCHES OF WHICH ARE STILL PRESERVED ON THE FLANKS OF THE PLUTON. THE AGES OF 1535 + OR - 50 AND 1585 + OR - 50 M.Y. ARE IN REASONABLE AGREEMENT WITHIN EXPERIMENTAL ERROR. HOWEVER, BOTH ARE SIGNIFICANTLY OLDER THAN R. VAN SCHMUS 1475 + OR - 50 M.Y. RB-SR ISOCHRON AGE ON THE EAGLE GRANITE WHICH HE CONSIDERS. TO BE PART OF THE SAME PLUTON. VAN SCHMUS 1475 M.Y. AGE WAS CALCULATED ON A RB87 DECAY CONSTANT OF 1.39. CALCULATION OF THIS AGE ON THE BASIS OF A RB87 DECAY CONSTANT OF 1.47 GIVES A VALUE OF 1390 M.Y. FROM VAN SCHMUS DATA. A SIMILAR RECALCULATION OF VAN SCHMUS DATA ON THE NEARBY CULTER BATHOLITH GIVES AN AGE OF 1645 M.Y. FOR THAT BODY. THE K-AR AGES OBTAINED ON THE CROKER ISLAND SAMPLES ARE THEREFORE INTERMEDIATE BETWEEN EAGLE GRANITE FROM THE BENJAMIN ISLANDS AND THE CULTER BATHOLITH OF THE NORTH SHORE MAINLAND.

REFERENCE-

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ONTARIO

GSC 65-109 WHOLE ROCK, K-AR AGE 1795 + OR - 190 M.Y.

K=0.63 PERCENT, AR40/K40=0.1757, RADIOGENIC AR=92 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM BASALT.
(41 O) ONTARIO, 47-10 N, 82-08 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE FA-81-63-2, COLLECTED AND INTERPRETED BY W. F. FAHRIG.

THE ROCK IS A FINE GRAINED, DARK GREEN BASALT CONSISTING OF A SUBOPHITIC INTERGROWTH SAUSSURITIZED PLAGIOCLASE AND PYROXENE, WITH MINOR HORNBLENDE AND IRON ORES. THE SAMPLE WAS TAKEN FROM A DIABASE DYKE, AND THE 1795 M.Y. DATE INDICATES THE APPROXIMATE AGE OF INTRUSION.

GSC 65-110 HORNBLENDE, K-AR AGE 1975 + OR - 195 M.Y.

K=0.51 PERCENT, AR40/K40=0.2041, RADIOGENIC AR=90 PERCENT.

CONCENTRATE- SLIGHTLY ALTERED BLUE-GREEN HORNBLENDE CONTAINING LESS THAN 5 PERCENT OPAQUE INCLUSIONS. SAMPLE IS CONTAMINATED BY ABOUT 2 PERCENT QUARTZ AND 5 PERCENT CHLORITE.

FROM GRANODIORITE
(31 M) UNDER FOURCLAIN (BEAVER) LAKE, CANADIAN KEELEY MINES, ONTARIO, 47-12 N, 79-30-30 W. MAP-UNIT 3B, O.D.M. PRELIMINARY MAP P289. SAMPLE O.D.M. 1964-1, COLLECTED BY A. R. KENT (CAN. KEELEY MINES) AND INTERPRETED BY W. H. MCILWAINE (O.D.M.).

THE GRANODIORITE IS A MEDIUM-GRAINED GREY ROCK CONTAINING OLIGOCLASE, ORTHOCLASE, HORNBLENDE, QUARTZ, AND MINOR MAGNETITE AND SPHENE. RED, TURBID ALTERATION IS PRESENT AROUND THE FELDSPARS WITH THE ORTHOCLASE HAVING THE GREATER AMOUNT.

THE SAMPLE WAS TAKEN FROM THE NO. 11 CROSSCUT OF THE 8TH LEVEL OF CANADIAN KEELEY MINES LIMITED. THE GRANODIORITE IS INTRUSIVE INTO METAVOLCANIC ROCKS (COMMONLY REFERRED TO AS KEEWATIN) AND IS CUT BY APATITE DYKES. SURFACE EXPOSURES ARE LIMITED, BUT DYKES OF GRANODIORITE CUT LAMPROPHYRE DYKES OF SO-CALLED HAILEYBURIAN AGE. THE RELATIONSHIP TO THE

NIPISSING DIABASE IS NOT KNOWN. TOWARDS THE MARGINS OF THE GRANODIORITE THE ROCKS TAKE ON AN APPEARANCE SIMILAR TO DIABASE. THE RESULTING AGE OF 1975 + OR - 195 M.Y. IS YOUNGER THAN ANTICIPATED AND MAY SUGGEST AN ASSOCIATION WITH THE NIPISSING DIABASE.

GSC 65-111 WHOLE ROCK, K-AR AGE 751 + OR - 75 M.Y.

K=1.50 PERCENT, AR40/K40=0.0540, RADIOGENIC AR=85 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM BASALT.

(31 C) KINGSTON-GANANOQUE AREA, ONTARIO, 44-20 N, 76-11 W. MAP-UNIT 13, GSC MAP 27-1962. SAMPLE FA-87-63-1, COLLECTED AND INTERPRETED BY W. F. FAHRIG.

THE ROCK IS AN EXTREMELY FINE GRAINED, DARK GREY BASALT CONSISTING OF MINUTE PLAGIOCLASE CRYSTALS IN A MICROCRYSTALLINE MATRIX OF PLAGIOCLASE, PYROXENE AND IRON ORES. THE SAMPLE IS FROM A DIABASE DYKE AND THE 751 M.Y. DATE INDICATES THE APPROXIMATE AGE OF INTRUSION.

QUEBEC

GSC 65-112 LEPIDOLITE, K-AR AGE 959 + OR - 38 M.Y.

K=8.66 PERCENT, AR40/K40=0.0731, RADIOGENIC AR=94 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF LEPIDOLITE. ABOUT 50 PERCENT OF THE FLAKES ARE STAINED SLIGHTLY BROWN ON THE EDGES.

FROM PEGMATITE

(31 G) LOT 25, R V11, WAKEFIELD TWP., NORTH OF BLANCHE RIVER, QUEBEC, 45-43 N, 75-45 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE MF57-350, COLLECTED AND INTERPRETED BY R. MULLIGAN.

THE SAMPLE WAS TAKEN FROM A COARSELY CRYSTALLINE SOLID MASS OF BROWN LITHIA MICA IN PEGMATITE. SUCH LITHIA MICA OCCURS IN BOOKS COMMONLY 8 INCHES IN DIAMETER AND 1 TO 2 INCHES THICK IN A ZONED PEGMATITE DYKE AT THE ABANDONED QUARRY KNOWN AS **LEDUC MINE**. THE PEGMATITE IS COMPOSED OF QUARTZ, FELDSPAR (INCLUDING AMAZONITE) AND TOURMALINE. IT CUTS GNEISSIC GRANITE COUNTRY ROCK.

THE MICA CONTAINS ABOUT 5 PERCENT LITHIUM OXIDE, 7.5 PERCENT FLUORINE, AND 2.7 PERCENT FERROUS OXIDE. IT IS APPARENTLY THE ONLY MICA PRESENT, AND NO OTHER LITHIUM MINERALS OR RARE METAL CONCENTRATIONS WERE FOUND. THIS IS THE ONLY SIGNIFICANT OCCURRENCE OF LITHIUM IN THE GRENVILLE PROVINCE AND THE DATE CONFIRMS ITS GRENVILLE AGE.

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QUEBEC

GSC 65-113 WHOLE ROCK, K-AR AGE 415 + OR - 70 M.Y.

K=0.38 PERCENT, AR40/K40=0.0271, RADIOGENIC AR=49 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM BASALT
(31 F) NORTH OF JUNCTION OF COULONGE AND OTTAWA RIVERS, QUEBEC, 45-55 N, 76-40 W. NO GEOLOGICAL MAP AVAILABLE. SAMPLE FA-650236B, COLLECTED AND INTERPRETED BY W. F. FAHRIG.

THE ROCK IS A VERY FINE GRAINED, DARK GREY BASALT FROM A DIABASE DYKE. THE DYKE AT THIS LOCALITY CUTS GRENVILLE STRATA BUT WAS THOUGHT TO BE PRECAMBRIAN IN AGE. THE PALAEOZOIC WHOLE-ROCK AGE OF 415 M.Y. IS POSSIBLY ANOMALOUSLY YOUNG DUE TO ARGON LOSS. FURTHER INVESTIGATION IS NECESSARY IN ORDER TO EVALUATE THIS AGE DETERMINATION.

GSC 65-114 BIOTITE, K-AR AGE 928 + OR - 30 M.Y.

K=8.28 PERCENT, AR40/K40=0.0701, RADIOGENIC AR=97 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF REDDISH-BROWN BIOTITE. SOME FLAKES HAVE FINE INCLUSIONS OF RUTILE(Q), AND ABOUT 5 PERCENT CONTAIN OPAQUE INCLUSIONS. ABOUT 5 PERCENT OF THE FLAKES ARE BLISTERED. MINOR IMPURITIES INCLUDE ABOUT 1 PERCENT CHLORITE AND HORNBLENDE.

FROM BIOTITE PARAGNEISS
(31 J) HIGHWAY 11, 3 MILES NW OF LABELLE, QUEBEC, 46-18-30 N, 74-47-30 W. SAMPLE WE-49-65-64, COLLECTED AND INTERPRETED BY H. R. WYNNE-EDWARDS.

THE ROCK IS A DARK LAYERED BIOTITE PARAGNEISS BELONGING TO THE GRENVILLE SERIES AND FORMING PART OF MAP-UNIT 8 IN THE FORTHCOMING PRELIMINARY MAP OF MONT LAURIER-KEMPT LAKE AREA. IT CONTAINS QUARTZ, OLIGOCLASE, PERTHITIC POTASH FELDSPAR, BIOTITE AND MINOR SILLIMANITE. ITS BIOTITE K-AR AGE OF 928 + OR - 30 M.Y. DATES ITS METAMORPHIC RECRYSTALLIZATION, FALLING ON THE MEAN ESTABLISHED FOR THE GRENVILLE OROGENY (945 M.Y.) WITHIN EXPERIMENTAL LIMITS.

QUEBEC

GSC 65-115 BIOTITE, K-AR AGE 967 + OR - 30 M.Y.

K=7.91 PERCENT, AR40/K40=0.0740, RADIOGENIC AR=97 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF UNALTERED DARK OLIVE-GREEN BIOTITE. ABOUT 5 PERCENT OF THE FLAKES ARE BLISTERED. MINOR IMPURITIES CONSIST OF LESS THAN 1 PERCENT OF EACH OF QUARTZ-FELDSPAR, CHLORITE, AND HORNBLENDE.

FROM BIOTITE SYENITE
(31 J) IN SMALL ROAD CUT, 1 MILE WEST OF ST. VERONIQUE, QUEBEC, 46-31-00 N, 75-00-30 W. SAMPLE WE-GH-5-64, COLLECTED BY A. F. GREGORY, INTERPRETED BY H. R. WYNNE-EDWARDS.

THE ROCK FORMS PART OF A SUBCYLINDRICAL PLUTON OF BIOTITE-PYROXENE SYENITE, ALKALI SYENITE AND PYROXENITE NEAR STE VERONIQUE, AND BELONGS TO MAP-UNIT 21 IN THE FORTHCOMING PRELIMINARY MAP OF THE MONT LAURIER-KEMPT LAKE AREA. THE ROCK IS FRESH, AND IS COMPOSED OF SUBHEDRAL LATHS OF GREY PLAGIOCLASE AND PERTHITE WITH BIOTITE AND GREEN CLINOPYROXENE AS THE PRINCIPAL DARK MINERALS. THE K-AR AGE (ON BIOTITE) OF 967 + OR - 30 M.Y. CONFIRMS THAT THE PLUTON WAS EMPLACED DURING THE GRENVILLE OROGENY, AND COINCIDES, WITHIN EXPERIMENTAL LIMITS, WITH DETERMINATIONS ON METAMORPHIC MINERALS IN ASSOCIATED ROCKS.

