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POTASSIUM-ARGON AGES OF MAINLY INTRUSIVE ROCKS IN THE SAINT ELIAS MOUNTAINS, YUKON AND BRITISH COLUMBIA

C.J. Dodds
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CONTENTS

1 Abstract/Résumé
1 Introduction
2 Acknowledgments
2 Geological setting
3 K-Ar age data
10 Interpretation of K-Ar data and suggested plutonic episodes and suites
11 Latest Pennsylvanian to early Permian plutonic episode
12 Late Jurassic to earliest Cretaceous plutonic episode
13 Late early Cretaceous plutonic episode
14 Eocene plutonic episode
15 Oligocene plutonic episode
15 Mid- to late-Miocene plutonic episode
16 Miscellaneous data
17 Northern part of Coast Plutonic Complex
17 Summary
18 References
21 Appendix

Table

6 1. Compilation of K-Ar isotopic age determinations for predominantly intrusive rocks from Saint Elias Mountains (Yukon and British Columbia)

Figure

4 1. Distribution of episodes of plutonism and location of all available K-Ar age data

POTASSIUM-ARGON AGES OF MAINLY INTRUSIVE ROCKS IN THE SAINT ELIAS MOUNTAINS, YUKON AND BRITISH COLUMBIA

Abstract

One hundred and two new K-Ar age determinations, largely from granitoid rocks, are reported from the Saint Elias Mountains of southwest Yukon, northwest British Columbia, and closely adjacent parts of Alaska. Six new K-Ar dates are also presented for rocks in the northern part of the Coast Plutonic Complex.

New and previously published K-Ar age data from the Saint Elias Mountains aid in defining at least six plutonic episodes in this region: latest Pennsylvanian to Early Permian (270-290 Ma); Late Jurassic to earliest Cretaceous (130-160 Ma); late Early Cretaceous (106-117 Ma); Eocene (41-52 Ma); Oligocene (23-33 Ma); and mid- to Late-Miocene (6-16 Ma) time. All can be correlated with plutons or plutonic belts previously outlined in adjoining Alaska. In the Saint Elias Mountains the plutonic episodes, except for the last two, are apparently confined to certain terranes, whereas equivalent plutons or plutonic belts in Alaska mostly are not. These six distinct episodes of mainly calc-alkaline plutonism in structurally complex Saint Elias Mountains and in contiguous Alaska, may be, but are not necessarily, related to periods of plate convergence and subduction.

Résumé

On a signalé cent deux nouvelles datations au K-Ar, en grande partie de roches granitoides, dans le massif de Saint-Élies du sud-ouest du Yukon et du nord-ouest de la Colombie-Britannique ainsi que dans des parties adjacentes et rapprochées de l'Alaska. On présente également six nouvelles datations au K-Ar de roches de la partie septentrionale du complexe plutonique côtier.

Les données de datations au K-Ar, publiées récemment et plus tôt, de roches du massif de Saint-Élies aident à définir au moins six phases plutoniques dans cette région: de la dernière partie du Pennsylvanien au Permien inférieur (270 à 290 Ma), du Jurassique supérieur au début du Crétacé (130 à 160 Ma), à la fin du Crétacé inférieur (106 à 117 Ma), à l'Éocène (41 à 52 Ma), à l'Oligocène (23 à 33 Ma) et du Miocène supérieur (6 à 16 Ma). Toutes ces phases peuvent être mis en corrélation avec des plutons ou des zones plutoniques ant/rieurement délimités dans des parties adjacentes d'Alaska. Dans le massif de Saint-Élie les phases plutoniques, à l'exception des deux dernières, sont apparemment confinés à certains terranes, tandis que les plutons ou zones plutoniques équivalents en Alaska ne le sont principalement pas. Ces six phases distinctes de plutonisme principalement calco-alcalin dans le massif de Saint-Élie et les parties adjacentes d'Alaska de structure complexe, peuvent être, mais ne sont pas nécessairement, reliées à des périodes de convergence et de subduction de plaques.

INTRODUCTION

From the Saint Elias Mountains of southwest Yukon, northwest British Columbia, and closely adjacent Alaska, ninety-six K-Ar isotopic age determinations made by the Geological Survey of Canada are reported here for the first time, as well as six new rerun K-Ar determinations made by the United States Geological Survey, Menlo Park (courtesy of M.A. Lanphere, personal communication). In addition, six new K-Ar dates from the Geological Survey of Canada are also presented for the northern part of the Coast Plutonic Complex within southwest Yukon and northwest British Columbia.

Of the new determinations from the Saint Elias Mountains, ninety-four are from intrusive rocks, the majority of which are plutonic; one is from a gneiss and one from a metavolcanic rock. Although an effort was made to obtain representative samples, many are grab samples and indicate spot ages only. Eighty-one per cent of the newly submitted granitoid samples contained both biotite and hornblende, potentially offering more reliable paired dates. Unfortunately, of these samples, forty-two per cent had biotite and a further twelve per cent had hornblende which were too chloritized to warrant analysis. Of the newly determined biotite-hornblende K-Ar paired dates, seventy-five per cent were reasonably concordant. These data represent the first major contribution to the dating of intrusive rocks within the Saint Elias Mountains of Canada.

All but five samples were collected in 1974, 1977-79, and 1981 during Operation Saint Elias, which was undertaken by the Geological Survey of Canada to complete geological mapping of the region, more than seventy per cent of which was essentially unstudied prior to 1974 (Campbell and Dodds, 1978, 1979, 1982a,b,c, and 1983a,b). Due to the extremely rugged, extensively ice-covered and remote terrain encountered, much of the mapping was on a reconnaissance scale, with more detailed ground coverage restricted mainly to the relatively accessible northeastern perimeter. Most of the main intrusive bodies have been delineated with some confidence, however data on their composition, intrusive relationships and setting are sparse. Names adopted for most of the batholiths, plutons, complexes, and plutonic suites are cited here for the first time. Although much of the descriptive information and interpretation of data is presented in the individual listings of the new K-Ar dates (see appendix), interpretations of all published and unpublished K-Ar age data from the Saint Elias Mountains are summarized in this paper.

Acknowledgments

Field work undertaken for this study involved many people, unfortunately too numerous to thank individually. K-Ar age determinations were made by R.K. Wanless, R.D. Stevens, and other staff members of the Geological Survey of Canada in Ottawa. Checks on the same concentrates from a few samples were run by M.A. Lanphere of the U.S. Geological Survey, Menlo Park. The paper has benefited from the constructive criticism of J.A. Roddick, H. Gabrielse, R.R. Parrish, and G.J. Woodsworth.

GEOLOGICAL SETTING

The Saint Elias Mountains lie outboard of the Coast Plutonic Complex, and hence are within the northern extension of the Insular Belt. They comprise parts of six narrow, northwest-trending, major-fault bounded, allochthonous terranes which extend into contiguous Alaska (Fig. 1, inset). These terranes include Yakutat, Chugach, Alexander and three possible elements of Wrangellia (W1, W2, W3). The Saint Elias Mountains region is dominated by the Alexander Terrane. Supposed segments of Wrangellia (W2 and W3) were moved northeast of Alexander Terrane by large dextral displacements along Duke River and Denali faults (Campbell and Dodds, 1983c). However, element W3 is also coextensive with Taku Terrain and cannot be conclusively correlated with Wrangellia. Accretion of these various terranes is believed to have occurred mostly in Mesozoic to Cenozoic time. The geology of this belt has been further complicated by large scale, mainly right-lateral, transcurrent faulting, which is both syn- and post-accretion.

The composition and tectonic significance of these distinctive terranes with their differing cover-rock sequences are discussed in greater detail elsewhere (Berg et al., 1972; Berg et al., 1978; Coney et al., 1980; Campbell and Dodds, 1983c; Monger and Berg, 1984). The Saint Elias Mountains, however, are predominantly underlain by the Alexander Terrane which is also widely exposed throughout southeastern Alaska. It consists of thick sequences of at least Late Cambrian to latest Triassic clastic, subordinate carbonate, and lesser mostly basic volcanic and related rocks. The strata are regionally metamorphosed to sub- or low-greenschist facies, but in the western parts the grade locally reaches upper greenschist to mid-amphibolite facies. The terrane has been complexly deformed. It is bounded to the southwest by the Hubbard Fault and to the northeast by the Duke River Fault.

Within the Saint Elias Mountains, segments of Wrangellia flank the Alexander Terrane on the southwest and west (W1), and north and northeast (W2 and W3). They consist of mostly weakly metamorphosed, variably deformed, volcanic and sedimentary rocks of latest Paleozoic and Triassic age, and are overlain by differing postaccretion Mesozoic rock sequences. W1 is covered by Jurassic

and Cretaceous, shallow-marine, fossiliferous, clastic strata (Matanuska belt, Berg et al. 1972; MacKevett, 1978), and bounded by the Hubbard and Border Ranges faults. W2 is contained by the Duke River and Denali faults. W3 (conterminous with the Taku Terrane of Berg et al., 1978) lies northeast of the Denali Fault System, and merges with metamorphic rocks of the Coast Plutonic Complex and is intruded by its plutons. Both W2 and W3 are overlain by deep-marine flyschoid strata and locally by associated volcanics of the Gravina-Nutzotin belt (Berg et al., 1972, 1978), which are metamorphosed to subgreenschist facies and variably folded and faulted.

The Chugach Terrane is confined to the region southwest of the Border Ranges Fault and comprises variably metamorphosed and deformed, late Mesozoic, deep marine, flyschoid and basic volcanic rocks. The Yakutat Terrane (of Monger and Berg, 1984) is only very locally present in Canada. In adjacent Alaska it consists of late Mesozoic flysch and mélange and overlying Cenozoic mainly marine clastic sediments, and lies south and southwest of the Chugach-Saint Elias and Fairweather faults.

The Alexander Terrane and Wrangellia segments W1 and W2 are overlain with angular unconformity by Oligocene and (?) older continental sedimentary strata, and by Miocene and Pliocene volcanics and associated clastic sediments (Campbell and Dodds, 1982a,b,c, 1983a). The Gravina-Nutzotin belt with its substrate of W3 is locally unconformably covered by Oligocene nonmarine sediments. Immediately north of Walsh Glacier flat-lying mid- to Late Cretaceous, fossiliferous shallow-marine sediments lie unconformably upon deformed strata of the Alexander Terrane; these extend westward into southern Alaska where similar strata unconformably cover rocks of W1 (MacKevett, 1978). In general these mostly mid- to Late Tertiary clastic and volcanic cover rocks are little deformed, being flat or only slightly tilted, except locally near fault traces where they are steeply tilted or folded (Souther and Stanciu, 1975).

K-Ar AGE DATA

Prior to 1974 only a few K-Ar dates were available from Saint Elias Mountains (Christopher et al., 1972). Studies during and related to Operation Saint Elias added further age data (Wanless et al., 1978; Downey et al., 1980; Jacobson et al., 1980; Sturrock et al., 1980; Stevens et al., 1982). Other K-Ar dates from the area were reported by Hudson et al. (1977). These combined with the one hundred and two new K-Ar dates of this paper, total one hundred and thirty-five determinations and include all known K-Ar dates from the Saint Elias Mountains in Canada. They comprise one hundred and eleven dates from granitoid plutonic intrusions, fourteen from subvolcanic intrusions, two from an Alaskan-type ultramafic complex, one from a gabbro complex, and seven from an assortment of volcanic, sedimentary, and metamorphic rocks. All available K-Ar data from Saint Elias Mountains, together with an additional six new K-Ar dates from the northern part of the Coast Plutonic Complex are compiled in Table 1. The locations of the dated samples are shown in Figure 1.

The majority of the K-Ar age determinations from the Saint Elias Mountains are from granitoid and subvolcanic intrusions. From granitoid intrusions these determinations include: twenty-eight paired biotite-hornblende, one paired muscovite-biotite, thirteen biotite, thirty-four hornblende, one muscovite, three rerun hornblende, and two rerun biotite dates. From subvolcanic intrusions they comprise: one paired whole-rock biotite, four whole-rock, six biotite, one hornblende, and one whole-rock rerun.

Of seventy-six new and previously submitted samples from granitoid plutonic intrusions within the study region, fifty-six contained both biotite and hornblende and offered the potential of providing more accurate ages of intrusion. Unfortunately, twenty-two of these samples had biotite and a further seven of them had hornblende which were too chloritized for reliable analysis. The remaining twenty-seven samples yielded twenty reasonably concordant paired K-Ar dates. A new sample also provided a further fairly concordant muscovite-biotite date. None of the twelve samples from subvolcanic intrusions carried both biotite and hornblende.

Most of the K-Ar dates from granitoid and subvolcanic intrusions within the Saint Elias Mountains fall into or are reasonably close to six distinct age groupings: 270-290 Ma, 130-160 Ma, 106-117 Ma*, 41-52 Ma, 23-33 Ma, and 6-16 Ma.