GSC 65-116 BIOTITE, K-AR AGE 984 + OR - 30 M.Y.

K=6.94 PERCENT, AR40/K40=0.0756, RADIOGENIC AR=87 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF OLIVE-GREEN BIOTITE. ABOUT 10 PERCENT OF THE GRAINS ARE ALTERED TO CHLORITE ON THE EDGES, AND ABOUT 15 PERCENT CONTAIN OPAQUE AND COLOURLESS INCLUSIONS. MINOR IMPURITIES INCLUDE QUARTZ, FELDSPAR, MUSCOVITE AND HORNBLENDE. TOTAL CHLORITE CONTENT 5-10 PERCENT.

FROM BIOTITE GRANITE
(31 J) QUARRY OFF HIGHWAY 11, TWO MILES NORTH OF GUENETTE, QUEBEC, 46-33-00 N, 75-15-00 W. MAP-UNIT G2ORM, QUEBEC DEPT. NAT. RESOURCES MAP 544. SAMPLE WE-GH-4-64, COLLECTED BY A. F. GREGORY, INTERPRETED BY H. R. WYNNE-EDWARDS.

QUEBEC

THE ROCK IS A PINK, EQUIGRANULAR, BIOTITE GRANITE WHICH HAS LONG BEEN QUARRIED AT GUENETTE. IT IS ASSIGNED TO MAP-UNIT 20 OF THE FORTHCOMING PRELIMINARY MAP OF MONT LAURIER-KEMPT LAKE AREA, AND REPRESENTS SYNTECTONIC, SUBSOLVUS GRANITE CRYSTALLIZED WITHIN THE GRENVILLE SERIES DURING THE GRENVILLE OROGENY (MEAN 945 M.Y.). THE ROCK CONSISTS OF QUARTZ, MICROCLINE, AND ALBITE OLIGOCLASE IN ROUGHLY EQUAL PROPORTIONS, AND ABOUT 5 PERCENT BIOTITE ON WHICH THE AGE WAS DETERMINED.

GSC 65-117 BIOTITE, K-AR AGE 1205 + OR - 43 M.Y.

K=7.85 PERCENT, AR40/K40=0.0989, RADIOGENIC AR=96 PERCENT.

CONCENTRATE- CLEAN, GREENISH-BROWN, UNALTERED BIOTITE. MINOR IMPURITIES ARE QUARTZ (2 PERCENT) AND HORNBLENDE (1 PERCENT).

FROM PORPHYRITIC QUARTZ MONZONITE.
(31 J) EAST SHORE OF LAC MOCASSINS, QUEBEC, 46-34-00 N, 74-25-00 W. SAMPLE WE-GN-2-64, COLLECTED BY E. GAUCHER, INTERPRETED BY H. R. WYNNE-EDWARDS.

THE ROCK IS A PORPHYRITIC QUARTZ MONZONITE FORMING PART OF MAP UNIT 18 IN THE FORTHCOMING PRELIMINARY MAP OF MONT LAURIER-KEMPT LAKE AREA IN THE GRENVILLE PROVINCE. THE QUARTZ MONZONITE IS USUALLY PINK OR BUFF IN COLOUR, HOMOGENEOUS, AND MASSIVE WHERE UNDEFORMED. UP TO 50 PERCENT OF THE ROCK CONSISTS OF PINKISH TABULAR CRYSTALS OF PERTHITE UP TO AN INCH LONG. THEIR MATRIX IS ALSO COARSE GRAINED, CONSISTING ESSENTIALLY OF PLAGIOCLASE, BROWNISH-GREEN BIOTITE, OLIVE-GREEN HORNBLENDE, AND QUARTZ. CATACLASIS AND PARTIAL RECRYSTALLIZATION HAVE CONVERTED THE ROCK TO AUGEN GNEISS IN MANY PLACES, BUT THIS SPECIMEN COMES FROM A RELATIVELY UNDEFORMED PART OF THE UNIT. ON INDEPENDENT STRUCTURAL AND PETROLOGIC GROUNDS (IN PRESS) THE MAP-UNIT HAS BEEN ASSIGNED TO A SUITE OF PLUTONIC IGNEOUS ROCKS THAT ARE YOUNGER THAN THE **GRENVILLE SYSTEM** BUT OLDER THAN THE GRENVILLE OROGENY. THIS SUITE ALSO INCLUDES MANGERITE AND THE ANORTHOSITE OF THE MORIN MASS. THE ROUGHLY CONTEMPORANEOUS EMPLACEMENT OF ALL THE LARGE MASSES OF ANORTHOSITE AND THEIR RELATED ROCKS IN LABRADOR AND IN THE GRENVILLE PROVINCE OF QUEBEC DURING THE EVENTS OF THE ELSONIAN OROGENY SEEMS LIKELY, AND THE AGE DETERMINATION, WHICH IS SOMEWHAT LESS THAN THE POSTULATED RANGE OF THE ELSONIAN (1220-1520 M.Y.), IS CONSISTENT WITH THIS HISTORY, THE ROCK HAVING INITIALLY CRYSTALLIZED DURING THE ELSONIAN EVENT, BUT SUFFERING SOME LOSS OF ARGON DURING THE LATER DEFORMATION OF THE GRENVILLE OROGENY (MEAN 945 M.Y.)

ALL OTHER AGE DETERMINATIONS SO FAR AVAILABLE FROM THIS AREA (GSC 65-115, 118) GIVE DATES THAT CORRESPOND TO THE LATTER EVENT.
EVENT.

GSC 65-118 BIOTITE, K-AR AGE 913 + OR - 30 M.Y.

K=7.46 PERCENT, AR40/K40=0.0687, RADIOGENIC AR=95 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF OLIVE-GREEN BIOTITE. LESS THAN 5 PERCENT OF THE FLAKES ARE ALTERED TO CHLORITE ON THE EDGES, AND ABOUT 1 PERCENT CONTAIN OPAQUE AND/OR TRANSPARENT INCLUSIONS. MINOR IMPURITIES (LESS THAN 1 PERCENT) CONSIST OF QUARTZ, FELDSPAR AND A MINUTE TRACE OF HORNBLENDE.

FROM GRANITE GNEISS
(31 O) CORNOR FALLS, MITCHINACAMECUS RIVER, QUEBEC, 47-08-30 N, 75-06-30 W. SAMPLE RMG-42-33-64, COLLECTED BY C. A. GIOVANELLA, INTERPRETED BY H. R. WYNNE-EDWARDS.

THE ROCK IS A GREY LEUCOCRATIC GRANITE GNEISS FORMING PART OF MAP-UNIT 1A IN THE FORTHCOMING PRELIMINARY MAP OF MONT LAURIER-KEMPT LAKE AREA IN THE GRENVILLE PROVINCE. IT IS AN EQUIGRANULAR MOSAIC OF QUARTZ AND OLIGOCLASE, WITH MINOR MICROCLINE, BROWN BIOTITE, AND GREEN HORNBLENDE. ITS K-AR AGE (ON BIOTITE) OF 913 + OR - 30 M.Y. CORRESPONDS TO THAT OF ITS METAMORPHISM DURING THE GRENVILLE OROGENY (MEAN AGE 945 M.Y.), ALTHOUGH THE ROCK IS INFERRED ON OTHER GROUNDS TO BE MUCH OLDER THAN THIS, FORMING PART OF THE BASEMENT COMPLEX ON WHICH THE GRENVILLE SERIES WAS DEPOSITED.

GSC 65-119 HORNBLENDE, K-AR AGE 1010 + OR - 95 M.Y.

K=1.45 PERCENT, AR40/K40=0.0781, RADIOGENIC AR=82 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF UNALTERED, DEEP OLIVE-GREEN HORNBLENDE. THE CONCENTRATE CONTAINS VERY MINOR IMPURITIES OF FELDSPAR AND PYROXENE.

QUEBEC

FROM GNEISS
(31 O) THREE MILES NORTH-NORTHWEST OF SHINGLE LAKE, QUEBEC, 47-46-30 N, 75-00-30 W. SAMPLE RMG-15-16-64, COLLECTED BY C. A. GIOVANELLA, INTERPRETED BY H. R. WYNNE-EDWARDS.

THE ROCK IS A DARK PYROXENE HORNBLENDE GNEISS FORMING PART OF MAP-UNIT 4 IN THE FORTHCOMING PRELIMINARY MAP OF MONT LAURIER-KEMPT LAKE AREA. IT CONSISTS OF BOTH CLINO- AND ORTHOPYROXENE, BROWNISH HORNBLENDE, OLIGOCLASE-ANDESINE, AND MINOR BIOTITE. THE K-AR AGE OF 1010 + OR - 95 M.Y., MEASURED ON METAMORPHIC HORNBLENDE, IS WITHIN THE RANGE OF THE GRENVILLE OROGENY BY VIRTUE OF ITS CALCULATED EXPERIMENTAL ERROR, BUT THE ROCK IS PROBABLY MUCH OLDER, REPRESENTING (WITH SAMPLE GSC 65-118 ABOVE) A BASEMENT ON WHICH THE GRENVILLE SERIES WAS DEPOSITED. THE ROCK MAY CORRELATE WITH ARCHEAN VOLCANIC ROCKS WEST OF THE GRENVILLE FRONT NEAR VAL DOR, AND IT IS TEMPTING TO POSTULATE THAT ITS SOMEWHAT OLDER AGE THAN THAT OF OTHER METAMORPHIC ROCKS IS DUE TO THE RETENTION OF SOME ARGON GENERATED BEFORE THE GRENVILLE OROGENY.

GSC 65-120 BIOTITE, K-AR AGE 1295 + OR - 45 M.Y.

K=7.49 PERCENT, AR40/K40=0.1087, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF LIGHT GREEN BIOTITE WITH ABOUT 5 PERCENT CHLORITE ALTERATION AROUND THE EDGES OF THE FLAKES. THERE IS ABOUT 5 PERCENT ATTACHED QUARTZ-FELDSPAR AND ABOUT 2 PERCENT FREE HORNBLENDE.

FROM GRANITE
(23 P) 6 MILES WEST OF THE NORTH END OF WHITE GULL LAKE, QUEBEC, 55-34 N, 64-34 W. NO GEOLOGICAL MAP. SAMPLE TA 64-T1, COLLECTED AND INTERPRETED BY F. C. TAYLOR.

THIS SAMPLE IS FROM A PINKISH GREY, MEDIUM TO COARSE GRAINED, LOCALLY PORPHYRITIC GRANITE CONTAINING DISSEMINATED BIOTITE THROUGHOUT. THIS GRANITE LIES IN AN AREA SHOWN BY STOCKWELL (1964) TO FORM PART OF THE NAIN PROVINCE.

OTHER AGE DETERMINATIONS IN THE AREA CONSIST OF GSC 65-121 WHICH LIES 35 MILES TO THE NORTHWEST, AND GSC 60-131 WHICH LIES 25 MILES TO THE SOUTHEAST OF THE PRESENT SAMPLE. GSC 65-121, AT 1595 M.Y., IS PROBABLY A PRODUCT OF LATE

QUEBEC

HUDSONIAN OROGENY.

FORTIER (IN LOWDON, 1961) SUGGESTS THAT GSC 60-131 (1615 M.Y.) **MIGHT BE LINKED WITH (THAT OF) THE CHURCHILL PROVINCE** ALTHOUGH STOCKWELL (1964) SHOWS GSC 60-131 IN THE NAIN PROVINCE. DISCREPANCIES IN THE REGION CANNOT BE RESOLVED UNTIL THE AREA HAS BEEN MAPPED AND MORE AGE DETERMINATIONS MADE. FOR THE PRESENT IT WOULD APPEAR THAT THE NAIN-CHURCHILL PROVINCE BOUNDARY LIES BETWEEN GSC 65-120 AND GSC 65-121.