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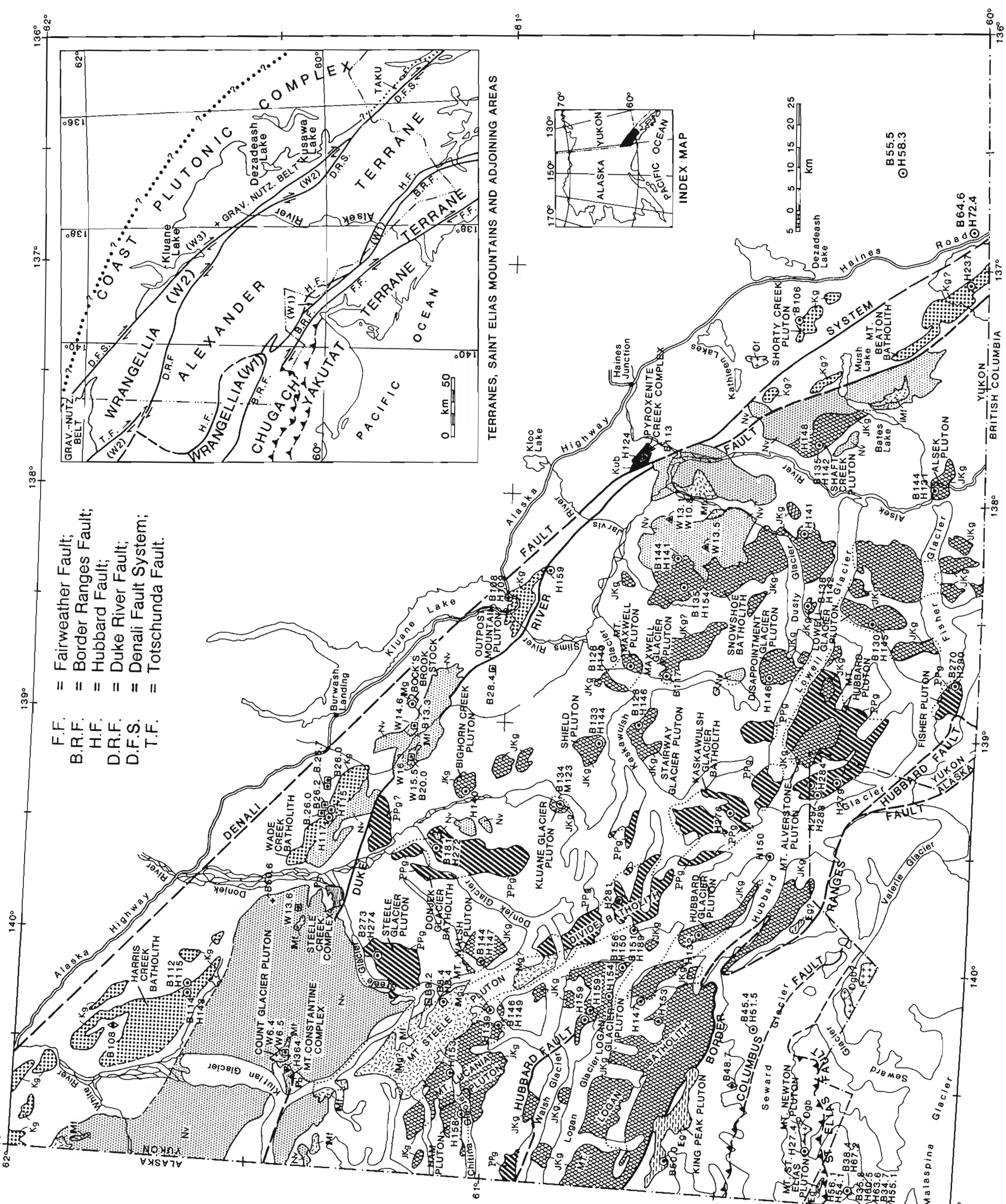
* Age range end-member or individual dates denoted by a single asterisk throughout this paper were not calculated using constants recommended by Steiger and Jager (1977)


F.F. = Fairweather Fault;
B.R.F. = Border Ranges Fault;
H.F. = Hubbard Fault;
D.R.F. = Duke River Fault;
D.F.S. = Denali Fault System;
T.F. = Totschunda Fault.
TERRANES, SAINT ELIAS MOUNTAINS AND ADJOINING AREAS
COAST PLUTONIC COMPLEX
WRANGELLIA (W2)
ALEXANDER TERRANE
WRANGELLIA (W1)
CHUGACH TERRANE
YAKUTAT TERRANE
PACIFIC OCEAN
GRAV.-NUTZ. BELT
INDEX MAP
ALASKA
YUKON
BRITISH COLUMBIA
DENALI FAULT SYSTEM
DUKE RIVER FAULT
HUBBARD FAULT
BORDER RANGES FAULT
COLUMBUS GLACIER FAULT
ST. ELIAS FAULT
Alaska Highway
Haines Road
Kluane Lake
Dezadeash Lake
Haines Junction
Burwash Landing
km

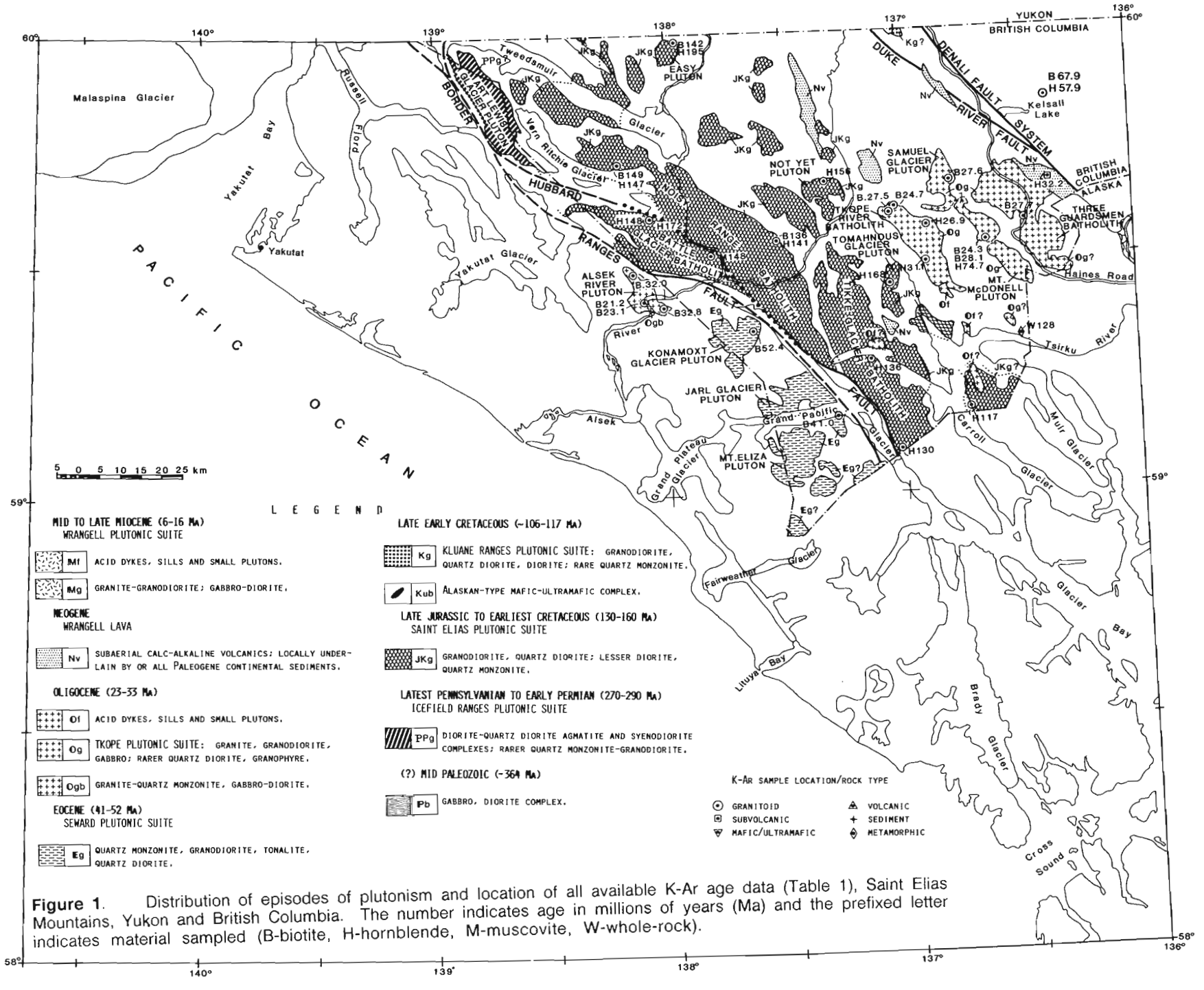


Figure 1. Distribution of episodes of plutonism and location of all available K-Ar age data (Table 1), Saint Elias Mountains, Yukon and British Columbia. The number indicates age in millions of years (Ma) and the prefixed letter indicates material sampled (B-biotite, H-hornblende, M-muscovite, W-whole-rock).

Table 1. Compilation of K-Ar isotopic age determinations for predominantly intrusive rocks from Saint Elias Mountains (Yukon and British Columbia)

AGE[1] NUMBER	FIELD NUMBER	LOCATION LATITUDE ; LONGITUDE: NTS. (name or geographic location)	ROCK TYPE	MINERAL DATED	AGE[2] (Ma)	TERRANE[3]	REFERENCE[4]
			MID TO LATE MIOCENE (6-16 Ma)				
			WRANGELL PLUTONIC SUITE				
	SUBVOLCANIC INTRUSIONS						
W6.4	WN-124-74	61°26.1'N ;140°29.7"W : 115F/8. (Count Glacier pluton).	altered qtz. trachyte; dome intruding Wrangell lava.	whole-rock	6.4 ± 0.8	W2	GSC 81-77
W6.5				whole-rock	6.5 ± 0.6		GSC 81-77
B9.2	32-CAc-74-1	61°08'09"N;140°14'05"W: 115F/1. (?phase of Mt. Steele pluton).	leuco. granite porphyry; moraine sample.	biotite	9.2 ± 0.7	Alex.	K-Ar #2542
W13.6	WN-122-74	61°25.1'N ;139°5l.3'W : 115G/5. (N. of Cement Creek).	altered felsite; small intrusion in Wrangell lava.	whole-rock	13.6 ± 1.2	W2	GSC 81-79
W15.5	WN-126-74	61°11.7'N ;139°10.6'W : 115G/3. (Duke R. valley NW of Grizzly Ck.).	bio. orthoclase trachyte porphyry; small intrusion in Wrangell lava.	whole-rock	15.5 ± 1.4	Alex.	GSC 81-81
B20.0				biotite	20.0 ± 1.8		GSC 81-82
W16.3	WN-127-74	61°11.7'N ;139°10.6'W : 115G/3. (Duke R. valley NW of Grizzly Ck.).	altered trachyte porphyry; small intrusion in Wrangell lava.	whole-rock	16.3 ± 1.4	Alex.	GSC 81-78
W14.6	WN-125-74	61°11.7'N ;139°01'W : 115G/3. (Duke R. valley NE of Grizzly Ck.).	altered bio. qtz. trachyte porphyry; small intrusion in Wrangell lava.	whole-rock	14.6 ± 1.3	W2	GSC 81-80
	HIGH-LEVEL PLUTONS						
B8.4	100-CAc-77-1	61°06'14"N;140°13'02"W: 115F/1. (Mt. Steele pluton).	med. grained, homogeneous, hbde. bio. granodiorite.	biotite	8.4 ± 0.6	Alex.	K-Ar #2909
H8.4				hornblende	8.4 ± 3.2		K-Ar #2910
B13.3	38-MD-I	61.198°N ;138.92°W : 115G/2. (Bock's Brook stock).	biotite diorite; zoned gabbro-diorite stock.	biotite	13.3 ± 0.5	W2	Downey '80
			OLIGOCENE (23-33 Ma)				
	SUBVOLCANIC INTRUSIONS						
B26.0	PC1	61°22'18"N;139°18'20"W: 115G/6. (Burwash Creek).	biotite quartz latite porphyry; small intrusion.	biotite	26.0 ± 1.0*	W2	Chris. '72
B26.7	PC2	61°22'17"N;139°18'10"W: 115G/6. (Burwash Creek).	biotite quartz latite porphyry; small intrusion.	biotite	26.7 ± 1.2*	W2	Chris. '72
B26.2	PC3	61°22'30"N;139°25'55"W: 115G/6. (Cork property, Burwash Creek).	biotite quartz latite porphyry; small intrusion.	biotite	26.2 ± 1.0*	W2	Chris. '72
B26.0	PC4	61°22'30"N;139°26'08"W: 115G/6. (Cork property, Burwash Creek).	biotite quartz latite porphyry; small intrusion.	biotite	26.0 ± 1.0*	W2	Chris. '72
B28.4	289-CAd-74-1	61°01'49"N;138°46'24"W: 115G/2. (Bullion Creek).	bio. qtz. plag. rhyolite porphyry; dyke near Duke River Fault.	biotite	28.4 ± 1.8	Alex.	K-Ar #2513
H32.2	4-CAc-81-1	59°40.2'N ;136°21.3'W : 114P/9. (Kusawak Range).	crowded hbde. plag. porphyry; sill in Paleogene sediments.	hornblende	32.2 ± 6.8	Alex.	K-Ar #3449
	TKOPE PLUTONIC SUITE						
B27.5	28-CAc-78-1	59°36'28"N;137°02'22"W: 114P/11. (Tkope River batholith).	fine med. grained, homogeneous, hornblende biotite granite.	biotite	27.5 ± 1.4	Alex.	K-Ar #3107
H31.1	30-CAc-78-1	59°30.0'N ;136°53.1'W : 114P/10. (Tkope River batholith).	fine med. grained, homogeneous, biotite hornblende granite.	hornblende	31.1 ± 2.8	Alex.	K-Ar #3070
B24.7	172-1	59°37.0'N ;137°1.8'W : 114P/11. (Tkope River batholith).	med. grained, equigranular, hbde. bio. quartz diorite.	biotite	24.7 ± 0.9	Alex.	Jacobson '80
H26.9	196-1	59°34.4'N ;136°53.1'W : 114P/10. (Tkope River batholith).	med..grained, subophitic, hornblende gabbro.	hornblende	26.9 ± 0.9	Alex.	Jacobson '80
B27.6	99-CAc-78-1	59°40.4'N';136°47'W : 114P/10. (Samuel Glacier pluton).	med. grained, homogeneous, hornblende biotite granite.	biotite	27.6 ± 1.3	Alex.	K-Ar #3068
B24.3	124-CAc-78-1	59°31'59"N;136°38'17"W: 114P/10. (W. of Rainy Hollow).	coarse med. grained, homogeneous, hbde. bio. granite/qtz. monzonite.	biotite	24.3 ± 1.6	Alex.	K-Ar #3093
B28.1				biotite	28.1 ± 1.8		K-Ar #3093(2)
H74.7				hornblende	74.7 ± 3.8		K-Ar #3094
B27.7	16-CAc-79-1	59°35.1'N ;136°28.2'W : 114P/9. (Three Guardsmen batholith).	med. grained, equigranular, hbde. bio. quartz monzonite.	biotite	27.7 ± 2.0	Alex.	K-Ar #3201
	OTHER HIGH-LEVEL PLUTONS						
H27.4	69APr-48A	60°19'N ;140°50'W : 115C/7. (Mt. Newton pluton).	foliated, fine coarse grained, hbde. gabbro/diorite; moraine sample.	hornblende	27.4 ± 22.9	Chug.	K-Ar #3056
B32.0	53-CAc-78-1	59°28.9'N ;138°09.2'W : 1140/8 (Alsek River pluton).	fine coarse grained, leucocratic bio. quartz monzonite/granite.	biotite	32.0 ± 1.9	Chug.	K-Ar #3055
B32.8	49-CAc-78-1	59°24'45"N;138°01'30"W: 1140/8. (Alsek River pluton).	medium grained, homogeneous, biotite quartz monzonite.	biotite	32.8 ± 1.9	Chug.	K-Ar #3087
B21.2	67APr-94C	59°25.5'N ;138°06.5'W : 1140/8. (Alsek River pluton). (Alaska)	med. grained, equigranular, garnet muscovite biotite granite.	biotite	21.2 ± 2.8	Chug.	Lanphere* *
B23.1				biotite	23.1 ± 2.0		Lanphere* *

AGE[1] NUMBER	FIELD NUMBER	LOCATION LATITUDE ; LONGITUDE: NTS. (name or geographic location)	ROCK TYPE	MINERAL DATED	AGE[2] (Ma)	TERRANE[3]	REFERENCE[4]
			EOCENE (41-52 Ma)				
			SEWARD PLUTONIC SUITE				
B50.0	106-CAc-77-1	60°36.25'N;140°51.9'W : 115C/10. (King Peak pluton).	weakly foliated, med. grained bio. tonalite.	biotite	50.0 ± 2.4	Chug.	K-Ar #2895
B45.4 H51.5	72-CAc-74-1	60°25'05"N;140°15'46"W: 115C/8. (nunatak, upper Seward Glacier).	med. grained, equigranular, homogeneous hbde. bio. tonalite.	biotite hornblende	45.4 ± 2.4 51.5 ± 3.0	Chug.	K-Ar #2579 K-Ar #2580
B35.8 H60.5 H63.6 B34.7 H55.1	138-CAc-77-1	60°12.9'N ;140°56.1'W : 115C/2. (Mt. St. Elias pluton). (Alaska)	homogeneous, med. grained, bio. hbde. quartz diorite; moraine sample, Libbey Gl.	biotite hornblende hornblende biotite hornblende	35.8 ± 2.1 60.5 ± 8.2 63.6 ± 8.7 34.7 ± 1.1 55.1 ± 1.8	Chug.	K-Ar #2892 K-Ar #2893 K-Ar #2893(2) Lanphere Lanphere
B38.4 H67.2	31-CAc-78-1	60°12.9'N ;140°56.1'W : 115C/2. (Mt. St. Elias pluton). (Alaska)	med. grained, homo. bio. hbde. quartz diorite; moraine, Libby Gl.	biotite hornblende	38.4 ± 2.2 67.2 ± 10.7	Chug.	K-Ar #3065 K-Ar #3066
H56.1 H54.1	69APr-54A	60°17'N ;140°53'W : 115C/7 (Mt. St. Elias pluton). (Alaska)	foliated, med. grained bio. hbde. quartz diorite; moraine, Libby Gl.	hornblende hornblende	56.1 ± 9.5 54.1 ± 1.7	Chug.	Lanphere** Lanphere**
B52.4	114-CAc-78-1	59°21.6'N ;137°38.2'W : 114P/5. (Konamoxt Glacier pluton).	med. grained, equigranular, porph., hbde. bio. granodiorite	biotite	52.4 ± 1.8	Chug.	K-Ar #3059(2)
B41.0	113-CAc-78-1	59°09'48"N;137°17'47"W: 114P/3. (Jarl Glacier pluton).	medium grained, equigranular, hbde. bio. granite/qtz. monzonite.	biotite	41.0 ± 2.2	Chug.	K-Ar #3088
			LATE EARLY CRETACEOUS (106-117 Ma*)				
	KLUANE RANGES PLUTONIC SUITE						
B112 H115	WN-135-74	61°38.5'N ;140°13.6'W : 115F/9. (Harris Creek batholith).	hornblende biotite granodiorite.	biotite hornblende	112 ± 4 115 ± 5	W2	GSC 81-73 GSC 81-74
B114 H143	MV-74-102	61°38'30"N;140°14'15"W: 115F/9 (Harris Creek batholith).	med. grained hornblende, biotite granodiorite.	biotite hornblende	114 ± 4 143 ± 6	W2	GSC 81-75 GSC 81-76
H115	PC5	61°22'00"N;139°25'09"W: 115G/6. (Wade Creek batholith).	gabbro.	hornblende	115 ± 4.0*	W2	Chris. '72
H117	PC6	61°22'05"N;139°25'09"W: 115G/6. (Wade Creek batholith).	gabbro.	hornblende	117 ± 4.0*	W2	Chris. '72
B108 H109	359-CAd-77-1	61°00.3'N ;138°27.2'W : 115G/1. (Outpost Mountain pluton).	weakly foliated, med. grained, homogeneous bio. hbde. qtz. diorite.	biotite hornblende	108 ± 4 109 ± 8	W2	K-Ar #2963 K-Ar #2964
B106	E74-51-2	60°24'30"N;137°14'W : 115A/6 (Shorty Creek pluton).	biotite granodiorite.	biotite	106 ± 4*	GNB	GSC 76-159
H237	55-CAj-78-7	60°02'35"N;137°03'46"W: 115A/3. (Mt. Beaton batholith).	med. grained, equigranular hbde. granodiorite.	hornblende	237 ± 24	W2	K-Ar #3084
	ULTRAMAFIC COMPLEX: ALASKAN-TYPE						
B113	DS 36	60°43.4'N ;137°48.1'W : 115A/12. (Pyroxenite Creek complex).	biotite pyroxenite.	biotite	113 ± 4	GNB	Sturrock '80
H124	DS 12C	60°43.5'N ;137°47.9'W : 115A/12. (Pyroxenite Creek complex).	hornblende pyroxenite.	hornblende	124 ± 4	GNB	Sturrock '80
			LATE JURASSIC TO EARLIEST CRETACEOUS (130-160 Ma)				
			SAINT ELIAS PLUTONIC SUITE				
H158	102-CAc-77-1	61°02.6'N ;140°43.1'W : 115F/2. (Ham pluton).	med. grained, leucocratic quartz monzonite-granodiorite.	hornblende	158 ± 7	Alex.	K-Ar #2905
H153	101-CAc-77-1	61°04'16"N;140°33'06"W: 115F/2. (Mt. Lucania pluton).	med. grained, porph. (microcline?) hbde. bio. quartz monzonite.	hornblende	153 ± 11	Alex.	K-Ar #2911(3)
B146 H149	118-CAc-77-1	60°58.7'N ;140°19.7'W : 115C/16. (Mt. Lucania pluton).	med. grained, leucocratic hbde. bio. granodiorite.	biotite hornblende	146 ± 4 149 ± 14	Alex.	K-Ar #2930 K-Ar #2931
H139	90-CAc-77-1	61°00.4'N ;140°15.2'W : 115F/1. (Mt. Lucania pluton).	med. grained hbde. bio. diorite.	hornblende	139 ± 12	Alex.	K-Ar #2934
B144 H147	164-CAc-77-1	61°01.5'N ;140°02.9'W : 115F/1. (Mt. Walsh pluton).	med. grained, porph. (orthoclase) bio. hbde. quartz monzonite.	biotite hornblende	144 ± 4 147 ± 10	Alex.	K-Ar #2932 K-Ar #2933
H140	190-CAd-74-1	61°04'45"N;139°18'06"W: 115G/3. (Bighorn Creek pluton).	med. grained, porph. (microcline) hbde. quartz monzodiorite.	hornblende	140 ± 6	Alex.	K-Ar #2594
H159	112-CAc-77-1	60°47.5'N ;140°16.9'W : 115C/16. (Logan Glacier pluton).	medium grained, biotite hornblende granodiorite.	hornblende	159 ± 11	Alex/W1	K-Ar #2973(2)
H159	110-CAc-77-1	60°47'16"N;140°14'03"W: 115C/16. (Logan Glacier pluton).	weakly foliated, medium grained bio. hbde. quartz diorite.	hornblende	159 ± 8	Alex/W1	K-Ar #2889
H154	111-CAc-77-1	60°44.7'N ;140°09.6'W : 115C/9. (Logan Glacier pluton).	med. grained, bio. hbde. diorite.	hornblende	154 ± 12	Alex.	K-Ar #2967(2)
B156 H150	16-CAc-77-1	60°43.1'N ;140°02'W : 115C/9. (Logan Glacier pluton).	very weakly foliated, med. grained bio. hbde. granodiorite.	biotite hornblende	156 ± 6 150 ± 11	Alex.	K-Ar #2890 K-Ar #2891
B151 H189	13-CAc-77-1	60°42.6'N ;139°51.9'W : 115B/12. (E side upper Hubbard Gl.).	coarse med. grained, porphyritic (Kspar.) hbde. bio. granodiorite.	biotite hornblende	151 ± 5 189 ± 10	Alex.	K-Ar #2938 K-Ar #2939
H147	82-CAc-77-1	60°40.8'N ;140°10.1'W : 115C/9. (Hubbard Glacier pluton).	medium grained, biotite hornblende granodiorite.	hornblende	147 ± 8	Alex/W1	K-Ar #2903