REFERENCES-

LOWDON, J.A.
1961 AGE DETERMINATIONS BY THE GEOLOGICAL SURVEY OF CANADA. GEOL. SURV. CAN., PAPER 61-17.

STOCKWELL, C.H.
1964 AGE DETERMINATIONS AND GEOLOGICAL STUDIES, PART II, GEOLOGICAL STUDIES. GEOL. SUR. CAN. PAPER 64-17, PT. II.

GSC 65-121 BIOTITE, K-AR AGE 1595 + OR - 55 M.Y.

K=7.65 PERCENT, AR40/K40=0.1464, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED OLIVE-GREEN BIOTITE. HORNBLENDE CONTAMINATION AMOUNTS TO ABOUT 5 PERCENT.

FROM GRANITE
(23 P) 6 MILES EAST OF LAC TUDOR, QUEBEC, 55-55 N, 65-15 W. NO GEOLOGICAL MAP. SAMPLE TA 64-T16, COLLECTED AND INTERPRETED BY F. C. TAYLOR.

THIS SAMPLE IS FROM A MASSIVE PORPHYRITIC GRANITE THAT LIES NEAR THE EASTERN BOUNDARY OF THE CHURCHILL PROVINCE. PINK POTASH FELDSPARS UP TO 2 IN. IN LENGTH ARE COMMON. QUARTZ, PLAGIOCLASE, BIOTITE, HORNBLENDE, MAGNETITE, APATITE AND CHLORITE ARE PRESENT IN ORDER OF DECREASING ABUNDANCE. BIOTITE IS BROWN TO OLIVE GREEN AND FREE OF ALTERATION FOR THE MOST PART. THE DETERMINED AGE GIVES THE TIME OF INTRUSION AND SUGGESTS THAT THIS OCCURRED DURING THE LATE STAGES OF THE HUDSONIAN OROGENY.

QUEBEC

GSC 65-122 BIOTITE, K-AR AGE 1375 + OR - 45 M.Y.

K=7.52 PERCENT,AR40/K40=0.1183,, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF TWO VARIETIES OF BIOTITE. ONE VARIETY (ONE THIRD OF CONCENTRATE) IS KHAKI, AND THE OTHER (TWO THIRDS) IS BROWN. BOTH VARIETIES ARE UNALTERED. THE ONLY IMPURITY IS HORNBLENDE (3-5 PERCENT).

FROM GRANITE
(14 D) 25 MILES EAST OF LAC DIHOURSE, QUEBEC, 56-25 N, 63-40 W. NO GEOLOGICAL MAP. SAMPLE TA64-T14, COLLECTED AND INTERPRETED BY F. C. TAYLOR.

THIS SAMPLE IS FROM A LIGHT TO MEDIUM GREY, MEDIUM GRAINED HYPERSTHENE-BEARING GNEISSIC GRANITE THAT LOCALLY SHOWS A GREENISH CAST. LAMINAE ARE MODERATELY WELL DEVELOPED AND BIOTITE IS CONCENTRATED IN SOME LAMINAE. ORTHOCLASE AND PLAGIOCLASE ARE CHIEFLY UNALTERED, THOUGH LOCALLY THEY ARE SERICITIZED AND ALONG WITH QUARTZ FORM 90 PERCENT OF THE ROCK. AS WELL AS HYPERSTHENE, SMALL AMOUNTS OF HORNBLENDE, APATITE, AND MAGNETITE ARE PRESENT.

THE SAMPLE LIES IN THE WESTERN PART OF THE NAIN PROVINCE AND THE BIOTITE AGE DATES THE METAMORPHISM AND THE OROGENY (ELSONIAN) FOR THIS UNMAPPED AREA. THE DATE OF 1,375 M.Y. IS IN GOOD AGREEMENT WITH GSC 63-175, A HORNBLENDE K-AR AGE OF 1,325 M.Y. THIS LATTER AGE IS FROM AN ADAMELLITE 30 MILES SOUTH OF THE PRESENT SAMPLE AND IS BELIEVED TO REPRESENT THE AGE OF THE ADAMELLITE INTRUSION.

GSC 65-123 BIOTITE, K-AR AGE 1750 + OR - 55 M.Y.

K=5.88 PERCENT, AR40/K40=0.1689, RADIOGENIC AR=97 PERCENT.

CONCENTRATE- CONTAMINATED AND ALTERED BROWN BIOTITE WITH CHLORITIZED FLAKE EDGES. THE SAMPLE IS CONTAMINATED WITH 15 PERCENT HORNBLENDE, AND THE TOTAL CHLORITE CONTENT IS 10 PERCENT.

FROM GRANITE
(24 I) 8 MILES EAST OF FORD RIVER, QUEBEC, 58-04 N, 65-12 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE TA64-T11, COLLECTED AND INTERPRETED BY F. C. TAYLOR.

QUEBEC

THIS SAMPLE IS FROM A MEDIUM TO COARSE GRAINED, MASSIVE TO WEAKLY FOLIATED BIOTITE-HORNBLENDE GRANITE THAT HAS A PALE PINK MATRIX. IT LIES ABOUT 25 MILES WEST-NORTHWEST OF GSC 62-138 (1,220 M.Y.) WHICH IS CONSIDERED TO LIE IN THE NAIN PROVINCE. THE PRESENT SAMPLE TIES THE BOUNDARY BETWEEN THE NAIN AND CHURCHILL PROVINCES, AT THIS LATITUDE, TO THE AREA BETWEEN GSC 62-138 AND THE PRESENT SAMPLE.

GSC 65-124 BIOTITE, K-AR AGE 507 + OR - 85 M.Y.

K=0.72 PERCENT, AR40/K40=0.0340, RADIOGENIC AR=61 PERCENT.

CONCENTRATE- IMPURE CONCENTRATE OF BROWN BIOTITE CONSISTING OF BIOTITE 60 PERCENT, PYROXENE 20 PERCENT, HORNBLENDE 10 PERCENT AND LESS THAN 5 PERCENT QUARTZ-PLAGIOCLASE CONTAMINANTS. THE HORNBLENDE CONTAINS ABUNDANT OPAQUE INCLUSIONS, WHILE THE BIOTITE IS ALMOST COMPLETELY ALTERED TO CHLORITE.

FROM GABBRO
(35 G) QUEBEC, 61-22 N, 74-35 W. MAP-UNIT 9, QUEBEC DEPT. MINES MAP P.M. 1279. SAMPLE FA-96-63, COLLECTED BY I. M. STEVENSON, INTERPRETED BY W. F. FAHRIG.

THE ROCK IS A COARSE GRAINED GABBRO FROM A DIABASE DYKE. THE 507 M.Y. DATE PROVIDES A FIRST APPROXIMATION TO THE AGE OF THE DYKE INTRUSION BUT IS SOMEWHAT YOUNGER THAN EXPECTED. AS THE BIOTITE CONCENTRATE WAS VERY IMPURE THE AGE OBTAINED SHOULD BE REGARDED AS A MINIMUM VALUE.

GSC 65-125 MUSCOVITE, K-AR AGE 442 + OR - 20 M.Y.

K=7.26 PERCENT, AR40/K40=0.0292, RADIOGENIC AR=88 PERCENT.

CONCENTRATE- THE SAMPLE IS A MIXTURE OF TWO SMALL VERY SIMILAR CONCENTRATES OF MUSCOVITE. THE FLAKES ARE IRON-STAINED AND BLISTERED. THERE IS ABOUT 10 PERCENT CHLORITE CONTAMINATION, AND LESS THAN 10 PERCENT QUARTZ, FELDSPAR, BIOTITE, AND OPAQUES.

FROM GRANITE.

(22 A) PROSPECTION TRENCH, 700 FEET SOUTH OF BEND TO EAST IN NORTH PORT DANIEL RIVER, QUEBEC, 48-16-00 N, 64-59-40 W. QUEBEC DEPT. NAT. RESOURCES MAP 1382. SAMPLE WBS-S-64-55-PB, COLLECTED AND INTERPRETED BY W. B. SKIDMORE, GEOLOGIST OF THE QUEBEC DEPARTMENT OF NATURAL RESOURCES.

THE GRANITE IS WHITE TO PINKISH AND MEDIUM GRAINED, AND CONTAINS QUARTZ, FELDSPAR, MUSCOVITE, AND PARTLY CHLORITIZED BIOTITE. A THIN SECTION SHOWS A CATACLASTIC GRANITIC TEXTURE. FELDSPARS ARE BENT AND CLOUDED, AND QUARTZ IS HIGHLY STRAINED AND RECRYSTALLIZED. MICAS, AMOUNTING TO A FEW PER CENT OF THE ROCK, CONSIST OF CHLORITE, MUSCOVITE, AND HIGHLY ALTERED BIOTITE AND ARE BENT AND SHREDDED. THE SAMPLE WAS COLLECTED FROM LOOSE BLOCKS OVERLYING A POORLY EXPOSED, APPARENTLY SMALL, INTRUSION CLOSE TO A SMALL SERPENTINITE BODY. THE COUNTRY ROCKS BELONG TO THE NORTH PORT DANIEL RIVER COMPLEX OF PRE-MIDDLE ORDOVICIAN AGE. SIMILAR SMALL GRANITE INTRUSIONS ELSEWHERE IN THE GENERAL AREA (SOUTHEAST GASPE PENINSULA) ARE ALWAYS FOUND ASSOCIATED WITH OR WITHIN, SERPENTINITE BODIES. THE GRANITE MAY THEREFORE BE ABOUT THE SAME AGE, OR A LITTLE YOUNGER THAN, THE SERPENTINITES. THE DATE OF 442 + OR - 20 M.Y. INDICATES A MIDDLE TO LATE ORDOVICIAN AGE, PERHAPS INDICATIVE OF THE EARLY STAGES OF THE TACONIC OROGENY. SUBSEQUENT EMPLACEMENT OF ONE BODY (WEIR TOWNSHIP) IN YOUNGER MIDDLE SILURIAN STRATA MAY HAVE BEEN BY SOME MECHANISM OF **COLD INTRUSION**.

REFERENCE-

AYRTON W.G.
1961 PRELIMINARY REPORT ON CHANDLER-PORT DANIEL AREA, BONAVENTURE AND GASPE-SOUTH COUNTIES, QUE. DEPT. NAT. RESOURCES, P.R. 447.

GSC 65-126 WHOLE ROCK, K-AR AGE 295 + OR - 22 M.Y.

K=4.90 PERCENT, AR40/K40=0.0187, RADIOGENIC AR=79 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM DIABASE DRILL CHIPS

(22 A) YORK RIVER, EASTERN GASPE, QUEBEC, 48-52-10 N, 64-42-00 W. SAMPLE POT-22 TRAY 4084, SELECTED BY R.D. STEVENS. INTERPRETED BY R.D. HOWIE.

QUEBEC

THE SAMPLE OF HAND-PICKED DIABASE CHIPS WAS OBTAINED FROM A DEVONIAN SEDIMENTARY SECTION BETWEEN 2,450 FT. AND 2,500 FT. IN THE PETROLEUM OIL TRUST NO. 22 WELL. H. W. MCGERRIGLE OF THE QUEBEC DEPARTMENT OF MINES LOGGED THE WELL AS FOLLOWS...

L. OR M. DEVONIAN - YORK RIVER - SHALE AND SANDSTONE 12-2,750 FT.

IGNEOUS ROCK (SILL) AT 2,450-2,500 FT.

LOWER DEVONIAN-GRAND GREVE-LIMESTONE 2,750-3,107 FT.

THE PENNSYLVANIAN AGE OF THE IGNEOUS ROCK IS COMPATIBLE WITH ITS INTERPRETATION AS AN INTRUSIVE BODY IN THE YORK RIVER SEQUENCE. SEE ALSO GSC 65-127.