AGE[1] NUMBER	FIELD NUMBER	LOCATION LATITUDE ; LONGITUDE: NTS. (name or geographic location)	ROCK TYPE	MINERAL DATED	AGE[2] (Ma)	TERRANE[3]	REFERENCE[4]
H132	33-CAc-77-1	60°34.3'N ;139°53.0'W : 115B/12. (Hubbard Glacier pluton).	weakly foliated, bio. hbde. granodiorite/quartz diorite.	hornblende	132 ± 9	Alex.	K-Ar #2904
H153	45-CAc-77-1	60°38.3'N ;140°15.2'W : 115C/9. (Mt. Logan batholith).	well foliated, coarse med. grained, bio. hbde. quartz diorite.	hornblende	153 ± 7	W1	K-Ar #2896
H150	6-CAc-77-1	60°25.4'N ;139°31.7'W : 115B/5. (NE side, central Hubbard Gl.).	well foliated, medium grained bio. hbde. quartz diorite.	hornblende	150 ± 10	Alex.	K-Ar #2937(2)
B134	37-CAc-74-1	60°52'34"N;139°20'52"W: 115B/14. (Kluane Glacier pluton).	coarse med. grained, leucocratic musc. hbde. bio. granodiorite.	biotite	134 ± 5	Alex.	K-Ar #2588
M123				muscovite	123 ± 4		K-Ar #2589
B133	439-CAd-74-1	60°47'52"N;139°04'38"W: 115B/14. (Shield pluton).	fine coarse grained, hornblende biotite granodiorite.	biotite	133 ± 5	Alex.	K-Ar #2598
H144				hornblende	144 ± 6		K-Ar #2599
B128	438-CAd-74-1	60°42'49"N;138°59'36"W: 115B/10. (Stairway Glacier pluton).	med. grained, slightly porphyritic hbde. bio. granodiorite.	biotite	128 ± 5	Alex.	K-Ar #2600
H146				hornblende	146 ± 6		K-Ar #2601
B128	441-CAd-74-1	60°44'20"N;138°44'36"W: 115B/10. (Mt. Maxwell pluton).	coarse med. grained, very weakly foliated bio. hbde. granodiorite.	biotite	128 ± 5	Alex.	K-Ar #2604
H140				hornblende	140 ± 7		K-Ar #2605
B117	440-CAd-74-1	60°39'43"N;138°46'17"W: 115B/10. (Maxwell Glacier pluton).	well foliated, leucocratic, med. grained bio. granodiorite.	biotite	117 ± 4	Alex.	K-Ar #2595
H159	MV-74-197	60°55'06"N;138°21'05"W: 115B/16. (upper part, Silver Creek).	hornblende gabbro-diorite.	hornblende	159 ± 22*	Alex/W2	K-Ar #2612
B135	73-CAc-74-1	60°37'54"N;138°23'08"W: 115B/9. (Snowshoe batholith).	weakly foliated, fine coarse grained porph. hbde. bio. granodiorite.	biotite	135 ± 5	Alex.	K-Ar #2582
H154				hornblende	154 ± 7		K-Ar #2583
B144	WN-129-74	60°38.8'N ;138°16.1'W : 115B/9. (Snowshoe batholith).	foliated, hornblende biotite granodiorite.	biotite	144 ± 5	Alex.	GSC 81-86
H141				hornblende	141 ± 6		GSC 81-87
H141	436-CAd-74-1	60°22'56"N;138°08'27"W: 115B/8. (? part of Snowshoe batholith).	fine coarse grained, porph., bio. hbde. qtz. monzonite/granodiorite.	hornblende	141 ± 6	Alex.	K-Ar #2606
H146	62-CAc-74-1	60°26'34"N;138°45'40"W: 115B/7. (Disappointment Glacier pluton).	med. grained, porphyritic bio. hbde. quartz monzodiorite.	hornblende	146 ± 6	Alex.	K-Ar #2590
B138	437-CAd-74-1	60°22'07"N;138°26'49"W: 115B/8. (S. edge Dusty Glacier).	medium grained, hornblende biotite granodiorite.	biotite	138 ± 5	Alex.	K-Ar #2596
H142				hornblende	142 ± 6		K-Ar #2597
B130	52-CAc-74-1	60°13'52"N;138°31'36"W: 115B/2. (Lowell Glacier pluton).	medium grained, biotite hornblende granodiorite.	biotite	130 ± 5	Alex.	K-Ar #2586
H145				hornblende	145 ± 6		K-Ar #2587
H148	435-CAd-74-2	60°21'20"N;137°45'35"W: 115A/5. (Shaft Creek pluton).	coarse grained, porphyritic hornblende quartz monzonite.	hornblende	148 ± 6	Alex.	K-Ar #2512
B135	435-CAd-74-1	60°21'20"N;137°45'35"W: 115A/5. (Shaft Creek pluton).	coarse med. grained clinopyroxene biotite hornblende diorite.	biotite	135 ± 5	Alex.	K-Ar #2602
H142				hornblende	142 ± 6		K-Ar #2603
B144	45-CAc-74-1	60°06'33"N;137°56'55"W: 115A/4. (Alsek pluton).	med. grained, equigranular, biotite hornblende granodiorite.	biotite	144 ± 5	Alex.	K-Ar #2584
H131				hornblende	131 ± 7		K-Ar #2585
B142	57-CAc-74-1	59°59'13"N;137°56'37"W: 114P/13. (Easy pluton).	med. grained, equigranular, hbde. bio. granodiorite.	biotite	142 ± 5	Alex.	K-Ar #2591
H195				hornblende	195 ± 8		K-Ar #2592
B149	115-CAc-78-1	59°43.4'N ;138°13.1'W : 114O/9. (Noisy Range batholith).	coarse med. grained, foliated biotite hornblende quartz diorite.	biotite	149 ± 5	Alex.	K-Ar #3075
H147				hornblende	147 ± 14		K-Ar #3076
B136	80-CAc-78-1	59°32 7'N ;137°31.1'W : 114P/12. (Noisy Range batholith).	fine coarse grained, weakly foliated bio. hbde. qtz. diorite.	biotite	136 ± 5	Alex.	K-Ar #3063(2)
H141				hornblende	141 ± 8		K-Ar #3064
H148	67-APr-94D	59°36.2'N ;138°04.8'W : 114O/9. (Battle Glacier batholith).	hornblende tonalite.	hornblende	148 ± 4*	WI?	Hudson '77
H172	76-CAc-78-1	59°36'04" ;138°04'42"W: 114O/9. (Battle Glacier batholith).	fine coarse grained, biotite, hornblende quartz diorite.	hornblende	172 ± 23	W1?	K-Ar #3086
M148	34-CAc-78-1	59°31'18"N;137°48'51"W: 114P/12. (Battle Glacier batholith).	weakly foliated, leucocratic, garnet bio. musc. granodiorite.	muscovite	148 ± 5	W1?	K-Ar #3090
H156	77-CAc-78-1	59°40.7'N ;137°19.5'W : 114P/11. (Not Yet pluton).	med. grained, equigranular, hornblende quartz diorite.	hornblende	156 ± 19	Alex.	K-Ar #3060
H168	15-CAc-79-1	59°27.0'N ;137°03.1'W : 114P/6. (Tomahnous Glacier pluton).	weakly foliated, equigranular, med. grained, bio. hbde granodiorite.	hornblende	168 ± 15	Alex.	K-Ar #3202
H136	111-CAc-78-1	59°17'33"N;137°08'56"W: 114P/6. (Tikke Glacier batholith).	weakly foliated, coarse med. grained bio. hbde. quartz diorite.	hornblende	136 ± 10	Alex.	K-Ar #3095
H130	12-CAc-78-1	59°05.3'N ;137°01.8'W : 114P/3. (Tikke Glacier batholith).	well foliated, med. grained bio. hbde. qtz. diorite/granodiorite	hornblende	130 ± 11	Alex.	K-Ar #3092
H117	109-CAc-78-1	59°10.5'N ;136°43.9'W : 114P/2. (E side, upper Carroll Glacier).	med. grained, equigranular, bio. hbde. quartz diorite.	hornblende	117 ± 11	Alex.	K-Ar #3067
			LATEST PENNSYLVANIAN TO EARLY PERMIAN (270-290 Ma)				
			ICEFIELD RANGES PLUTONIC SUITE				
B273	15-CAc-74-1	61°14'53"N;140°02'59"W: 115F/1. (Steele Glacier pluton).	med. grained, porphyritic (fspar) hbde. bio. granodiorite.	biotite	273 ± 9	Alex.	K-Ar #2557
H274				hornblende	274 ± 11		K-Ar #2558
B181	7-CAc-74-1	61°08'05"N;139°34'13"W: 115G/4. (Donjek Glacier batholith).	heterogeneous, med. grained hbde. bio. quartz monzodiorite.	biotite	181 ± 6	Alex.	K-Ar #2514
H272				hornblende	272 ± 11		K-Ar #2515
H281	71-CAc-74-1	60°44'29"N;139°44'57"W: 115B/12. (Divide batholith).	fine med. grained bio. hbde. monzodiorite.	hornblende	281 ± 12	Alex.	K-Ar #2593

AGE[1] NUMBER	FIELD NUMBER	LOCATION LATITUDE ; LONGITUDE: NTS. (name or geographic location)	ROCK TYPE	MINERAL DATED	AGE[2] (Ma)	TERRANE[3]	REFERENCE[4]
H276	66-CAc-74-1	60°30'46"N;139°21'17"W: 115B/11. (Kaskawulsh Gl. batholith).	foliated, coarse med. grained porphyritic bio. hbde. monzonite.	hornblende	276 ± 11	Alex.	K-Ar #2511
H297	54-CAc-74-1	60°19'53"N;139°15'14"W: 115B/6.	med. grained, equigranular, bio.	hornblende	297 ± 20	Alex.	K-Ar #2581
H288		(Mt. Hubbard pluton). (Alaska)	hbde. quartz monzodiorite.	hornblende	288 ± 20		K-Ar #2581(2)
H284	69APr-31C2	60°20.1'N ;139°12.6'W : 115B/6. (Mt. Hubbard pluton). (Alaska)	diorite/quartz diorite.	hornblende	284 ± 7*	Alex.	Hudson '77
H279	69APr-31B	60°17.2'N ;139°11.9'W : 115B/6. (Mt. Hubbard pluton). (Alaska)	sheared, somewhat altered hornblende quartz diorite.	hornblende	279 ± 8*	Alex.	Hudson '77
B270	155-CAc-77-1	60°03'N ;138°45.6'W : 115B/2.	med. grained, equigranular,	biotite	270 ± 9	Alex.	K-Ar #2935
H290		(Fisher pluton).	hbde. bio. quartz monzonite.	hornblende	290 ± 15		K-Ar #2936
			MISCELLANEOUS DATA				
			NEOGENE VOLCANICS				
	WRANGELL LAVA						
W13.1	WN-128-74	60°40'N ;138°05.5'W : 115B/9.	massive basalt from basal flows	whole-rock	13.1 ± 2.0	Alex.	GSC 81-84
W10.8		(Chalcedony Mt. area).	of Alsek Province.	whole-rock	10.8 ± 1.9		GSC 81-84
W13.5	WN-130-74	60°35.3'N ;138°12.4'W : 115B/9. (N side Felsite Creek).	volcanic glass from neck within flows of Alsek Province.	whole-rock	13.5 ± 1.2	Alex.	GSC 81-85
			PALEOGENE SEDIMENTS				
	AMPHITHEATRE FORMATION						
B50.6	E74-5-1	61°28'N ;139°50'W : 115G/5. (E side Wolverine Plateau).	lithic sandstone.	biotite	50.6 ± 3.6	W2	GSC 76-158
			METAMORPHIC ROCKS				
	(?)METAMORPHOSED VALDEZ GROUP						
B48.7	51-CAc-77-1	60°28.7'N ;140°31.0'W : 115C/7. (N side upper Seward Glacier).	well foliated, med. grained, biotite granitoid gneiss.	biotite	48.7 ± 2.7	Chug.	K-Ar #2929
	(?)METAMORPHOSED SKOLAI GROUP OR NIKOLAI GREENSTONE						
B108	WN-136-74	61°47.9'N ;140°25.2'W : 115F/16. (Upper Moose Creek).	biotite amphibolite.	biotite	108 ± 5	W2	GSC 81-72
	(?)METAMORPHOSED LATE TRIASSIC VOLCANICS						
W128	105-CAc-78-1	59°19.9'N ;136°30.1'W : 114P/7. (N side lower Tsirku Glacier).	fine grained, pillow meta-basalt	whole-rock	128 ± 7	Alex.	K-Ar #3071
			(?)MID PALEOZOIC GABBRO COMPLEX				
H364	126-CAc-77-1	61°25.4'N ;140°33.1'W : 115F/7. (Mt. Constantine complex).	med. grained, weakly foliated, clinopyroxene hornblende gabbro.	hornblende	364 ± 37	W2	K-Ar #2962(2)
			NORTHERN PART COAST PLUTONIC COMPLEX				
B55.5	82-CAc-74-1	60°11'30"N;136°35'19"W: 115A/2.	med. grained, porph. (orthoclase),	biotite	55.5 ± 2.4	?	K-Ar #2577
H58.3		(W side upper Kluhini River).	hbde. bio. granodiorite.	hornblende	58.3 ± 2.8		K-Ar #2578
B64.6	81-CAc-74-1	60°02'37"N;136°51'02"W: 115A/2.	weakly foliated, coarse grained,	biotite	64.6 ± 2.5	?	K-Ar #2516
H72.4		(SSE of Takhanne R. bridge).	bio. hbde. granodiorite.	hornblende	72.4 ± 3.3		K-Ar #2517
B67.9	90-CAc-78-1	59°51.1'N ;136°21.9'W : 114P/16.	weakly foliated, coarse grained,	biotite	67.9 ± 2.7	?	K-Ar #3061
H57.9		(E of Reilly Mountain).	porph. (hbde.) bio. hbde. grano-diorite/qtz. diorite.	hornblende	57.9 ± 3.7		K-Ar #3062

In Table 1, K-Ar age data for intrusive rocks (mostly plutonic) are grouped according to age range. Four of the six age groupings comprise plutonic suites and one of these is subranked by intrusive type; the remaining two are subranked by intrusive type and plutonic suite. Most batholiths, plutons, complexes and plutonic suites are informally named. Individual age data within these various groupings are listed by the following NTS sequence: 115F(E1/2), 115G(W1/2), 115G(E1/2), 115C(E1/2), 115B(W1/2), 115B(E1/2), 115A(W1/2), 114O(E1/2), 114P(W1/2), 114P(E1/2). Where possible within this sequence, data are ordered approximately north to south. A more accurate NTS location is given with each sample. The few determinations from a gabbro complex, volcanic, sedimentary and metamorphic rocks, and Coast Plutonic Complex are listed at the foot of the table.

[1]This number corresponds to age (in Ma) and is prefixed by a letter indicating the material dated (B = biotite, H = hornblende, W = whole rock, etc.). This number is used to identify the location of age determinations in Figure 1. Age pairs and rerun data are grouped for individual samples. The occurrence of identical single or sets of age numbers per sample are rare.

[2]K-Ar isotopic ages were calculated with the decay constants recommended by Steiger and Jager (1977) except those with an asterisk (*). For analytical procedures used in the determination of the new K-Ar age dates the reader is referred to Stevens et al. (1982).

[3]Suspect terrane occurrence of individual data is abbreviated as follows:
Chug. = Chugach terrane; W1, W2, W3 = Wrangellia; Alex. = Alexander terrane; GNB = Gravina-Nutzotin belt on Wrangellia W3.

[4]The sources are as follows:
For GSC 76-158, 159: see Wanless et al. (1978) p. 32.
For GSC 81-72 to 81-87: see Stevens et al. (1982) p. 24-26.
For K-Ar #(Run No.): see appendix this report.
For Chris. '72: see Christopher et al. (1972).
For Downey '80: see Downey et al. (1980).
For Jacobson '80: see Jacobson et al. (1980).
For Sturrock '80: see Sturrock et al. (1980).
For Hudson '77: see Hudson et al. (1977).
For Lanphere: see M.A. Lanphere, personal communication.
For Lanphere*: see rerun samples in Hudson et al. (1977).

Only about fourteen of the dates are significantly outside these age ranges. The question of whether or not the K-Ar dates reflect the true ages of intrusion emplacement is addressed in the following section.

INTERPRETATION OF K-Ar DATA AND SUGGESTED PLUTONIC EPISODES AND SUITES

Early in the field work it became clear that granitoid and subvolcanic intrusions within the Saint Elias Mountains could be divided into several suites based on fairly distinctive lithologies, local stratigraphical and structural constraints, tectonic setting, and limited chemical and K-Ar data. Further field, petrographical, chemical, and geochronological (mostly K-Ar dating) studies in the area in large part confirmed these findings.

K-Ar dates from intrusive rocks of the Saint Elias Mountains imply at least six major plutonic episodes in the region. Most intrusions of these periods are separable into plutonic suites. Episodes of plutonism and plutonic suites believed to be represented in the study area include: 270-290 Ma (Icefield Ranges suite), 130-160 Ma (Saint Elias suite), 106-117 Ma* (Kluane Ranges suite), 41-52 Ma (Seward suite), 23-33 Ma (incorporates Tkope suite), and 6-16 Ma (Wrangell suite).

The majority of the K-Ar dates from each suite are similar and significantly different from the other suites. Different intrusions from the same suite give similar and consistent ages. Where intrusions of the same plutonic suite were multiply sampled for K-Ar age determination, most yield corroborating dates. Independent K-Ar dating by different laboratories of some intrusions from most suites represented in the region are in reasonably close agreement. The few dates obtained using other isotopic systems are very similar to those made by the K-Ar method.

The problem remains, however, as to whether or not the K-Ar dates from plutonic and subvolcanic intrusions within the Saint Elias Mountains document real emplacement ages. Rapidly cooled, simple-phase, high-level bodies which have intruded relatively cool country rocks, and which have not been subjected to possible resetting by later metamorphism or pervasive deformation, might be expected to give K-Ar dates that reflect the age of emplacement. Concordant paired K-Ar mineral dates suggest rapid cooling, and thus may represent the time of emplacement of high-level plutons.

The Wrangell plutonic suite which mostly comprises subvolcanic intrusions but includes at least two epizonal plutons, was emplaced in both unmetamorphosed Tertiary rocks and in much older regionally metamorphosed (mainly sub- or low-greenschist grade) Paleozoic and Mesozoic rocks. The Tkope plutonic suite consisting of discordant, composite, epizonal plutons, intruded and contact metamorphosed predominantly lowermost greenschist grade, mainly Paleozoic, sedimentary and volcanic strata. Unnamed Oligocene subvolcanic intrusions of uncertain affinity to the latter suite crosscut and some hornfelsed a variety of low-grade regionally metamorphosed and relatively unmetamorphosed Paleozoic, Mesozoic and Paleogene sedimentary and volcanic rocks. The Seward plutonic suite together with a few Oligocene intrusions (all occurring mostly within Chugach Terrane), collectively comprise single or multiphase, epizonal plutons which were emplaced in late Mesozoic sedimentary and volcanic sequences, believed to have been variably regionally metamorphosed during latest Mesozoic to earliest Eocene time.

Late Early Cretaceous intrusions include the Kluane Ranges plutonic suite and an Alaskan-type ultramafic complex. The former suite comprises both high-level plutons and composite batholiths (some could be mesozonal) most of which discordantly intruded and thermally metamorphosed low- to very low-grade regionally metamorphosed latest Paleozoic to mid-Mesozoic strata. The ultramafic complex crosscuts subgreenschist-grade Jura-Cretaceous flysch, producing hornfels along the contacts. Plutons of the Saint Elias suite are believed to be crudely divisible into eastern and western groups. Most of the generally smaller, compositionally less complex, eastern plutons are epizonal and were discordantly emplaced into lowermost greenschist-grade Paleozoic and earliest Mesozoic strata, causing contact metamorphism. Sparse field evidence indicates that the mostly larger, compositionally more complex western bodies are deeper-level and intruded generally more highly metamorphosed (locally to at least mid-amphibolite facies) rocks of similar age. The Icefield Ranges plutonic suite consist mostly of large compositionally diverse, probably fairly high-level batholiths which appear to have complex intrusive histories. They generally occur in greenschist- to locally mid-amphibolite-grade Paleozoic rocks. Unfortunately, the intrusive and metamorphic relationships involving most western members of the Saint Elias

and the Icefield Ranges suites are poorly understood due to the rugged terrain and extensive ice-cover.

On the balance, therefore, it seems reasonable to treat K-Ar dates (particularly concordant pairs) as indicating ages of emplacement for intrusions of the following groups: most members of the Wrangell, Tkope (including other Oligocene intrusions of uncertain kinship), and Seward suites; only the discordant, epizonal plutons of the Kluane Ranges suite (including the Alaskan-type ultramafic complex) and of the eastern members of the Saint Elias suite; and a few proven high-level plutons of the Icefield Ranges suite. Due to the possibly somewhat deeper-levels of emplacement and to the probably more complex intrusive and host-rock metamorphic histories of many western members of the Saint Elias and Icefield Ranges plutonic suites, K-Ar dates from these intrusions are less apt to represent emplacement ages.

In general, no compelling evidence for widespread resetting of dates due to mass uplift or postemplacment metamorphism was found. K-Ar dates more likely to be affected by such factors are, however, those from the older, more complex intrusions occurring in the western parts of the Saint Elias Mountains.

The relatively few K-Ar dates, which lie significantly outside the age ranges designated for the major episodes of plutonism, are thought to result from either excess argon or to later resetting by nearby intrusions or by local uplift (see below and in the appendix). But if any of these dates represent emplacement ages, other periods of plutonism may indeed be present in the area.

Finally, however, each K-Ar date in this study has been considered individually, and many cannot be interpreted unequivocally.

In summary, most of the K-Ar age data from intrusive (mainly granitoid) rocks together with restricted field, lithological and chemical data, collectively suggest that at least six major plutonic episodes are represented in the Saint Elias Mountains of Canada and closely adjacent parts of Alaska. These occurred during latest Pennsylvanian to Early Permian (Icefield Ranges plutonic suite), Late Jurassic to earliest Cretaceous (Saint Elias plutonic suite), late Early Cretaceous (Kluane Ranges plutonic suite), Eocene (Seward plutonic suite), Oligocene (includes Tkope plutonic suite), and mid- to Late Miocene (Wrangell plutonic suite) time. The few dates which fall outside these age ranges may reflect such factors as excess argon, or resetting due to later intrusion or local uplift. Some, however, may well indicate other, unrecognized periods of plutonism in the region. The proof of this obviously awaits future investigation.

LATEST PENNSYLVANIAN TO EARLY PERMIAN PLUTONIC EPISODE

This episode is represented by the Icefield Ranges plutonic suite, members of which occur mainly in the western, higher parts of the mountains in Canada. Most form small elongate to subcircular, fairly high-level batholithic complexes or plutons emplaced entirely in Alexander Terrane. The larger of these include Donjek Glacier, Divide, and Kaskawulsh Glacier batholiths and Mt. Hubbard pluton. Limited study indicates that they are predominantly agmatite and multiphase complexes, ranging from syenite to diorite. Darker quartz diorite-diorite phases are commonly veined and intruded by leucocratic syenite-granodiorite. Sparse major-element chemistry indicates that the suite is alkaline to calc-alkaline. Two smaller bodies (Steele Glacier and Fisher plutons), however, are uniformly quartz monzonite to granodiorite and lithologically are more typical of the Saint Elias plutonic suite.

Except for one of two hornblende ages of 297 ± 20 Ma (K-Ar no. 2581) from Mt. Hubbard pluton and the biotite age of 181 ± 6 Ma (K-Ar no. 2514) of a discordant biotite-hornblende pair from Donjek Glacier batholith, all remaining new K-Ar data (6 hornblende and 2 biotite-hornblende pairs) indicate a range of 270-290 Ma for the suite. A rerun of the determination from Mt. Hubbard pluton yielded an age of 288 ± 20 Ma (K-Ar no. 2581(2)). This date is similar to two previously reported K-Ar, hornblende ages from that pluton of 284 ± 7 Ma* and 279 ± 8 Ma* (Hudson et al., 1977), and all three are within the range assigned to this plutonic suite. Further, because these dates were determined on three separate samples from the Mt. Hubbard pluton, different parts of this pluton prove to be reasonably consistent in age. Field and petrographical evidence suggest that the Donjek Glacier batholith is fairly typical of this plutonic suite, but it may have been intruded by younger phase(s) or pluton(s). The biotite date of a discordant biotite-horblende pair (biotite, 181 ± 6 Ma and hornblende 272 ± 11 Ma; K-Ar no. 2514 and K-Ar no. 2515) from this batholith may reflect resetting by younger intrusions. Other bodies grouped with this plutonic suite on the basis of field, lithological, and

chemical criteria as well as the age data include Divide, Cathedral Glacier (incorporates Mt. Hubbard pluton) batholiths, and Art Lewis Glacier pluton (largely in Alaska). They, however, may contain younger intrusions. Hudson et al. (1977) reported K-Ar ages on hornblende of 136 ± 4 Ma* and 225 ± 6 Ma* from the Art Lewis Glacier pluton, but believed that it may be the same age as Mt. Hubbard pluton on the grounds of similarities of lithologies and geological setting. Perhaps these represent disturbed dates, possibly the result of resetting by such younger plutons.

Few ages within or close to the 270-290 Ma range have been recorded from plutons in adjacent Alaska. They include K-Ar dates on hornblende of 295 ± 8 and 297 ± 9 Ma (MacKevett, 1978) and fairly concordant K-Ar hornblende and biotite, and zircon dates, respectively, of 272-295 Ma, and 308 ± 8 Ma from Barnard Glacier and Ram Glacier plutons (MacKevett et al., 1986) in adjoining southeast McCarthy quadrangle; K-Ar dates on biotite of 282 ± 7.7 and 285 ± 7.7 Ma* from Ahtell pluton in eastern Alaska Range (Richter et al., 1975); and three dates from southeastern Alaska (in Wilson et al., 1979). These plutons are all lithologically similar, and where known, are chemically similar as well to those of the Icefield Ranges suite.

In southern Alaska plutons of this age group occur within (Ahtell pluton) or close by an extensive belt of volcanic and related rocks of identical age belonging to the Skolai Group (part of Wrangellia, W1 and W2). Volcanics coeval with this plutonic suite are unrecognized in the Alexander Terrane within Saint Elias Mountains.

LATE JURASSIC TO EARLIEST CRETACEOUS PLUTONIC EPISODE

This episode is represented by the Saint Elias plutonic suite, members of which are the most abundant and widespread within the Saint Elias Mountains of Canada. They occur in Icefield, Donjek and Alsek ranges, within an area covering more than seventy per cent of the region studied. Plutons are emplaced throughout the Alexander Terrane and also in the narrow segment of Wrangellia (W1) between Hubbard and Border ranges faults. They vary from large elongate batholithic complexes to smaller single or multiphase plutons. Compositions mainly range from granodiorite to quartz diorite, with relatively minor quartz monzonite and diorite. Major element chemistry reveals that the suite is decidedly calc-alkaline. Levels of emplacement are probably mesozonal to epizonal. Generally, members of this suite decrease in size, abundance and possibly depth of emplacement from west to east, with a crudely similar decrease in regional metamorphic grade of the host rocks. The larger elongate western batholithic complexes (Mt. Logan, Noisy Range, Battle Glacier and Tikke Glacier batholiths) appear more basic (quartz diorite-diorite) and conform more to regional structural trends. The smaller more circular and widely-spaced eastern plutons are generally less basic (granodiorite), more discordant and display distinct thermal aureoles; some have marginal phases of coarse hornblendite.

Fifty-eight K-Ar age determinations are available from this plutonic suite of which fifty-five are reported here for the first time (21 hornblende, 1 biotite, 1 muscovite, and 1 muscovite-biotite and 15 biotite-hornblende pairs). The remaining three (1 hornblende and 1 biotite-hornblende pair) are from Hudson et al. (1977) and Stevens et al. (1982). Most of the age data falls between 130-160 Ma, spanning Late Jurassic-earliest Cretaceous time. Only two plutons give late Early Cretaceous ages, Maxwell Glacier pluton (biotite 117 ± 4 Ma, K-Ar no. 2595) and another at the head of Carroll Glacier (hornblende 117 ± 11 Ma, K-Ar no. 3067); most of the latter body is within southeastern Alaska. Two yielded mid-Jurassic ages, Tomahnous Glacier pluton (hornblende 168 ± 15 Ma, K-Ar no. 3202) and Battle Glacier batholith (hornblende 172 ± 23 Ma, K-Ar no. 3086). Only two of the seventeen paired dates are highly discordant, one is from the upper reaches of Hubbard Glacier (biotite 151 ± 5 Ma and hornblende 189 ± 10 Ma; K-Ar no. 2938 and 2939) and another from Easy pluton (biotite 142 ± 5 and hornblende 195 ± 8 Ma; K-Ar no. 2591 and 2592).