REFERENCE-

DEBLOIS, R., SIMARD, P.O. AND HOUDE, M.
1960 DATA ON WELLS DRILLED FOR PETROLEUM AND GAS IN THE GASPE PENINSULA. DEPT. MINES. PROVINCE OF QUE. REPT. S-53, P.56.

GSC 65-127 WHOLE ROCK, K-AR AGE 309 + OR - 22 M.Y.

K=4.60 PERCENT, AR40/K40=0.0196, RADIOGENIC AR=89 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM DIABASE DRILL CHIPS
(22 A) YORK RIVER, EASTERN GASPE, QUEBEC, 48-53-49 N, 64-43-07 W. SAMPLE GVE-2 TRAY 2213, SELECTED BY R.D. STEVENS. INTERPRETED BY R.D. HOWIE.

THE SAMPLE OF HAND-PICKED DIABASE CHIPS WAS OBTAINED FROM A DEVONIAN SEDIMENTARY SECTION BETWEEN 1,940 FT. AND 2,005 FT. OF GASPE OIL VENTURES NO. 2 WELL. H. W. MCGERRIGLE OF THE QUEBEC DEPARTMENT OF MINES LOGGED THE WELL AS FOLLOWS...

L. OR M. DEVONIAN - YORK RIVER - SANDSTONE AND THIN INTERBEDS OF SILTY SHALE 10-1,940 FT

IGNEOUS ROCK (SILL) 1,940-2,005 FT

L. DEVONIAN - GRANDE GREVE - DARK GREY, HARD, DENSE SILICEOUS LIMESTONE 2,005-2,132 FT

THE PENNSYLVANIAN AGE OF THE IGNEOUS ROCK IS COMPATIBLE

WITH ITS INTERPRETATION AS AN INTRUSIVE BODY IN THE YORK RIVER SEQUENCE. IT IS POSSIBLE THAT THIS ROCK MIGHT BE PART OF THE SAME SILL FROM WHICH GSC 65-126 WAS TAKEN IN ANOTHER WELL. AT ANY EVENT, IT IS APPARENT THAT THE IGNEOUS MATERIAL ENCOUNTERED IN BOTH WELLS IS OF THE SAME AGE WITHIN THE LIMITS OF THE AGE DETERMINATIONS.

REFERENCE-

DEBLOIS, R. SIMARD, P.P. AND HOUDE, M.
1960 DATA ON WELLS DRILLED FOR PETROLEUM AND GAS IN THE GASPE PENINSULA. DEPT. MINES, PROVINCE OF QUE. REPT. S-53, P.29.

GSC 65-128 BIOTITE, K-AR AGE 350 + OR - 15 M.Y.

K=8.00 PERCENT, AR40/K40=0.0225, RADIOGENIC AR=87 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF UNALTERED LIGHT OLIVE-GREEN BIOTITE. THE FLAKES CONTAIN LESS THAN 1 PERCENT ZIRCON INCLUSIONS SURROUNDED BY PLEOCHROIC HALOS, 5 PERCENT APATITE AND 5 PERCENT OPAQUES. HORNBLENDE CONTAMINATION AMOUNTS TO ABOUT 3 PERCENT.

FROM GRANITE.
(22 A) DIAMOND DRILL HOLE 1600 TO 1650 FT BELOW ADIT LEVEL, COPPER MOUNTAIN, QUEBEC, 48-58 N, 65-30 W. GRANITE NOT EXPOSED AT SURFACE. QUE. DEPT. MINES MAP 1225. SAMPLE MB-U-1906-1645, COLLECTED AND INTERPRETED BY W. D. MCCARTNEY.

THE SAMPLE IS A PINK, MEDIUM-GRAINED GRANITE WITH RARE VEINLETS OF QUARTZ WITH CHALCOPYRITE AND MOLYBDENITE. SOME PARTS OF THE DRILL CORE FROM 1600 TO 1650 FEET BELOW THE COPPER MOUNTAIN ADIT LEVEL CONTAINED ABOVE AVERAGE AMOUNTS OF FRESH BIOTITE AND WERE SELECTED FOR THIS SAMPLE. BIOTITE COMPRISES ABOUT 5 PERCENT OF THE THIN SECTION. PLAGIOCLASE IS CLOUDY (SERICITIZED) AND STRONGLY ZONED, AND ORTHOCLASE IS ALSO ALTERED. QUARTZ FORMS 1 MM. ANHEDRAL GRAINS IN A GROUNDMASS OF 0.1 MM. GRAIN SIZE

THIS BURIED GRANITE HAS PRODUCED THE SKARN ZONES AND PROBABLY PROVIDED THE SILICA AND COPPER, MOLYBDENUM AND NATIVE BISMUTH IN THE ORE DEPOSIT. SKARN IS WELL DEVELOPED IN THE CAP BON AMI AND GRANDE GREVE CALCAREOUS BEDS AND LESSER ALTERATION IS REPORTED IN THE OVERLYING YORK LAKE CLASTIC BEDS OF LATE

QUEBEC

LOWER DEVONIAN AGE.

GSC 65-129 WHOLE ROCK, K-AR AGE 138 + OR - 28 M.Y.

K=0.53 PERCENT, AR40/K40=0.0084, RADIOGENIC AR=39 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM DIABASE
(12 E) DE PUYJALON CLIFF, NORTH SHORE OF ANTICOSTI ISLAND, QUEBEC, 49-55 N, 63-15 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE BF-L1-64, COLLECTED BY R. SANSCHAGRIN, DESCRIBED BY R. D. STEVENS, INTERPRETED BY T. E. BOLTON.

THE ROCK IS A FRESH, FINE TO MEDIUM GRAINED DIABASE CONSISTING MAINLY OF PLAGIOCLASE LATHS (55 PERCENT) AND SUBOPHITIC CLINOPYROXENE (40 PERCENT), WITH ABOUT 3 PERCENT OPAQUE IRON OXIDES AND ABOUT 2 PERCENT RED-BROWN IDDINGSITE PSEUDOMORPHS AFTER ORIGINAL OLIVINE.

THE DIABASE SAMPLE WAS COLLECTED FROM A 55 TO 60 FT. WIDE, NEAR VERTICAL DYKE STRIKING NORTH 50 DEG WEST AND INTRUDING NEARLY FLAT-LYING LIMESTONES OF THE UPPER ORDOVICIAN VAUREAL FORMATION (BOLTON, 1961, GSC PAPER 61-26). THE DYKE IS EXPOSED ON THE REEF AT LOW TIDE AND IS THE MOST WESTERLY LOCATED OF THE TWO DESCRIBED BY TWENHOFEL (1927, P. 14, GSC MEM. 154). FURTHER STUDY OF THESE DYKES IS SCHEDULED FOR THE 1966 FIELD SEASON.

NEW BRUNSWICK

GSC 65-130 MUSCOVITE, K-AR AGE 370 + OR - 15 M.Y.

K=8.54 PERCENT, AR40/K40=0.0239, RADIOGENIC AR=95 PERCENT.

CONCENTRATE- FAIRLY CLEAN, COARSE GRAINED MUSCOVITE. SOME FLAKES ARE STAINED WITH IRON OXIDES, AND MOST ARE BLISTERED. MINOR IMPURITIES CONSIST OF QUARTZ AND FELDSPAR (TOTAL LESS THAN 10 PERCENT).

FROM QUARTZ-MUSCOVITE-FLUORITE-WOLFRAM VEIN.
(21 J) WASTE DUMP OF BURNT HILL TUNGSTEN MINE, 1/2 MILE SOUTHEAST OF JUNCTION OF MAIN SOUTHWEST MIRAMICHI RIVER AND BURNT HILL BROOK, NEW BRUNSWICK. 46-34-10 N, 66-48-36 W. SAMPLE 64-PK-4-1, COLLECTED AND INTERPRETED BY R. R. POTTER.

THIS IS A MEDIUM-GRAINED, MINERALIZED QUARTZ VEIN FROM THE BURNT HILL TUNGSTEN MINE. IT IS TYPICAL OF THE EARLY MINERALIZED VEINS AT THIS LOCALITY WHICH ARE COMPOSED OF 50 TO 80 PERCENT QUARTZ, 20 TO 30 PERCENT MUSCOVITE, AND SMALL AMOUNTS OF FLUORITE, TOPAZ, WOLFRAMITE, CHLORITE, MOLYBDENITE, AND PYRITE. THESE VEINS ARE COMMONLY SMALL AND RARELY EXCEED ONE INCH IN WIDTH. IN THIN SECTION, IRREGULAR GRAINS OF QUARTZ, UP TO 5 MM. IN DIAMETER OCCUR WITH UNORIENTED LATHS OF MUSCOVITE. THE QUARTZ IS COMMONLY BROKEN AND STRAINED WITH **FISH SCALE** EXTINCTION. A FEW LARGE, BENT PLATES OF MUSCOVITE, UP TO 3 MM. IN DIAMETER, HAVE BEEN NOTED. HOWEVER MOST OF THIS MINERAL OCCURS AS SMALL AGGREGATES WITH TINY GRAINS OF QUARTZ. DUSTY INCLUSIONS AND FLUORITE ARE COMMON ALONG THE BASAL (001) CLEAVAGE. SMALL ANHEDRAL CRYSTALS OF TOPAZ, SUBHEDRAL WOLFRAMITE, AND MOLYBDENITE HAVE BEEN NOTED. THE MARGINS OF THESE VEINS ARE SHARP AND WELL-DEFINED. PORPHYROBLASTS AND PRIMARY BEDDING WITHIN THE ENCLOSING ORDOVICIAN ARGILLITES (POOLE,1963) ARE TRUNCATED AT THE VEIN WALLS.

THIS MUSCOVITE WAS DATED IN ORDER TO DETERMINE, IF POSSIBLE, THE TIME DIFFERENCE BETWEEN BATHOLITHIC INTRUSION AND VEIN EMPLACEMENT. AS FIELD RELATIONSHIPS INDICATE THAT THE COMPLEX SYSTEM OF GREISEN AND PEGMATITIC QUARTZ-WOLFRAMITE-BERYL-MOLYBDENITE VEINS REPRESENT THE YOUNGEST INTRUSIVE EVENT IN THIS IMMEDIATE AREA, AN AGE FROM ONE OF THESE MAY ALSO BE USEFUL IN INTERPRETING SOME OF THE ANOMALOUSLY YOUNG DATES OBTAINED NEARBY (GSC 61-136, 192).

ACCORDING TO THE TIME SCALE OF KULP (1961), THIS MINERALIZED VEIN IS AT LEAST MIDDLE DEVONIAN IN AGE, AND IS IN GOOD AGREEMENT WITH THE 380 M.Y. TO 398 M.Y. DATES ON DEVONIAN GRANITES ELSEWHERE IN THE PROVINCE (TUPPER AND HART, 1961). THE ONLY DATE ON A **TYPICAL** DEVONIAN BATHOLITH IN THE

VICINITY OF BURNT HILL (POOLE, 1963) HAS YIELDED A MINIMUM AGE OF 339 M.Y. (GSC 61-192), AND IS NOT COMPATIBLE WITH THE DETERMINATION ON THE MINERALIZED VEIN. A 392 M.Y. DATE (GSC 62-157) WAS OBTAINED FROM THE GREISENIZED CONTACT OF A MINERALIZED QUARTZ VEIN CUTTING SIMILAR, BUT YOUNGER (ON THE BASIS OF FIELD RELATIONSHIPS) QUARTZ MONZONITE, AND IS CLOSE TO THE EXPECTED VALUE.

THE RELATIVE AGE OF THIS QUARTZ-MUSCOVITE VEIN AND THE QUARTZ MONZONITE HAS NOT BEEN CLARIFIED. THE 339 M.Y. DATE MAY BE PARTLY EXPLAINED BY ARGON LOSS DUE TO THE EMPLACEMENT OF KNOWN YOUNGER STOCKS AND YOUNGER MINERALIZED VEINS. AGE DETERMINATIONS ON GREISEN DYKES AND OTHER **TYPICALLY DEVONIAN** QUARTZ MONZONITES OF THIS AREA ARE RECOMMENDED.

NOVA SCOTIA

GSC 65-131 WHOLE ROCK, K-AR AGE 280 + OR - 34 M.Y.

K=2.85 PERCENT, AR40/K40=0.0177, RADIOGENIC AR=82 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM PHYLLITE
(21 H) ON FOWLER BROOK, NEAR PARRSBORO SHORE, 3,500 FT. UPSTREAM FROM HIGHWAY 9, NOVA SCOTIA, 45-23-25 N, 64-41-45 W. MAP-UNIT F, GSC MAP 910A. SAMPLE KA62-84, COLLECTED BY D. G. KELLEY. NO INTERPRETATION AVAILABLE.

GSC 65-132 PHLOGOPITE, K-AR AGE 366 + OR - 16 M.Y.

K=7.08 PERCENT, AR40/K40=0.0237, RADIOGENIC AR=88 PERCENT.

CONCENTRATE- CLEAN, BLEACHED REDDISH BROWN PHLOGOPITE WITH LESS THAN 2 PERCENT HORNBLENDE IMPURITY.

FROM NORITE
(21 A) SOUTHWEST OF LIVERPOOL BAY, NOVA SCOTIA, 44-02 N, 64-41 W. MAP-UNIT 4, GSC MAP 439A (LIVERPOOL, EAST HALF). SAMPLE E-8, COLLECTED AND DESCRIBED BY W.A. ROBERTSON, INTERPRETED BY R.D. STEVENS.

THE ROCK IS A COARSE-GRAINED PHLOGOPITE-OLIVINE NORITE CONTAINING LARGE POIKILITIC CRYSTALS OF HYPERSTHENE, PHLOGOPITE AND HORNBLENDE, AND ALTERED OLIVINE. THE OUTCROP OF THIS ROCK FORMS THE PROMINENT HEADLAND OF BLACK POINT ON THE SOUTH SHORE OF LIVERPOOL BAY.

THE RELATIONSHIP OF THIS MASS WITH ADJACENT ROCKS IS OBSCURED BY SHINGLE AND SOIL, BUT IT WAS MAPPED AS TRIASSIC (Q) **BIOTITE GABBRO** (MAP-UNIT 4) IN GSC MAP 439A AND THUS, PRESUMABLY, CORRELATED WITH THE SHELBURNE DYKE, WHICH IS NOW KNOWN TO BE OF UPPER-TRIASSIC AGE (194 + OR - 32 M.Y., LAROCHELLE AND WANLESS, 1966, ON THE PALAEOMAGNETISM OF A TRIASSIC DIABASE DYKE, NOVA SCOTIA, JOUR. GEOPHYS. RESEARCH, IN PRESS). THE MIDDLE- TO UPPER-DEVONIAN AGE NOW DETERMINED ON THE BLACK POINT BODY INVALIDATES THIS CORRELATION AND INDICATES THAT THE BLACK POINT GABBRO CONSIDERABLY PRE-DATES THE SHELBURNE DYKE, AND IS IN FACT OF COMPARABLE AGE TO THE DEVONIAN GRANITIES OF NOVA SCOTIA AND NEWFOUNDLAND.

PRINCE EDWARD ISLAND

GSC 65-133 BIOTITE, K-AR AGE 387 + OR - 12 M.Y.

K=7.40 PERCENT, AR40/K40=0.0252, RADIOGENIC AR=84 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF GREENISH-BROWN MICA CONTAINING LESS THAN 1 PERCENT OF COLOURLESS INCLUSIONS. A FEW FLAKES ARE ALTERED TO CHLORITE ON THE EDGES. MINOR IMPURITIES CONSIST OF QUARTZ, FELDSPAR AND RARE HORNBLENDE. TOTAL CHLORITE CONTENT LESS THAN 1 PERCENT.

FROM GRANITE
(11 L) PRINCE EDWARD ISLAND, 46-09 N, 62-38 W. NO GEOLOGICAL MAP REFERENCE AVAILABLE. SAMPLE PC61-64, COLLECTED AND INTERPRETED BY V. K. PREST.

THE SAMPLE WAS FROM A PORPHYRITIC GRANITE BOULDER FOUND AT THE SURFACE IN NEWLY CLEARED BUSHLAND NEAR MONTAGUE IN EASTERN P.E.I. THE AGE OF 387 + OR - 12 M.Y. LIES IN THE RANGE OF DATED GRANITES FROM BOTH CAPE BRETON AND NEW BRUNSWICK

SEE GSC 65-135 FOR FURTHER DISCUSSION.

GSC 65-134 BIOTITE, K-AR AGE 500 + OR - 20 M.Y.

K=7.26 PERCENT, AR40/K40=0.0335, RADIOGENIC AR=88 PERCENT.

CONCENTRATE- SLIGHTLY ALTERED REDDISH-BROWN BIOTITE WITH PLEOCHROIC HALOS, SOME OF WHICH ARE ASSOCIATED WITH COLOURLESS INCLUSIONS. OPAQUE BLEB INCLUSIONS ARE ALSO PRESENT, AND THERE IS ABOUT 2 PERCENT CHLORITIC ALTERATION ON FLAKE EDGES. ABOUT 5 PERCENT OF THE FLAKES ARE BLEACHED. IMPURITIES CONSIST OF MUSCOVITE (2 PERCENT) AND HORNBLENDE (2 PERCENT).

FROM GNEISS
(11 L) SOUTHEAST OF STREAM AT BURLINGTON, PRINCE EDWARD ISLAND, 46-29 N, 63-36-30 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE PC30/64, COLLECTED AND INTERPRETED BY V. K. PREST.

PRINCE EDWARD ISLAND

THE SAMPLE WAS TAKEN FROM A BOULDER OF BIOTITE **GRANITE** GNEISS FOUND IN A ROAD CUT IN SANDY TILL NEAR PARKS CORNER IN NORTH CENTRAL P.E.I. THE DATE OBTAINED ALMOST PRECLUDES A PRECAMBRIAN SOURCE AREA. IT IS SOMEWHAT OLDER THAN ANY PRESENTLY DATED BIOTITE GNEISS FROM NEW BRUNSWICK BUT MAY NEVERTHELESS REPRESENT THE GROUP OF OLDER **GNEISSES** INTRUDED BY YOUNGER **GRANITES** THAT RANGE FROM 400 TO 500 M.Y. GNEISSIC ROCKS OF ABOUT 500 M.Y. ARE KNOWN FROM CAPE BRETON ISLAND. THUS EITHER AN EAST OR WEST FLOWING GLACIER MAY HAVE IMPLANTED THIS BOULDER ON THE NORTH-CENTRAL PART OF P.E.I.

GSC 65-135 BIOTITE, K-AR AGE 1125 + OR - 40 M.Y.

K=6.93 PERCENT, AR40/K40=0.0901, RADIOGENIC AR=95 PERCENT.

CONCENTRATE- SLIGHTLY ALTERED KHAKI BIOTITE. A FEW FLAKES ARE ALTERED TO CHLORITE ON THE EDGES AND SOME ARE SLIGHTLY BLISTERED. HORNBLENDE CONTAMINATION AMOUNTS TO 3 PERCENT AND CHLORITE 5 PERCENT.

FROM GRANITE
(11 L) RUSTICO W/2, NORTH OF MAYFIELD CORNER, PRINCE EDWARD ISLAND, 46-27 N, 63-23 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE PC99/64, COLLECTED BY G. H. CROWL FOR V. K. PREST, INTERPRETED BY V. K. PREST.

THE ROCK IS A MEDIUM-GRAINED, PORPHYRITIC GRANITE CONSISTING OF FRESH MICROCLINE, SLIGHTLY ALTERED SODIC PLAGIOCLASE, ABUNDANT BROWN BIOTITE, AND ACCESSORY ILMENITE. THE SAMPLE WAS TAKEN FROM A SMALL BOULDER FOUND PROTRUDING FROM THE TILL NEAR MAYFIELD IN THE RUSTICO AREA OF NORTH-CENTRAL P.E.I. SINCE THE AGE OBTAINED IS 1125 + OR - 40 M.Y., THE ROCK IS ASSUREDLY FROM THE PRECAMBRIAN AND PRESUMABLY WAS DEPOSITED FROM LABRADOREAN ICE THAT FIRST INVADED NEW BRUNSWICK FROM THE NORTH AND LATER WAS CARRIED EASTWARD BY THE NEW BRUNSWICK ICE-CAP.

GSC 65-133,134, AND 135 ARE ALL SAMPLES OF GLACIAL ERRATICS FROM PRINCE EDWARD ISLAND WHICH WERE SUBMITTED FOR AGE-DATING IN AN ATTEMPT TO IDENTIFY THEIR PROBABLE SOURCE AREAS, AND THUS HELP ESTABLISH THE PROVENANCE OF THE GLACIERS THAT TRAVERSED THE ISLAND. THOUGH THE CONCEPT OF AN ACADIAN ICE-LOBE, MOVING SOUTHWARD ACROSS THE GULF OF ST. LAWRENCE, HAS LONG BEEN ACCEPTED THERE IS ACTUALLY NO EVIDENCE ON THE ISLAND OF SUCH AN EVENT. GLACIAL ERRATICS ARE COMMON IN THE

WESTERMOST PART OF THE ISLAND, THESE HAVE BEEN ATTRIBUTED TO EASTWARD MOVING GLACIERS FROM NEW BRUNSWICK. IT IS POSSIBLE THAT THE EASTERN END OF THE ISLAND WAS OVERRIDDEN BY GLACIERS FROM CAPE BRETON ISLAND, AND ALSO THAT THE SOUTHERN COAST MAY HAVE BEEN SUBJECTED TO NORTHWARD-MOVING ICE FROM THE COBEQUID MOUNTAINS OF NORTHERN NOVA SCOTIA. IT WAS WITH THIS CONTROVERSIAL PROBLEM IN MIND THAT THESE SAMPLES OF BOULDERS WERE SUBMITTED FOR K-AR DATING.

IT IS CLEAR FROM THE DATES OBTAINED THAT THE PROBLEM OF SOURCE AREA IS FAR FROM SOLVED, BUT AT LEAST SOME FACTUAL DATA ARE NOW ON HAND. IT IS HOPED THAT CAREFUL SELECTION OF A FEW PERTINENT BOULDER ERRATICS WILL SERVE TO FIRM UP THE CURRENT HYPOTHESIS AS TO THE DIRECTION OF GLACIER FLOW ON PRINCE EDWARD ISLAND.

NEWFOUNDLAND

GSC 65-136 BIOTITE, K-AR AGE 342 + OR - 20 M.Y.

K=6.10 PERCENT, AR40/K40=0.0220, RADIOGENIC AR=64 PERCENT.

CONCENTRATE- THE CONCENTRATE CONTAINS TWO TYPES OF BIOTITE. ONE (80 PERCENT) IS LIGHT REDDISH-BROWN AND CONTAINS NO INCLUSIONS. IT IS SLIGHTLY ALTERED TO CHLORITE ON THE FLAKE EDGES. THE OTHER (5 PERCENT) IS DARK REDDISH-BROWN AND CONTAINS OPAQUE INCLUSIONS. IT IS ALTERED TO CHLORITE ON THE FLAKE EDGES. AN INTERMEDIATE TYPE OF MICA (10 PERCENT) HAS THE PROPERTIES OF BOTH TYPES AND IS ALSO BLISTERED. THE CONCENTRATE IS CONTAMINATED WITH MINOR AMOUNTS OF HORNBLENDE, QUARTZ, FELDSPAR, AND **PYROXENE**. TOTAL CHLORITE CONTENT IS 1-2 PERCENT.