Maxwell Glacier pluton is lithologically distinctly different to smaller plutons of the Saint Elias suite. Where sampled it is strongly foliated as a result of cataclastic deformation of unknown age. Consequently, this biotite age may reflect either the true age of the pluton or merely resetting by deformation. Little is known about the large unnamed batholith sampled at the head of the Carroll Glacier or the significance of the biotite date from it. Tentatively, however, those two granitic bodies are included with this plutonic suite. The hornblende dates from Tomahnous Glacier and Easy plutons, and the body in the upper reaches of the Hubbard Glacier are older than anticipated. Although an older plutonism suggested by these dates should not be totally overlooked, all could be

due to excess argon. Those plutons, however, are lithologically characteristic of many of the intrusions grouped with the Saint Elias plutonic suite, and for this reason they are included with that suite. Two additional independent samples from the Battle Glacier batholith gave latest Jurassic ages of hornblende 148 ± 4 Ma* (Hudson et al., 1977) and muscovite 148 ± 5 Ma (K-Ar no. 3090). The sample yielding the former date (hornblende) and that giving the mid-Jurassic hornblende date (K-Ar no. 3086) for this batholith, were collected from closely adjacent sites. The reason for the disparity between these ages is uncertain. Based on the two latest-Jurassic dates, however, the Battle Glacier batholith is tentatively grouped with 130-160 Ma suite.

Multiple samples from members of this suite (except Battle Glacier batholith) yield consistent ages within the 130-160 Ma range, such as: Chitina Glacier batholith (includes Ham and Mt. Lucania plutons) (139-158 Ma, from 3 hornblende and 1 biotite-hornblende pair); Logan Glacier pluton (150- 159 Ma, from 3 hornblende and 1 biotite-hornblende pair); Hubbard Glacier pluton (132-147 Ma, from 2 hornblende); Snowshoe batholith (135-154 Ma, from 1 hornblende and 2 biotite-hornblende pairs); Shaft Creek pluton (135-148 Ma, from 1 hornblende and 2 biotite-hornblende pairs); Noisy Range batholith (136-149 Ma, from 2 biotite-hornblende pairs); and Tikke Glacier batholith (130-136 Ma, from 2 hornblende). In the Yukon part of Saint Elias Mountains, a vague west to east "younging" was observed for members of this suite; the larger western bodies generally give Late Jurassic and the smaller eastern ones earliest Cretaceous ages. However, this trend is not apparent to the southeast in British Columbia.

Plutons similar in age and composition were reported in Alaska from southern McCarthy, northeastern Bering Glacier, and eastern Valdez quadrangles (MacKevett, 1978; Hudson, 1983). Late Jurassic dates were recorded from two plutons within Chugach Terrane in the Alaska part of Yakutat map area (Hudson et al., 1977). However, new data (biotite 32.0 ± 1.9 and biotite 32.8 ± 1.9 Ma; K-Ar no. 3055 and 3087) and reruns on original material (biotite 21.2 ± 2.8 and biotite 23.1 ± 2.0 Ma) by M.A. Lanphere (personal communication) indicate that the Alsek River pluton is much younger. Surprisingly, few plutons currently dated in southeastern Alaska (Wilson et al., 1979; Brew and Morrell, 1983) give ages within the 130-160 Ma range; those that do are from large, fairly basic batholithic complexes on north-central Baranof and on Chichagof islands. The mainly Late Jurassic plutonism in Alaska forms the Tonsina-Chichagof belt of Hudson (1983).

Batholithic complexes and plutons of the 130-160 Ma range in Saint Elias Mountains and adjoining Alaska occur predominantly northeast of Border Ranges Fault. In southern Alaska and immediately adjacent Yukon they intrude rocks of Wrangellia (W1) but throughout Saint Elias Mountains and southeastern Alaska most intrude Alexander Terrane and only very locally Wrangellia (W1, adjacent to Border Ranges Fault). No volcanic rocks considered cogenetic with this plutonic suite have been recognized in the Saint Elias Mountains, but thick sequences of probably coeval andesitic to basaltic flows and volcaniclastics (Douglas Island and Brothers volcanics) occur within the north-central part of the Gravina-Nutzotin belt in southeastern Alaska (Lathram et al., 1965; Brew and Ford, 1985). However, no direct relationship between this volcanism and the Late Jurassic-earliest Cretaceous plutonism is known. New K-Ar data (this report) indicate that the Saint Elias suite in Canada is broadly contemporaneous with plutonism in the Tonsina-Chichagof belt. Field, petrographic and age data suggest a twofold subdivision of this suite, comprising a western belt of Late Jurassic age, and an eastern belt of earliest Cretaceous age. The plutons in the western belt are more basic and form larger batholithic complexes. The narrow western belt appears to extend along the Border Ranges Fault from southeast McCarthy quadrangle (61°N) to eastern Chichagof Island (57.3°N), where it is truncated by Chatham Strait Fault. The eastern belt, best exemplified in Saint Elias Mountains, is less well defined in adjoining southeastern Alaska where somewhat younger Early Cretaceous ages were recorded (Brew and Morrell, 1983). A major Late Jurassic-Early Cretaceous structural disturbance associated with granitic intrusion (coextensive with Mt. Logan batholith) was documented in McCarthy quadrangle (MacKevett, 1978). The cause of this widespread and abundant calc-alkaline plutonism is uncertain.

LATE EARLY CRETACEOUS PLUTONIC EPISODE

This episode is mainly represented by the Kluane Ranges plutonic suite, but also includes an Alaskan-type ultramafic complex. The plutons are restricted

to the northeast perimeter of Saint Elias Mountains, and emplaced northeast of Duke River Fault in Wrangellia (W2) and its flyschoid Gravina-Nutzotin belt cover (of Berg et al., 1972). The Kluane Ranges suite comprises mesozonal(?) to epizonal elongate batholithic complexes and plutons of granodiorite, quartz diorite, diorite and rarer quartz monzonite compositions. Sparse major-element chemistry suggests that the suite is calc-alkaline. The Alaskan-type ultramafic body (Pyroxenite Creek complex), the only one of its kind reported from Saint Elias Mountains, is emplaced in Gravina-Nutzotin belt rocks and has been studied in detail by Sturrock et al. (1980).

Ten K-Ar age determinations (3 hornblende, 1 biotite, and 3 hornblende-biotite pairs) are available from the Kluane Ranges plutonic suite. Three are new dates, the remainder are from Christopher et al. (1972), Wanless et al. (1978), and Stevens et al. (1982). Two K-Ar dates (biotite, 113 ± 4 and hornblende 124 ± 4 Ma) and a Rb-Sr date (biotite, 116 ± 4 Ma) were reported from the ultramafic complex (Sturrock et al., 1980). Most of the age data indicate a 106-117 Ma* range for this suite. Only two dates are well outside this range, hornblende 143 ± 6 Ma from a discordant biotite-hornblende pair (Stevens et al., 1982) and hornblende 237 ± 24 Ma (K-Ar no. 3084), suggesting the possibility of an older plutonic event. The former date is from the Harris Creek batholith and its biotite age was 114 ± 4 Ma. The latter date is from the Mt. Beaton batholith and is much older than expected. Both could be the result of excess argon, but the possibility of older plutonism in this belt should not be excluded. However, based on litholgical similarities of these two batholiths to other bodies within this belt, they have tentatively been grouped with this plutonic suite.

Plutons similar in age and composition to the Kluane Ranges suite were described from the eastern Alaska Range, Nabesna quadrangle (Richter et al., 1975) and from southeastern Alaska (in Brew and Morrell, 1983), where they form the Nutzotin-Chichagof (105-120 Ma) and Muir-Chichagof (100-115 Ma) plutonic belts, respectively, of Hudson (1983) and Brew and Morrell (1983). The Pyroxenite Creek complex is the northernmost in a belt of concentrically zoned mafic-ultramafic complexes which extends the length of southeastern Alaska, and is part of the Klukwan-Duke belt of Brew and Morrell (1983) who reported slightly younger (100-110 Ma) ages for similar rocks to the southeast.

In Saint Elias Mountains and adjacent Nabesna quadrangle, late Early Cretaceous granitic plutons occur entirely in Wrangellia (W2) and its Gravina-Nutzotin belt cover (except for K-Ar no. 2595, 3067). Enigmatically, however, those in southeastern Alaska are found largely in Alexander Terrane. The Klukwan-Duke belt is within or close by the Gravina-Nutzotin belt. Volcanic rocks coeval with the Kluane Ranges plutonic suite and Pyroxenite Creek complex are unknown in Saint Elias Mountains. However, Early Cretaceous volcanics considered cogenetic with similar plutons and complexes of this age occur in Nabesna quadrangle (Richter and Jones, 1973) and in southeastern Alaska (Irvine, 1973). The Klukwan-Duke and Muir-Chichagof belts are believed closely related; the mafic-ultramafic complexes are possibly the "specific roots" of volcanism in the Gravina-Nutzotin belt and the granitoid rocks possibly the "general base" of the magmatic arc (Berg et al., 1972; Irvine, 1973; Brew and Morrell, 1983).

EOCENE PLUTONIC EPISODE

This episode, represented by the Seward plutonic suite, occurs along the westernmost side of Saint Elias Mountains in Canada and closely adjoining southern Alaska. Most of the plutons of this suite are emplaced southwest of the Border Ranges Fault in Chugach Terrane. One body (King Peak pluton) apparently cuts the trace of Border Ranges Fault, which may limit the time of the latest movement on this part of the fault. The suite comprises epizonal plutons of variable size and shape, composed of tonalite, quartz diorite, granodiorite, and quartz monzonite. Major element chemistry shows the suite to be calc-alkaline.

Fourteen new K-Ar determinations on five plutons of this suite are presented in this report (3 biotite, 3 biotite-hornblende pairs, and 5 biotite-hornblende reruns). Four of the plutons yielded ages in the 41 to 52 Ma range. However, the nine new biotite and hornblende dates on three separate samples from Mt. St. Elias pluton, run as a check on the initial highly discordant pair (biotite, 87.2 ± 3 and hornblende 188 ± 6 Ma*) of Hudson et al. (1977), ranged from 35 to 67 Ma, and are also highly discordant. For a more complete interpretation of these latter dates, see K-Ar no. 3066 in the appendix. The age of the Mt. St. Elias pluton remains uncertain, but most of the K-Ar age data suggest a 41 to 52 Ma range for the suite.

Plutons of the Seward suite are correlative with those of the Sanak-Baranof plutonic belt of Hudson (1983) in Alaska, particularly the eastern part of this belt where an almost identical (43-52 Ma) age range was recorded. Plutons there (including the Seward suite) are emplaced in variably regionally metamorphosed rocks of Chugach Terrane, mostly between the Border Ranges Fault (to the northeast) and the Contact, St. Elias, Boundary and Fairweather faults (to the southeast). East of Baranof Island this belt of plutons is apparently truncated by the Chatham Strait Fault. No coeval volcanism has been reported. Plutons of the Sanak-Baranof belt are believed anatectic in origin and to be temporally and genetically related to a postaccretion, high-temperature, low-pressure metamorphic belt in Chugach Terrane, which developed along the leading edge of the continental margin during the Late Paleocene-Early Eocene (Hudson et al., 1979; Hudson and Plafker, 1982).

OLIGOCENE PLUTONIC EPISODE

This episode is represented by the Tkope plutonic suite and other unnamed groups of subvolcanic and epizonal intrusions. They are fairly widely distributed in Saint Elias Mountains and emplaced in most terranes represented there. The Tkope suite comprises elongate, composite, epizonal batholithic complexes and plutons composed of granite-quartz monzonite, lesser gabbro, granodiorite, and rarer quartz diorite and granophyre. Major-element chemistry indicates the suite to be predominantly calc-alkaline. They are recognized only in the southeasternmost corner of Saint Elias Mountains, and occur entirely in Alexander Terrane. One of these (Tkope River batholith) has been studied in detail (Jacobson et al., 1980). The unnamed subvolcanics comprise dykes, sills and plugs mainly of rhyolite and rhyodacite. They occur throughout Kluane Ranges in Wrangellia (W2 and W3) and locally in Alexander Terrane and may be more widespread than has been recognized. Two epizonal plutons of gabbro-diorite and granite-quartz monzonite in Chugach Terrane are included in this age group. Relationships of the unnamed subvolcanics and the epizonal plutons in the Chugach Terrane to the Tkope suite are not known.

Nine K-Ar determinations (4 biotite, 2 hornblende, 1 biotite-hornblende pair, and a rerun biotite) are available from the Tkope plutonic suite; two are from Jacobson et al. (1980), the rest are previously unpublished dates. All but one fall within a narrow (24-31 Ma) range. The exception is a hornblende determination (hornblende 74.7 $\pm$ 3.8 Ma; K-Ar no. 3094) of a discordant biotite-hornblende pair from an unnamed granitoid body possibly coextensive with the Samuel Glacier and Mt. McDonnell plutons. The biotite age of that pair (biotite 24.3 $\pm$ 1.6 Ma; K-Ar no. 3093) was confirmed by a rerun (biotite 28.1 $\pm$ 1.8 Ma; K-Ar no. 3093(2)), and both are within the 24-31 Ma range. The older hornblende date could contain excess argon and be erroneous. Rb-Sr isochron and fission track age data from Tkope River batholith (Jacobson et al., 1980) also fall within this range. Six K-Ar dates (5 biotite, 1 hornblende) are reported from the subvolcanics; two are new, the remainder from Christopher et al. (1972). These range from 26 Ma* to 32 Ma. Five new K-Ar dates (4 biotite, 1 hornblende) from the two plutons in Chugach Terrane range from 21 to 33 Ma. Four are from Alsek River pluton, suggesting that the initial age of 165 $\pm$ 5 Ma* (Hudson et al., 1977) is incorrect. All but two of the dates listed fall within a 23 to 33 Ma range indicating an Oligocene (mostly late) age for this plutonism.