FROM GRANODIORITE
(1 M) 5.5 MILES WEST OF BELLEORAM, NEWFOUNDLAND, 47-32 N, 55-32 W. MAP-UNIT 19, GSC MAP 8-1965. SAMPLE AA-11-236-13, COLLECTED AND INTERPRETED BY F. D. ANDERSON.

THE SAMPLE IS FROM AN EQUIANGULAR, PINK, FINE TO MEDIUM GRAINED GRANODIORITE CONSISTING OF QUARTZ, K-FELDSPAR, ALBITE, HORNBLENDE, AND MINOR CHLORITE, MAGNETITE AND EPIDOTE. THE GRANODIORITE INTRUDES A CONGLOMERATE THAT HAS BEEN DATED AS LATE UPPER DEVONIAN FROM PLANT REMAINS IN CONTAINED SANDSTONE LENSES.

THIS GRANODIORITE WAS PREVIOUSLY SAMPLED AND GAVE AN ANOMALOUSLY HIGH AGE OF 400 + OR - 20 M.Y. (GSC 63-160). HOWEVER, THE BIOTITE OF THE CONCENTRATE USED HAD SUFFERED CONSIDERABLE ALTERATION TO CHLORITE RESULTING IN A LOW POTASSIUM CONTENT OF 5.21 PERCENT. THE GRANODIORITE WAS RESAMPLED AND THE PRESENT REPORTED AGE OF 342 + OR - 20 M.Y. IS IN AGREEMENT WITH THE PALAEONTOLOGICAL EVIDENCE, INDICATING A LATE DEVONIAN OR EARLY CARBONIFEROUS AGE FOR THE INTRUSION.

GSC 65-137 BIOTITE, K-AR AGE 355 + OR - 16 M.Y.

K=7.75 PERCENT, AR40/K40=0.0229, RADIOGENIC AR=83 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF UNALTERED OLIVE-GREEN TO GREEN BIOTITE. MOST OF

THE FLAKES ARE BLISTERED AND ABOUT 1 PERCENT CONTAIN OPAQUE INCLUSIONS. THE SAMPLE IS SLIGHTLY CONTAMINATED WITH ABOUT 3 PERCENT HORNBLENDE AND 1-2 PERCENT CHLORITE AS SEPARATE GRAINS.

FROM BIOTITE-GARNET GNEISS.

(1 M) NORTHWEST END OF ROTI BAY, BAY DE ESPOIR, NEWFOUNDLAND, 47-48-40 N, 55-54-15 W. MAP-UNIT 7, GSC MAP 8-1965. SAMPLE AA 5-191-2, COLLECTED AND INTERPRETED BY F. D. ANDERSON.

THE ROCK IS A MEDIUM TO COARSE GRAINED BIOTITE-GARNET GNEISS CONSISTING MAINLY OF QUARTZ AND BIOTITE, WITH MINOR K AND NA FELDSPAR AND GARNET. IT IS FROM THE THERMALLY METAMORPHOSED ROCKS OF THE BAIE DE ESPOIR GROUP. THE NORTHERN PART OF THE BAIE DE ESPOIR GROUP WAS INTRUDED AND METAMORPHOSED BY GRANITE. THE GRANITE IS PART OF A NORTHEASTERLY TRENDING BELT OF GRANITE THAT CUTS ACROSS CENTRAL NEWFOUNDLAND. THE ISOTOPIC AGE OF 355 + OR - 16 M.Y. INDICATES METAMORPHISM AND INTRUSION DURING THE ACADIAN OROGENY (DEVONIAN) AND IS IN GENERAL AGREEMENT WITH OTHER ISOTOPIC DATES REPORTED ALONG THIS BELT.

REFERENCES-

JENNESS S.E.
1963 TERRA NOVA AND BONAVISTA MAP-AREAS, NEWFOUNDLAND. GEOL. SURV. CAN., MEM 327

WILLIAMS H.
1964 NOTES ON THE OROGENIC HISTORY AND ISOTOPIC AGES IN BOTWOOD MAP-AREA, NORTHEASTERN NEWFOUNDLAND, IN AGE DETERMINATIONS AND GEOLOGICAL STUDIES. GEOL. SURV. CAN., PAPER 64-17 (PART II).

GSC 65-138 BIOTITE, K-AR AGE 350 + OR - 16 M.Y.

K=7.04 PERCENT, AR40/K40=0.0225, RADIOGENIC AR=90 PERCENT.

CONCENTRATE- RELATIVELY CLEAN OLIVE-GREEN BIOTITE. MINOR IMPURITIES CONSIST OF 1 PERCENT QUARTZ-FELDSPAR AND 5 PERCENT HORNBLENDE. SOME FLAKES ARE ALTERED TO CHLORITE ON THE EDGES AND SOME ARE BLISTERED. TOTAL CHLORITE CONTENT IS 5 PERCENT.

FROM GRANODIORITE

(11 O) 0.13 MILES SOUTHWEST OF THE NORTHEAST TIP OF

NEWFOUNDLAND

SMOCKY ISLAND, NEWFOUNDLAND, 47-39-30 N, 58-00-07 W. NO PUBLISHED GEOLOGICAL MAP. SAMPLE GJ-59-64, COLLECTED AND INTERPRETED BY J. W. GILLIS.

THE GRANODIORITE IS GREY AND PORPHYRITIC. PLAGIOCLASE CONSTITUTES ABOUT 45 PERCENT OF THE ROCK, QUARTZ 30 PERCENT, BIOTITE 20 PERCENT, AND OPAQUE MINERALS 5 PERCENT.

SEE GSC 65-141 FOR GEOLOGICAL INTERPRETATION OF THE AGE.

GSC 65-139 BIOTITE, K-AR AGE 350 + OR - 16 M.Y.

K=7.30 PERCENT, AR40/K40=0.0225, RADIOGENIC AR=93 PERCENT.

CONCENTRATE- A RELATIVELY CLEAN, ALMOST UNALTERED CONCENTRATE OF DARK BROWN BIOTITE. ABOUT 5 PERCENT OF THE FLAKES CONTAIN OPAQUE INCLUSIONS WHICH ARE SURROUNDED BY DARK PATCHES. ABOUT 1 PERCENT OF THE FLAKES ARE ALMOST COMPLETELY BLACK. CHLORITE AS SEPARATE GRAINS CONSTITUTES ABOUT 1 PERCENT OF THE SAMPLE, AND MINOR IMPURITIES CONSIST OF QUARTZ, FELDSPAR, AND HORNBLENDE.

FROM GRANODIORITE.
(11 O) 0.8 MILES SOUTHEAST OF THE HEAD OF LITTLE GARIA BAY, NEWFOUNDLAND, 47-39-07 N, 58-34-45 W. NO PUBLISHED GEOLOGICAL MAP. SAMPLE GJ-216-64, COLLECTED AND INTERPRETED BY J. W. GILLIS.

THE GRANODIORITE IS LIGHT GREY AND MASSIVE. QUARTZ MAKES UP ABOUT 45 PERCENT OF THE ROCK, PLAGIOCLASE 37 PERCENT, MICROCLINE 15 PERCENT, AND BIOTITE 3 PERCENT.

FOR DESCRIPTION AND INTERPRETATION SEE GSC 65-141.

GSC 65-140 BIOTITE, K-AR AGE 346 + OR - 20 M.Y.

K=6.07 PERCENT, AR40/K40=0.0222, RADIOGENIC AR=86 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF DARK BROWN BIOTITE CONTAINING OPAQUE INCLUSIONS. THESE

INCLUSIONS ARE SURROUNDED BY DARKER BROWN AREAS AND SOME FLAKES ARE ALMOST BLACK WITH SUCH AREAS. ABOUT 5 PERCENT OF THE FLAKES SHOW ALTERATION TO CHLORITE ON THEIR EDGES. MINOR IMPURITIES CONSIST OF HORNBLENDE (2 PERCENT) AND A TRACE OF QUARTZ-FELDSPAR. TOTAL CHLORITE CONTENT 5 PERCENT.

FROM QUARTZ MONZONITE
(11 O) LA POILE RIVER, 3.0 MILES SOUTH OF THE MOUTH OF MORG KEEPINGS BROOK, NEWFOUNDLAND, 47-54-34 N, 58-12-17 W. MAP-UNIT 14, GSC MAP 1036A (J. R. COOPER). SAMPLE GJ-623-64, COLLECTED AND INTERPRETED BY J. W. GILLIS.

FOR DESCRIPTION AND INTERPRETATION SEE GSC 65-141.

GSC 65-141 MUSCOVITE, K-AR AGE 344 + OR - 15 M.Y.

K=8.66 PERCENT, AR40/K40=0.0221, RADIOGENIC AR=92 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF MUSCOVITE. ABOUT 50 PERCENT OF THE FLAKES HAVE A SLIGHT BROWN STAIN AND ABOUT 5 PERCENT HAVE ATTACHED QUARTZ FELDSPAR GRAINS. THE SAMPLE IS CONTAMINATED WITH ABOUT 5 PERCENT FREE QUARTZ-FELDSPAR.

FROM GRANITE
(11 O) LA POILE RIVER, 3.0 MILES SOUTH OF MOUTH OF MORG KEEPINGS BROOK, NEWFOUNDLAND, 47-54-34 N, 58-12-17 W. MAP-UNIT 14, GSC MAP 1036A (J. R. COOPER). SAMPLE GJ-623-64, COLLECTED AND INTERPRETED BY J. W. GILLIS.

THE QUARTZ MONZONITE (GSC 65-140 AND 141) IS GREY AND MASSIVE. QUARTZ CONSTITUTES ABOUT 63 PERCENT OF THE ROCK, PLAGIOCLASE 20 PERCENT, MICROCLINE 10 PERCENT, MUSCOVITE 4 PERCENT, BIOTITE 2 PERCENT, AND GARNET 1 PERCENT.

ONE OF THE GRANODIORITES (GSC 65-139) AND THE QUARTZ MONZONITE (GSC 65-140 AND 141) CUT THE LOWER TO MIDDLE DEVONIAN BAY DU NORD GROUP (COOPER, 1954, GILLIS, 1965). GRANODIORITES SIMILAR TO THE OTHER GRANODIORITE (GSC 65-138) CUT THE DEVONIAN AND/OR EARLIER LA POILE GROUP. THE 350 (GSC 65-139), 346 (GSC 65-140), 344 (GSC 65-141), AND 350 (GSC 65-138) M. Y. DATES ARE YOUNGER THAN A 415 M.Y. DATE (GSC

61-202) ON MUSCOVITE FROM A PEGMATITIC LAYER IN SCHISTOSE QUARTZITE AND AMPHIBOLITE NEAR PORT AUX BASQUES, AND ARE YOUNGER THAN A 400 M.Y. DATE (GSC63-162) ON MUSCOVITE FROM A PEGMATITE INTERBANDED WITH SCHISTS AND GNEISSES NEAR ROSE BLANCHE. ACCORDING TO KULPS TIME SCALE (1961) THE 350, 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 415 AND 400 M.Y. DATES INDICATE A LATE SILURIAN OR EARLY DEVONIAN AGE. THESE 415 AND 400 M.Y. DATES TOGETHER WITH OTHER ISOTOPIC AGES IN THE 415-484 M.Y. RANGE SUGGEST A PERIOD OR PERIODS OF PRE-DEVONIAN, PALEOZOIC INTRUSIONS IN A BROAD BELT THAT EXTENDS FROM CAPE RAY NORTHEASTWARD TO NOTRE DAME BAY (GSC 63-167).

REFERENCES-

COOPER, J.R.
1954 LA POILE-CINQ CERF MAP-AREA, NEWFOUNDLAND, GEOL. SURV. CAN. MEM. 276.

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 65-142 BIOTITE, K-AR AGE 342 + OR - 16 M.Y.