Epizonal plutons similar in age to the Tkope suite and also emplaced in Alexander Terrane were reported from adjacent Skagway quadrangle, Alaska (MacKevett et al., 1974). Both the Kuiu-Etolin and Behm Canal plutonic belts of Brew and Morrell (1983) cut across major terranes in southeastern Alaska and gave narrow (20-30 Ma) age ranges. Several other plutons and subvolcanics within Chugach Terrane in southern Alaska yielded somewhat similar ages (Hudson et al., 1977; Hudson, 1983).

The compositionally diverse Oligocene plutons are present within most terranes in Saint Elias Mountains and contiguous Alaska. Coeval volcanics are associated with plutons of the Tkope suite and in the Kuiu-Etolin belt. Brew and Morrell (1983) related the latter and the Behm Canal belt to vertical or large-scale strike-slip faults. Many of the Oligocene intrusions in Saint Elias Mountains occur near sites of major transcurrent faults.

MID- TO LATE-MIOCENE PLUTONIC EPISODE

Members of this episode, represented by the Wrangell plutonic suite, occur widely throughout the northern and eastern parts of Saint Elias Mountains. They are emplaced within or close to the Wrangell lava or underlying continental sediments, mostly

northeast of poorly defined major faults which flank the generally higher parts of Icefield and northern Alsek ranges. The mid- to late-Cenozoic volcanics and sediments lie with angular unconformity on rocks of Alexander Terrane and Wrangellia (W2 and W3). The Wrangell plutonic suite consists largely of dykes, sills, plugs and domes of rhyolitic to dacitic (commonly porphyritic) and andesitic to basaltic compositions, but also includes two epizonal bodies of granite-granodiorite (Mt. Steele pluton) and diorite-gabbro (Bock's Brook stock, studied in detail by Downey et al., 1980). The widespread Wrangell lava volcanism is calc-alkaline in composition (Richter, 1976; Souther, 1977; MacKevett, 1978).

Eight K-Ar determinations (6 whole-rock and 2 biotite) are available from subvolcanic intrusions of this suite; one is new, the remainder are from Stevens et al. (1982). All but one of these fall within a 6 to 16 Ma range. The exception is a biotite determination (biotite 20.0 ± 1.8 Ma; Stevens el al., 1982) which is somewhat discordant with the whole-rock determination from a small unnamed trachyte porphyry intrusion. That whole-rock age (15.5 ± 1.4 Ma; Stevens et al., 1982) is supported by an independent whole-rock date (16.3 ± 1.4 Ma; Stevens et al., 1982) on another sample collected from close by within the same intrusion. A new highly concordant K-Ar age pair (biotite 8.4 ± 0.6 and hornblende 8.4 ± 3.2 Ma; K-Ar no. 2909, 2910) is reported from Mt. Steele pluton. Downey et al. (1980) recorded a K-Ar age (biotite 13.3 ± 0.5 Ma) together with very similar Rb-Sr isochron and fission track dates from Bock's Brook stock. As all but one of the age data are within the 6 to 16 Ma range, a Middle to Late Miocene age for this suite is indicated. Whole-rock K-Ar ages from Wrangell lava in Saint Elias Mountains (Stevens et al., 1982) also fall within this range. These volcanics are chemically similar to and are believed related to this plutonic suite (Richter, 1976; Souther, 1977; MacKevett 1978).

Intrusions of similar age and compositions to the Wrangell suite are documented from McCarthy and Nabesna quadrangles, Alaska (MacKevett, 1978; Richter, 1976), where they are associated with vast piles of Wrangell lava north of the Border Ranges Fault. Mid- to Late Miocene plutonism in Saint Elias Mountains and adjacent southern Alaska is considered to be the hypabyssal and deeper phases of the calc-alkaline, Wrangell lava volcanism, and is interpreted to be a result of northward oblique subduction of the Pacific Plate beneath the continent (MacKevett, 1978).

MISCELLANEOUS DATA

Basic dykes, sills, small plutons and complexes of gabbro, diorite, diabase and basalt abound in Saint Elias Mountains, particularly along their northeast perimeter. Field evidence suggests Cambrian-Ordovician, mid- to late-Paleozoic, Permian-Triassic, Early Cretaceous, Cretaceous-Tertiary, Oligocene and Miocene ages for them. Most may be related to periods of basic volcanism.

The Steele Creek and Mt. Constantine gabbro-diabase complexes, which include rare ultramafic rocks, apparently form a "basement" to strata of Wrangellia (W2) (Read and Monger, 1976). Both occur close to the Duke River Fault. The Steele Creek complex lies disconformably below Early Permian strata. The Mt. Constantine complex yielded a K-Ar date (K-Ar no. 2962(2)) of 364 ± 37 Ma from hornblende. Rocks of the same age and type could be present in the eastern Saint Elias Mountains, but are unproven.

Of seven K-Ar determinations available from various volcanic, sedimentary and metamorphic rocks in Saint Elias Mountains, three are whole-rock dates from Wrangell lava (Stevens et al., 1982) which range from 10.8 to 13.5 Ma and compare well with ages from the Wrangell plutonic suite. Another from a chloritized biotite (50.6 ± 3.6 Ma; Wanless et al., 1978) in sediments of Amphitheatre Formation, considered Oligocene (Eisbacher and Hopkins, 1977), probably reflects the age of metamorphic and granitic rocks of Coast Plutonic Complex to the east, which are believed to be the provenance of the sediments. The remaining three K-Ar dates are from metamorphic rocks. Of these one is a new date (biotite 48.7 ± 2.7 Ma, K-Ar no. 2929) from granitoid gneisses regarded as metamorphosed Cretaceous Valdez Group rocks in Chugach Terrane. This date closely agrees with ages from coextensive metamorphic rocks in southern Alaska (Hudson et al., 1979), and with those from the Seward plutonic suite which were considered by them to be genetically related to the metamorphic event. The other two determinations consist of a biotite date (108 ± 5 Ma; Stevens et al., 1982) from amphibolite believed to represent volcanics in Wrangellia (W2) and a new whole-rock date (128 ± 7 Ma, K-Ar no. 3071) from low-grade metamorphosed basic pillow volcanics thought to be Late Triassic in Alexander

Terrane. Both probably reflect ages of metamorphism resulting from granitic intrusion; the former from the 106-117 Ma* suite, the latter from the 130-160 Ma suite.

NORTHERN PART OF COAST PLUTONIC COMPLEX

Three grab samples were collected during Operation Saint Elias in 1974 and 1978 to obtain preliminary age data on an essentially undivided and previously undated part of the Coast Plutonic Complex in the Boundary Ranges of the Coast Mountains in eastern Dezadeash and northeastern Tatshenshini River map areas. Although they do not pertain to the main theme of this paper, the three biotite-hornblende K-Ar age pairs determined from these granitoid samples are reported here.

Most previously published K-Ar dates from the Coast Plutonic Complex (Ruby Range batholith and a small satellitic pluton) in eastern Kluane Lake and southwestern Aishihik Lake map areas to the northeast of the region sampled, support a 49 to 58 Ma* cooling event (Lowdon, 1960, 1961; Christopher et al., 1972; Tempelman-Kluit and Wanless, 1975; Stevens et al., 1982). A further two K-Ar dates within the latter range (Stevens et al., 1982) from the Kluane schists, believed to be Jurassic-Cretaceous Dezadeash Group flyschoid rocks metamorphosed by the Coast Plutonic Complex (Eisbacher, 1976), corroborate that event.

One of the three grab samples yielded a concordant biotite-hornblende age pair of 55.5 ± 2.4 and 58.3 ± 2.8 Ma (K-Ar no. 2577, 2578). However, the remaining two samples gave somewhat discordant, but older biotite-hornblende age pairs of 64.6 ± 2.5 and 72.4 ± 3.3 Ma, 67.9 ± 2.7 and 57.9 ± 3.7 Ma (respectivly K-Ar no. 2516, 2517, 3061, 3062), suggesting the probability of a slightly earlier plutonic event within this part of the Coast Plutonic Complex. A few of the previously reported K-Ar dates from the Ruby Range batholithic complex also revealed similar 65 to 68 Ma* ages (Tempelman-Kluit and Wanless, 1975). A significantly older biotite date of 176 ± 11 Ma* from the latter batholith and a biotite date of 140 Ma* from a nearby metamorphic rock, indicate distinctly older plutonism within that part of the Coast Plutonic Complex.

SUMMARY

Most new and previously published K-Ar age determinations from Saint Elias Mountains in Canada are from granitoid rocks. These data coupled with limited field, petrographic and chemical criteria, suggest that at least six distinct, mainly calc-alkaline, plutonic episodes are represented in this region: 270-290 Ma (Icefield Ranges plutonic suite), 130-160 Ma (Saint Elias plutonic suite), 106-117 Ma* (Kluane Ranges plutonic suite), 41-52 Ma (Seward plutonic suite), 23-33 Ma (includes Tkope plutonic suite), and 6-16 Ma (Wrangell plutonic suite).

The 270-290 Ma episode occurs mainly along the southwestern extremity of the Alexander Terrane, and consists chiefly of multiphase batholithic complexes or plutons ranging from syenite to diorite. No volcanics in the Saint Elias Mountains are known to be coeval with this plutonic episode. In adjacent southern Alaska, however, correlative plutons juxtapose or intrude extensive, coeval volcanics within Wrangellia (W1), but the relationship between volcanism and plutonism remains unknown.

The 130-160 Ma episode is the most widespread recognized in the Saint Elias Mountains of Canada and is represented throughout the Alexander Terrane and parts of Wrangellia (W1) there. Preliminary data suggest a twofold subdivision comprising a western belt of mostly larger, possibly deeper, more elongate and basic (quartz diorite-diorite), mainly Late Jurassic batholithic complexes, and an eastern belt of smaller, shallower, more discordant and widely spaced, less basic (granodiorite), mostly earliest Cretaceous plutons. This plutonism , particularly in the western segment, is correlative with the mainly Late Jurassic Tonsina-Chichagof belt of Hudson (1983), but few plutons currently dated in southeastern Alaska support this event. Coeval volcanism is unrecognized in the Saint Elias Mountains, although fairly abundant volcanics, of similar age but of unknown affinity occur within the north-central part of the Gravina-Nutzotin belt in southeastern Alaska. Although a major Late Jurassic-Early Cretaceous structural disturbance was documented in McCarthy quadrangle, southern Alaska (MacKevett, 1978), the origin of this extensive, decidedly calc-alkaline episode of plutonism remains unresolved.

The 106-117 Ma* episode within the Saint Elias Mountains is restricted to their northeastern perimeter, and comprises mesozonal(?) to epizonal, elongate batholithic complexes and plutons (mostly granodiorite, quartz diorite and diorite of the Kluane Ranges plutonic suite), and an Alaskan-type ultramafic body (Pyroxenite Creek complex). The calc-alkaline Kluane Ranges plutonic suite is correlative with the Nutzotin-Chichagof belt of Hudson (1983) and probably the Muir-Chichagof belt of Brew and Morrell (1983) in adjacent parts of Alaska. The Pyroxenite Creek complex is the northernmost in the Klukwan-Duke belt of mafic-ultramafic complexes of Brew and Morrell (1983). Granitic plutons of this age in the Saint Elias Mountains and adjacent southern Alaska occur entirely in Wrangellia (W2) and its Gravina-Nutzotin cover; those in southeastern Alaska are found largely in Alexander Terrane. The Klukwan-Duke belt is within or close by the Gravina-Nutzotin belt. Although volcanism equivalent in age is unknown from the Saint Elias Mountains, Early Cretaceous volcanics in southern and southeastern Alaska are considered cogenetic with associated plutonism of that age. Ultramafic-mafic complexes of the Klukwan-Duke belt are believed to be the roots of volcanism in the Gravina-Nutzotin belt, and the granitoid rocks of the Muir-Chichagof belt the base of the magmatic arc.

The 41-52 Ma episode in the Saint Elias Mountains is confined to the southwestern periphery of the region, and comprises calc-alkaline, epizonal plutons composed of tonalite, quartz diorite, granodiorite and quartz monzonite. They are correlative with plutons of the Sanak-Baranof belt of Hudson (1983), particularly those of the eastern part of that belt. Collectively these plutons are emplaced mostly in rocks of the Chugach Terrane. No coeval volcanism has been reported from the study area or adjoining parts of Alaska. Plutons of the Sanak-Baranof belt are believed anatectic in origin and related to a postaccretion, high-temperature low-pressure metamorphic belt in Chugach Terrane, which formed along the edge of the continental margin in Late Paleocene-Early Eocene time.

Members of the 23-33 Ma episode are widely distributed in the Saint Elias Mountains and intrude most terranes there. They are represented by: Tkope plutonic suite, a group of calc-alkaline, elongate, composite, epizonal batholithic complexes and plutons ranging from granite to gabbro and emplaced in Alexander Terrane; dykes, sills and plugs, mainly rhyolite and rhyodacite intruding Wrangellia (W1 and W2) and parts of Alexander Terrane; and two epizonal plutons (a granite and a diorite) emplaced in Chugach Terrane. Relationships between the groupings are unknown. Temporally and compositionally similar epizonal and subvolcanic intrusions are present in adjacent parts of Alaska. These include the Kuiu-Etolin and Behm Canal plutonic belts in southeastern Alaska, which are believed related to vertical or major strike-slip faults (Brew and Morrell, 1983). Coeval volcanism is associated with the Tkope suite and the Kuiu-Etolin belt. In the Saint Elias Mountains many Oligocene intrusions are close to, and may also be related to major transcurrent faults.