K=6.92 PERCENT, AR40/K40=0.0220, RADIOGENIC AR=86 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF BIOTITE. THERE ARE TWO VARIETIES OF BIOTITE, ONE OLIVE-GREEN (85 PERCENT), AND THE OTHER REDDISH BROWN (15 PERCENT). THE OLIVE-GREEN VARIETY APPEARS TO BE UNALTERED ALTHOUGH ABOUT 5 PERCENT OF THE GRAINS ARE BLISTERED. THE REDDISH-BROWN MATERIAL IS ALTERED TO CHLORITE AROUND THE EDGES OF THE FLAKES. TOTAL CHLORITE CONTENT IS 10 PERCENT.

FROM GRANITE
(2 D) NORTHWEST SHORE OF BRAZIL POND, NEWFOUNDLAND, 48-03-45 N, 55-58-30 W. MAP-UNIT GR, GSC MAP 1043A (D. M. BAIRD). SAMPLE AA.A.29.1, COLLECTED AND INTERPRETED BY F. D. ANDERSON.

THE ROCK IS A GREY, MEDIUM TO COARSE GRAINED GRANITE CONSISTING MAINLY OF QUARTZ, MICROCLINE, PERTHITE, ORTHOCLASE,

SODIC PLAGIOCLASE AND BIOTITE. IT IS PART OF THE GRANITIC BELT THAT EXTENDS NORTHEASTERLY ACROSS NEWFOUNDLAND. THE ISOTOPIC AGE OF 342 + OR - 16 M.Y. SUGGESTS A LATE DEVONIAN OR EARLY CARBONIFEROUS AGE FOR THE GRANITE WHICH WAS POSSIBLY INTRUDED DURING A LATE PHASE OF THE ACADIAN OROGENY.

GSC 65-143 HORNBLENDE, K-AR AGE 264 + OR - 52 M.Y.

K=0.53 PERCENT, AR40/K40=0.0166, RADIOGENIC AR=44 PERCENT.

CONCENTRATE- IMPURE CONCENTRATE OF GREENISH-BROWN HORNBLENDE. THE HORNBLENDE IS RELATIVELY UNALTERED, BUT THE CONCENTRATE CONTAINS ABOUT 15 PERCENT FREE CHLORITE, 10 PERCENT OPAQUES (PROBABLY PYRITE OR CHALCOPYRITE), 5 PERCENT MUSCOVITE AND 5 PERCENT QUARTZ-FELDSPAR.

FROM GRANODIORITE
(2 D) NEAR MOUTH OF NORTHWEST GANDER RIVER, ALONG BOWATER PRIVATE ROAD, NEWFOUNDLAND, 48-51-12 N, 55-02-42 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE WF-507-64, COLLECTED AND INTERPRETED BY H. WILLIAMS.

THE ROCK IS A MEDIUM-GRAINED MASSIVE PINK GRANODIORITE COMPOSED ESSENTIALLY OF ALTERED EUHEDRAL PLAGIOCLASE FELDSPAR, CHLORITIZED AMPHIBOLE, AND MICROPEGMATITE THAT IS INTERSERTAL AMONG THE PLAGIOCLASE CRYSTALS. THE ROCK IS A YOUNG SILICIC PHASE OF A COMPOSITE INTRUSION THAT CUTS SILURIAN ROCKS OF THE BOTWOOD GROUP, AND INTERPRETED ON GEOLOGICAL EVIDENCE TO BE DEVONIAN. THE AMPHIBOLE USED FOR THE ISOTOPIC AGE DETERMINATION IS COMMONLY CHLORITIZED AND THE LOW AGE OBTAINED IS THEREFORE SUSPECT. (SEE GSC 65-147).

GSC 65-144 BIOTITE, K-AR AGE 129 + OR - 7 M.Y.

K=7.41 PERCENT, AR40/K40=0.0078, RADIOGENIC AR=73 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF UNALTERED BIOTITE. MOST OF THE FLAKES ARE BLISTERED AND LESS THAN 5 PERCENT OF THEM CONTAIN COLOURLESS INCLUSIONS. CHLORITE WAS NOT DETECTED, BUT THE

CONCENTRATE IS CONTAMINATED WITH ABOUT 5 PERCENT QUARTZ-FELDSPAR AND OPAQUES, AND ABOUT 2 PERCENT HORNBLENDE.

FROM LAMPROPHYRE.

(2 E) ONE MILE NORTHEAST OF CHAPEL HEAD, BAY OF EXPLOITS, NEWFOUNDLAND, 49-22-27 N, 54-54-33 W. GSC MAP 60-1963. SAMPLE WF 511-64, COLLECTED AND INTERPRETED BY H. WILLIAMS.

SEE GSC 65-145 FOR DESCRIPTION AND GEOLOGICAL INTERPRETATION.

GSC 65-145 HORNBLENDE, K-AR AGE 115 + OR - 20 M.Y.

K=1.60 PERCENT, AR40/K40=0.0069, RADIOGENIC AR=63 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF UNALTERED REDDISH-BROWN HORNBLENDE. MOST OF THE GRAINS CONTAIN FINE OPAQUE INCLUSIONS, AND ABOUT 5 PERCENT CONTAIN NEEDLE-LIKE INCLUSIONS. TOTAL CHLORITE CONTENT LESS THAN 5 PERCENT.

FROM LAMPROPHYRE.

(2 E) ONE MILE NORTHEAST OF CHAPEL HEAD, BAY OF EXPLOITS, NEWFOUNDLAND, 49-22-27 N, 54-54-23 W. GSC MAP 60-1963. SAMPLE WF 511-64, COLLECTED AND INTERPRETED BY H. WILLIAMS.

THE ROCK IS A BROWNISH WEATHERING DARK GREY TO BLACK MASSIVE AND PORPHYRITIC LAMPROPHYRE DYKE WITH PHENOCRYSTS OF DARK BROWN HORNBLENDE AND BIOTITE SET IN A MATRIX OF PYROXENE, MAGNETITE, PLAGIOCLASE, AND CARBONATE. THESE DYKES ARE COMMON IN NORTHEAST NEWFOUNDLAND AND CUT ORDOVICIAN AND SILURIAN STRATA AS WELL AS DEVONIAN INTRUSIVE ROCKS, AND THE DYKES ARE CONSIDERED TO BE THE YOUNGEST CONSOLIDATED ROCKS IN THE NOTRE DAME BAY AREA. THE AGE DETERMINATIONS OF 115 AND 129 M.Y. MADE ON HORNBLENDE AND BIOTITE RESPECTIVELY, ARE REASONABLY CLOSE AND COMPARE FAVOURABLY WITH AN EARLIER ISOTOPIC AGE DETERMINATION OF 144 M.Y. ON A SIMILAR DYKE. THUS THE LAMPROPHYRE DYKES ARE OF LATE JURASSIC TO EARLY CRETACEOUS AGE AND ARE APPARENTLY NOT RELATED TO EARLIER OROGENIC AND PLUTONIC EVENTS IN THIS AREA.

NEWFOUNDLAND

GSC 65-146 BIOTITE, K-AR AGE 362 + OR - 20 M.Y.

K=6.61 PERCENT, AR40/K40=0.0233, RADIOGENIC AR=91 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF REDDISH-BROWN BIOTITE WITH SOME (5 PERCENT) ATTACHED QUARTZ-FELDSPAR. ABOUT 10 PERCENT OF THE FLAKES CONTAIN VERY FINE OPAQUE INCLUSIONS AND ABOUT HALF OF THE FLAKES SHOW CHLORITE ALTERATION AROUND THE EDGES. TOTAL CHLORITE CONTENT IS 15-20 PERCENT, HORNBLENDE 5 PERCENT, AND QUARTZ-FELDSPAR 5 PERCENT.

FROM GRANODIORITE
(2 E) NORTH SHORE OF KIPPER COVE, FOGO ISLAND, NEWFOUNDLAND, 49-37-48 N, 54-05-59 W. MAP-UNIT 23, GSC MAP 60-1963. SAMPLE WF491-64, COLLECTED AND INTERPRETED BY H. WILLIAMS.

ROCK IS A MEDIUM-GRAINED HORNBLENDE BIOTITE GRANODIORITE. MUCH OF THE CONTAINED PLAGIOCLASE FELDSPAR IS ALTERED ALTHOUGH THE BIOTITE IS RELATIVELY CLEAN WITH ONLY SLIGHT CHLORITIC ALTERATION AROUND THE EDGES AND LOCALLY ALONG CLEAVAGES OF THE BIOTITE FLAKES. THE GRANODIORITE INTRUDES FOSSILIFEROUS SEDIMENTARY ROCKS THAT ARE MAPPED AS TYPICAL OF THE SILURIAN BOTWOOD GROUP AND THE DEVONIAN AGE OF 362 M.Y. FITS WELL WITH THE PATTERN ESTABLISHED FOR DEVONIAN ACADIAN OROGENY IN NORTHEASTERN NEWFOUNDLAND.

GSC 65-147 HORNBLENDE, K-AR AGE 380 + OR - 50 M.Y.

K=1.00 PERCENT, AR40/K40=0.0247, RADIOGENIC AR=79 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF DARK OLIVE-GREEN HORNBLENDE. IMPURITIES CONSIST OF 5 PERCENT QUARTZ-FELDSPAR, 5 PERCENT OPAQUES, AND LESS THAN 5 PERCENT BIOTITE AND CHLORITE.

FROM SYENITE
(2 E) NEAR DAM AT NORTH END OF RATTLING LAKE, NEWFOUNDLAND, 49-01-48 N, 55-17-56 W. MAP-UNIT 23, GSC MAP 60-1963. SAMPLE WF505-64, COLLECTED AND INTERPRETED BY H. WILLIAMS.

NEWFOUNDLAND

ROCK IS A MEDIUM-GRAINED MASSIVE PINK BIOTITE HORNBLENDE SYENITE THAT IS A YOUNGER SILICIC PHASE OF A COMPOSITE INTRUSION THAT CUTS SILURIAN ROCKS OF THE BOTWOOD GROUP. THE METAMORPHIC AUREOLE OF THE INTRUSION AND ITS OLDER MORE BASIC COMPONENT ARE DATED AT 423 AND 410 M.Y. RESPECTIVELY. THE INTRUSION IS DATED STRATIGRAPHICALLY AS POST EARLY SILURIAN AND THE EMPLACEMENT OF THE SILICIC PHASE AT 380 M.Y. AGREES WITH THE ESTABLISHED PATTERN OF DEVONIAN ACADIAN OROGENY IN NEWFOUNDLAND. THE ISOTOPIC DATES FOR THE METAMORPHIC AUREOLE AND BASIC PHASE OF THE SAME INTRUSION ARE DISCUSSED ELSEWHERE (WILLIAMS, 1964).

REFERENCE-

WILLIAMS H.
1964 NOTES ON THE OROGENIC HISTORY AND ISOTOPE AGES IN BOTWOOD MAP-AREA, NORTHEASTERN NEWFOUNDLAND, IN AGE DETERMINATIONS AND GEOLOGICAL STUDIES, GEOL. SURV. CAN., PAPER 64-17 (PART 2), PP. 22-29

GSC 65-148 HORNBLENDE, K-AR AGE 286 + OR - 58 M.Y.

K=0.75 PERCENT, AR40/K40=0.0180, RADIOGENIC AR=18 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF DARK OLIVE-GREEN HORNBLENDE, ALL THE GRAINS OF WHICH CONTAIN VERY FINE OPAQUE INCLUSIONS. IMPURITIES CONSIST OF 3 PERCENT BIOTITE, 3 PERCENT CHLORITE, AND 3 PERCENT QUARTZ-FELDSPAR.

FROM GRANODIORITE
(2 E) NORTHEAST END OF LARGEST ISLAND AT SOUTH END OF SOUTH TWIN LAKE, NEWFOUNDLAND, 49-11-36 N, 55-51-33 W. MAP-UNIT 24, GSC MAP 60-1963. SAMPLE WF509-64, COLLECTED AND INTERPRETED BY H. WILLIAMS.

SEE GSC 65-149 FOR DESCRIPTION AND INTERPRETATION.

GSC 65-149 BIOTITE, K-AR AGE 376 + OR - 12 M.Y.

K=7.17 PERCENT, AR40/K40=0.0244, RADIOGENIC AR=93 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF TWO VARIETIES OF BIOTITE. ONE (50 PERCENT OF THE MICA) IS LIGHT OLIVE GREEN AND CONTAINS ROD-LIKE COLOURLESS INCLUSIONS AND HAIR-LIKE ORIENTATED INCLUSIONS. IT IS NOT VISIBLY ALTERED. THE OTHER MICA IS DARK OLIVE-GREEN TO BLACK AND CONTAINS COLOURLESS BLEBS AND IS ALTERED TO CHLORITE ON THE EDGES. THE SAMPLE IS CONTAMINATED WITH ABOUT 3 PERCENT HORNBLENDE.

FROM GRANODIORITE

(2 E) NORTHEAST END OF LARGEST ISLAND AT SOUTH END OF SOUTH TWIN LAKE, NEWFOUNDLAND, 49-11-36 N, 55-51-33 W. MAP UNIT 24, GSC MAP 60-1963. SAMPLE WF509-64, COLLECTED AND INTERPRETED BY H. WILLIAMS.

ROCK IS A MEDIUM-GRAINED MASSIVE GREY HORNBLENDE BIOTITE GRANODIORITE AND IT IS INTERPRETED TO CONSTITUTE A YOUNGER SILICIC PHASE OF A COMPOSITE INTRUSION THAT CUTS THE TENTATIVE SILURIAN SPRINGDALE GROUP. THE OLDER BASIC PHASE OF THE SAME INTRUSION IS DATED AT 415 M.Y. THE ISOTOPIC AGE DETERMINATION OF 286 M.Y. OBTAINED USING AMPHIBOLE IS SUSPECT ON GEOLOGICAL EVIDENCE AND IS CONSIDERED UNRELIABLE AS THE EXTRACTED ARGON IN THE AMPHIBOLE IS ONLY 18 PERCENT RADIOGENIC. IN CONTRAST THE BIOTITE ISOTOPIC AGE DETERMINATION OF 376 M.Y. FITS WELL WITH THE OROGENIC HISTORY OF THIS PART OF NFLD. AND COMPARES FAVOURABLY IN AGE WITH THE DATED SILICIC PHASE OF A NEARBY SIMILAR COMPOSITE INTRUSION (SEE GSC 65-147).

GSC 65-150 WHOLE ROCK, K-AR AGE 457 + OR - 82 M.Y.

K=0.32 PERCENT, AR40/K40=0.0303, RADIOGENIC AR=43 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM ANDESITE.

(1 N) NORTHWEST SHORE OF HOLYROOD BAY, 1.5 MILES NORTHEAST OF MOUTH OF NORTH ARM RIVER, NEWFOUNDLAND, 47-24-30 N, 53-08-30 W. MAP-UNIT 5 (CONCEPTION GROUP), GSC PRELIMINARY MAP 54-3. SAMPLE MB-510, COLLECTED BY W. D. MCCARTNEY, INTERPRETED BY W. H. POOLE, AND W. D. MCCARTNEY.

THE ROCK IS AN ANDESITE CONSISTING OF ABOUT 60 PERCENT ANDESINE, WITH INTERSTITIAL CHLORITE AND CALCITE, TOGETHER WITH

MINOR ORTHOCLASE WHICH IS IN PART REPLACED BY CALCITE.

THIS WHOLE ROCK AGE DETERMINATION WAS MADE ON A SMALL HAND SPECIMEN FROM THE ONLY LAVA FLOW RECOGNIZED TO DATE IN THE SILTSTONES, SLATES AND GREYWACKES OF THE PRECAMBRIAN CONCEPTION GROUP. THE ANDESITE FLOW IS ABOUT 60 FT. THICK AND INCLUDES A THIN CHILLED BASE AND A BRECCIATED UPPER PORTION 10 FT THICK. WELL DEVELOPED PILLOW STRUCTURES AND SMALL PATCHES OF GREY LIMESTONE WITHIN THE FLOW ATTEST TO ITS MARINE EXTRUSION.

GEOLOGICAL RELATIONS INDICATE THAT THE AGE OF THIS LAVA SHOULD BE YOUNGER THAN THE HOLYROOD GRANITE (574 + OR - 11 M.Y. MCCARTNEY ET AL,), AND OLDER THAN THE BULL ARM VOLCANICS RECENTLY DATED BY H.W. FAIRBAIRN ET AL AT 494 + OR - 30 M.Y. BY WHOLE ROCK RB-SR DETERMINATIONS ON TEN SAMPLES

THE AGE HEREIN REPORTED (457 + OR - 82 M.Y.) WAS DETERMINED ON MATERIAL RELATIVELY UNSUITABLE FOR K-AR DATING (WHOLE-ROCK, LOW POTASSIUM CONTENT, HIGH ATMOSPHERIC ARGON CONTENT), AND MUST THERFORE BE REGARDED AS A MINIMUM AGE. IN THIS LIGHT IT IS NOT IN IRRECONCILABLE CONFLICT WITH THE CONCLUSION THAT THE FLOW MUST BE OLDER THAN 494 M.Y. (BULL ARM) AND YOUNGER THAN 574 M.Y. (HOLYROOD GRANITE).

REFERENCES-

MCCARTNEY W.D.,POOLE W.H., WANLESS R.K., WILLIAMS H., AND LOVERIDGE W.D.
1966 RB-SR AGE AD GEOLOGICAL SETTING OF THE HOLYROOD GRANITE, SOUTHEAST NEWFOUNDLAND, CAN. J. EARTH SCI. VOL. 3, NO, 7.

FAIRBAIRN H.W., BOTTINO M.L., PINSON W.H. JR. AND HURLEY P.M.
1966 WHOLE ROCK AGE AND INITIAL SR87-SR86 OF VOLCANICS UNDERLYING FOSSILIFEROUS LOWER CAMBRIAN IN THE ATLANTIC PROVINCES OF CANADA. CAN. J. EARTH SCI. VOL. 3, PP 509-521.

GSC 65-151 WHOLE ROCK, K-AR AGE 843 + OR - 125 M.Y.

K=0.25 PERCENT, AR40/K40=0.0622, RADIOGENIC AR=69 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM TUFF
(13 L) SIX MILES NORTH OF KANAIRIKTOK RIVER, NEWFOUNDLAND (LABRADOR), 54-35 N, 63-01 W. MAP-UNIT 8, GSC MAP 3-1964. SAMPLE S62-190, COLLECTED BY

NEWFOUNDLAND

G. B. SKIPPEN, INTERPRETED BY R. F. EMSLIE.
THE SPECIMEN IS A LIGHT GREY-GREEN TUFF MADE UP OF 60 PERCENT UNSORTED VOLCANIC FRAGMENTS UP TO 1.5 INCHES ACROSS, BUT MOSTLY MUCH SMALLER, ENCLOSED IN AN APHANITIC MATRIX. THE VOLCANIC FRAGMENTS ARE VARIABLE IN TEXTURE AND GRAIN SIZE.

THE SAMPLE WAS TAKEN FROM FLAT-LYING TUFF BEDS OF INTERMEDIATE COMPOSITION. THE TUFFS ARE ASSOCIATED WITH FLAT-LYING RED ARKOSE AND CONGLOMERATE BUT DUE TO PATCHY EXPOSURE THEIR STRATIGRAPHIC RELATIONSHIP IS UNKNOWN. SIMILAR REDBEDS OCCUR AT WIDELY SCATTERED LOCALITIES IN THE AREA AND SHOW SIMILARITIES TO THOSE DESCRIBED BY FAHRIG (1959) FROM THE SEAL LAKE GROUP.

BECAUSE OF THE UNDEFORMED AND UNRECRYSTALLIZED NATURE OF THE TUFF IT IS BELIEVED THAT THE AGE IS NOT RELATED TO THE GRENVILLE OROGENY. UNTIL FURTHER EVIDENCE IS AVAILABLE, THE MOST LIKELY CORRELATION SEEMS TO BE WITH THE ROCKS OF THE SEAL LAKE GROUP, THE YOUNG AGE BEING THE RESULT OF ARGON LOSS FROM THE SPECIMEN.

REFERENCE-

FAHRIG W.F.
1959 SNEGAMOOK LAKE, COAST OF LABRADOR, NEWFOUNDLAND. GEOL. SURV. CAN., MAP 1079A.

GSC 65-152 BIOTITE, K-AR AGE 1265 + OR - 45 M.Y.

K=7.86 PERCENT, AR40/K40=0.1054, RADIOGENIC AR=97 PERCENT.

CONCENTRATE- RELATIVELY CLEAN REDDISH-BROWN BIOTITE. THE FLAKES CONTAIN LESS THAN 5 PERCENT COLOURLESS INCLUSIONS WHICH ARE SURROUNDED BY PLEOCHROIC HALOS. THERE IS SLIGHT CHLORITE ALTERATION ON THE EDGES OF THE FLAKES. IMPURITIES CONSIST OF 5 PERCENT ATTACHED QUARTZ-FELDSPAR, 2 PERCENT HORNBLENDE, AND A TRACE OF CHLORITE.

FROM GNEISS.
(14 D) SOUTH SHORE OF CABOT LAKE, NEWFOUNDLAND (LABRADOR), 56-08 N, 62-39 W. NO GEOLOGICAL MAP. SAMPLE TA 64-T4, COLLECTED AND INTERPRETED BY F. C. TAYLOR.

THE SAMPLE IS FROM A YELLOWISH GREY TO MEDIUM GREY, MEDIUM

GRAINED, WELL LAMINATED GARNET-SILLIMANITE-QUARTZ-FELDSPAR GNEISS CONTAINING DISSEMINATED BIOTITE. IT LIES WITHIN THE NAIN PROVINCE. THE AGE OF 1,265 M.Y. GIVES THE TIME OF METAMORPHISM OF THE AREA, WHICH OCCURRED DURING THE LATE STAGES OF THE ELSONIAN OROGENY.

GSC 65-153 BIOTITE, K-AR AGE 1550 + OR - 50 M.Y.

K=7.67 PERCENT, AR40/K40=0.1410, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF DARK KHAKI BIOTITE. THE MICA IS UNALTERED, BUT THE CONCENTRATE IS CONTAMINATED WITH ABOUT 3 PERCENT HORNBLENDE.

FROM GNEISSIC GRANITE.

(14 E) HEADWATERS OF KINGURUTIK RIVER, NEWFOUNDLAND (LABRADOR), 57-02 N, 63-41 W. NO GEOLOGICAL MAP. SAMPLE TA 64-T13, COLLECTED AND INTERPRETED BY F. C. TAYLOR.

THIS SAMPLE IS FROM A FINE GRAINED, LIGHT TO YELLOWISH GREY, WELL FOLIATED BIOTITE GNEISSIC GRANITE. FELDSPARS ARE LOCALLY REDDISH AND BIOTITE-RICH LAMINATIONS ARE COMMON.

THIS GNEISS LIES IN AN AREA CONSIDERED TO BE PART OF THE NAIN PROVINCE, BUT 1550 M.Y. IS SOMEWHAT OLDER THAN MOST AGE DETERMINATIONS FOR THIS PROVINCE. ON THE BASIS OF THE PRESENT AGE IT WOULD APPEAR THAT THE CHURCHILL PROVINCE AT THIS LATITUDE MAY EXTEND FARTHER EAST THAN PREVIOUSLY THOUGHT OR ELSE THE PRESENT AGE IS A RELICT AGE ONLY PARTIALLY AFFECTED BY THE ELSONIAN OROGENY. A MORE DEFINITIVE INTERPRETATION WILL HAVE TO WAIT UNTIL THIS REGION IS MAPPED.