The 6-16 Ma episode is widespread throughout the northern and eastern parts of the Saint Elias Mountains in Canada. It largely comprises dykes, sills, plugs and domes ranging in composition from rhyolite to basalt, but includes two epizonal bodies. Intrusions occur within or close by coeval Wrangell lava, which unconformably overlies rocks of the Alexander Terrane and Wrangellia (W1 and W2). Correlative intrusions and extensive volcanics are also documented from adjacent southern Alaska. This episode of plutonism in Saint Elias Mountains and contiguous Alaska is believed to be subvolcanic, and deeper phases of the calc-alkaline, Wrangell lava volcanism, and to be related to the northward oblique subduction of the Pacific Plate beneath the continent.

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APPENDIX

New K-Ar age determinations are listed below by determination number. Each age determination is accompanied by a description of the rock and mineral concentrate used, the geographical location of the sample, the geological setting and the interpretation of the date or sets of dates. Note ages with an asterisk (*) indicate age was calculated without using decay constants of Steiger and Jager (1977).

K-Ar no. 2511 Hornblende, K-Ar age **276 ± 11 Ma**

K = 1.39%, radiogenic Ar = 1.611 x 10^{-5} cm^3/g, atmos. Ar = 7.6%.

Concentrate: Clean, fresh and unaltered, pleochroic, brown to dark green hornblende, with no visible contamination.

From monzonite

(115B) Summit 2286 m (7500 ft.) of unnamed peak, some 22 km WNW of Pinnacle Peak, Mt. St. Elias map area, Yukon, 60°30'46"N, 139°21'17"W. Map unit PPyd[1], Geological Survey of Canada Open File 830. Sample 66-CAc-74-1 collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a pinkish grey, coarse medium grained, weakly foliated porphyritic biotite hornblende monzonite. It consists of quartz (2%), plagioclase (36%), microcline (50%), biotite (2%), hornblende (6%), opaque ore(s) (3%) and accessory chlorite, sphene and apatite. Biotite is ragged, strained and sporadically intensly chloritized; hornblende is fresh and inclusion free. Microcline occurs predominantly as discrete crystals and phenocrysts (6%), but is present interstitially. Plagioclase is subhedral, unaltered, and riddled with patch antiperthitic microcline. Opaque ore(s) are ubiquitous, and occasionally rimmed by sphene.

The specimen is from a more leucocratic and homogeneous phase of a veined, agmatitic syenodiorite complex (Kaskawulsh Glacier batholith). It is typical of the Icefield Ranges plutonic suite, and the hornblende age concurs with this. The complex is emplaced in carbonates of mid-Paleozoic age (Alexander Terrane).

K-Ar no. 2512 Hornblende, K-Ar age **148 ± 6 Ma**

K = 0.989%, radiogenic Ar = 5.929 x 10^{-6} cm^3/g, atmos. Ar = 15.7%.

Concentrate: Clean fresh and unaltered, pleochroic, brown to olive green, with no visible contamination.

From quartz monzonite.

(115A) At approx. 1828 m (6000 ft.) on ridge crest, some 10 km NE of Goatherd Mt., between Alsek R. and Bates Lake, Dezadeash map area, Yukon, 60°21'20"N, 137°45'35"W. Map unit JKgd, Geological Survey of Canada Open File 831. Sample 435-CAd-74-2, collected and interpreted by C.J. Dodds.

The rock is a buff grey, fairly homogeneous, coarse grained, porphyritic hornblende quartz monzonite. It consists of quartz (5.5%); mildy saussuritized, subhedral plagioclase (44%); subhedral to euhedral and megacrystic, perthitic orthoclase (36%); and fresh, subhedral to euhedral hornblende (12%). Accessories are of chlorite, sphene, opaque ore(s), apatite and rare zircon. Orthoclase megacrysts (18%) are well shaped and up to 2.5 cm long. Myrmekite commonly borders plagioclase. It is a grab sample from the northwest part of Shaft Creek pluton.

See K-Ar no. 2603 for interpretation.

K-Ar no. 2513 Biotite, K-Ar age **28.4 ± 1.8 Ma**

K = 7.23%, radiogenic Ar = 8.044 x 10^{-6} cm^3/g, atmos. Ar = 15.4%.

Concentrate: Clean, fresh and unaltered, light brown biotite, with no visible contamination.

From rhyolite porphyry

(115G) Some 100 m up small tributary of Bullion Creek, approximately 14 km WNW of mile 1060 on Alaska Hwy., Kluane Lake map area, Yukon, 61°01'49"N, 138°46'24"W. Map unit Of, Geological Survey of Canada Open File 829. Sample 289-CAd-74-1 collected and interpreted by C.J. Dodds.

The sample is of a fresh, undeformed, light pinkish buff biotite quartz plagioclase rhyolite porphyry. It is composed of phenocrysts of subhedral to euhedral quartz (7%), euhedral complexly zoned plagioclase (10%), and subhedral to euhedral very fresh biotite (3%), set in an aphanitic, potash feldspar-rich groundmass (78%).

The rock is from a 10 m thick dyke. It forms one of many similar acid porphyry dykes, sills, and small, lensoid plutons which intrude very complexly folded and faulted rocks in the vicinity of the Duke River and Denali Fault zones. These intrusions are locally highly deformed by syn or post-emplacement faulting.

K-Ar no. 2514 Biotite, K-Ar age **181 ± 6 Ma**

K = 7.33%, radiogenic Ar = 5.424 x 10^{-5} cm^3/g, atmos. Ar = 5.6%.

Concentrate: Clean fresh and unaltered, light brown biotite, with no visible contamination.

[1]Technical difficulties preclude the use in this text of the specialized symbols found on maps. Conventional type has been used to approximate these symbols.

From quartz monzodiorite

(115G) S side of Donjek Glacier, approximately 8 km SW of Donjek River, Kluane Lake map area, Yukon, 61°08'05"N, 139°34'13"W. Map unit JKg, Geological Survey of Canada Open File 829. Sample 7-CAc-74-1 collected by R.B. Campbell and interpreted by C.J. Dodds.

See K-Ar no. 2515 for description and interpretation.

K-Ar no. 2515 Hornblende, K-Ar age **272 ± 11 Ma**

K = 0.608%, radiogenic Ar = 6.938 x 10^{-6} cm^3/g, atmos. Ar = 17.6%.

Concentrate: Clean, fresh unaltered, pleochroic, brown to dark green hornblende, with no visible contamination.

From quartz monzodiorite

(115G) Details as for K-Ar no. 2514.

The sample is of a darkish grey, unfoliated, somewhat heterogeneous hornblende biotite quartz monzodiorite. It consists of quartz (4%), saussuritized, complexly zoned plagioclase (55%), interstitial microcline (10%), ragged biotite (15%), subhedral hornblende (13%), opaque ore(s) (2%) with accessory sphene, apatite and epidote.

The rock is a grab sample from an elongate batholithic complex in the lower Donjek Glacier area. Little is known of the overall composition of this body. Mainly from distant observations, it appears to consist of darker granitic rocks which are locally intruded by a light pinkish grey granitic phase(s) and by similarly coloured dykes. The highly discordant age pair may reflect this intrusive complexity. The Donjek Glacier batholith has many of the characteristics of the Icefield Ranges plutonic suite and on the basis of this and the hornblende age, it is tentatively grouped with this suite. The biotite age may suggest partial resetting, possibly by a younger granitic phase(s) within the complex. Although this body is emplaced mainly in (?) early Paleozoic clastic rocks, locally it cuts pelitic rocks which may include thin limestones and argillites of (?) latest Paleozoic and Late Triassic age. This may be further evidence of younger granitic phase(s) within this complex.

K-Ar no. 2516 Biotite, K-Ar age **64.6 ± 2.5 Ma**

K = 7.19%, radiogenic Ar = 1.838 x 10^{-5} cm^3/g, atmos. Ar = 16.4%.

Concentrate: Clean, fresh and unaltered dark greenish brown biotite, with approximately 1% free chlorite contamination.

From granodiorite

(115A) Boundary Ranges, about 2 km E of Haines Road and 9 km SSE of Takhanne River bridge, Dezadeash map area, Yukon, 60°02'37"N, 136°51'02"W. Map unit 7, Geological Survey of Canada Map 1019A. Sample 81-CAc-74-1, collected by R.B. Campbell and interpreted by C.J. Dodds. See K-Ar no. 2517 for description.

K-Ar no. 2517 Hornblende, K-Ar age **72.4 ± 3.3 Ma**

K = 0.715%, radiogenic Ar = 2.053 x 10^{-6} cm^3/g, atmos. Ar = 43.0%.

Concentrate: Clean, fresh and unaltered, pleochroic brown to green hornblende, with no visible contamination.

From granodiorite

Details as for K-Ar no. 2516.

The rock is a light grey, fine coarse grained, weakly foliated but homogeneous, nonporphyritic biotite hornblende granodiorite. It is composed of quartz (21%), plagioclase (51%), orthoclase (7%), biotite (10%), hornblende (11%), with accessory chlorite, and rarer apatite and opaque ore(s). Subhedral biotite is sporadically chloritized, mildly deformed, but contains few inclusions. Hornblende forms fresh, subhedral to euhedral prisms and is mostly inclusion free. Plagioclase is slightly saussuritized and complexly zoned; orthoclase is interstitial and unaltered. Myrmekitic intergrowth is commonn. It is a grab sample from the northern part of the Coast Plutonic Complex.

K-Ar no. 2542 Biotite, K-Ar age **9.2 ± 0.7 Ma**

K = 6.78%, radiogenic Ar = 2.431 x 10^{-6} cm^3/g, atmos. Ar = 68.1%.

Concentrate: Dark brown biotite, with approximately 5% chloritic alteration.

From leucocratic granite porphyry

(115F) Collected from moraine debris, 7 km NE of Mt. Steele, Kluane Lake map area, Yukon, 61°08'09"N, 140°14'05"W. Originating from map unit Mg, Geological Survey of Canada Open File 829. Sample 32-CAc-74-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a creamy grey, fine medium grained, homogenous, fairly fresh biotite quartz plagioclase granite porphyry. It consists of quartz (37%), plagioclase (33%), orthoclase (24%), biotite (5%), chlorite (1%), with accessory sphene, apatite, opaque ore(s) and epidote. Phenocrysts are of plagioclase, quartz and biotite.

The sample is from moraine debris shedding from the precipitous flanks of Mt. Steele. Although this massif appears largely underlain by granitic rocks, little is known of its overall composition, intrusive relationships and extent due to the extremely rugged and ice-covered terrain. It could represent either a phase of Mt. Steele pluton, or a later intrusion associated with tectonism which collectively may have reset the pluton age (see K-Ar no. 2910).

As a result of the biotite age, this subvolcanic is grouped with the Wrangell plutonic suite. The Mt. Steele pluton occurs in mid-Paleozoic carbonates (Alexander Terrane).

K-Ar no. 2557 Biotite, K-Ar age **273 ± 9 Ma**

K = 6.83%, radiogenic Ar = 7.824 x 10^{-5} cm^3/g, atmos. Ar = 2.4%.

Concentrate: Light brown biotite, with approximately 10% chloritic alteration.

From granodiorite

(115F) At 1981 m (6500 ft.), on west side of small N-S trending glacier, 2.5 km S of its confluence with Steele Glacier, 22 km WSW of Donjek River, Kluane Lake map area, Yukon, 61°14'53"N, 140°02'59"W. Map unit PPqm, Geological Survey of Canada Open File 829. Sample 15-CAc-74-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

See K-Ar no. 2558 for description and interpretation.

K-Ar no. 2558 Hornblende, K-Ar age **274 ± 11 Ma**

K = 0.818%, radiogenic Ar = 9.408 x 10^{-6} cm^3/g, atmos. Ar = 15.2%.

Concentrate: Pleochroic, brown to dark green hornblende with a trace of attached chlorite contamination.

From granodiorite

(115F) Details as for K-Ar no. 2557

The rock is a fairly fresh, grey, medium grained, fairly homogeneous, porphyritic hornblende biotite granodiorite. It consists of quartz (27%), plagioclase (44%), microcline (19%), biotite (4%), hornblende (1%), chlorite (1%), with accessory sphene and apatite. Megacrysts are of K-feldspar and plagioclase.

The sample is from Steele Glacier pluton which appears to be mainly fault-bounded against very complexly deformed Paleozoic carbonates, argillites and siltstones (Alexander Terrane). It is included with Icefield Ranges plutonic suite on the basis of this concordant age pair.

K-Ar no. 2577 Biotite, K-Ar age **55.5 ± 2.4 Ma**

K = 7.46%, radiogenic Ar = 1.634 x 10^{-5} cm^3/g, atmos. Ar = 13.3%.

Concentrate: Relatively clean, deep reddish brown biotite, with approximately 1% chloritic alteration.

From granodiorite

(115A) Boundary Ranges, approximately 4.8 km NE of 2159 m (7085 ft.) peak, just W of upper Kluhini River, Dezadeash map area, Yukon, 60°11'30"N, 136°35'19"W. Map unit 7, Geological Survey of Canada Map 1019A. Sample 82-CAc-74-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

See K-Ar no. 2578 for description.

K-Ar no. 2578 Hornblende, K-Ar age **58.3 ± 2.8 Ma**

K = 1.52%, radiogenic Ar = 3.501 x 10^{-6} cm^3/g, atmos. Ar = 36.1%.

Concentrate: Pleochroic, deep greenish brown to pale greenish yellow hornblende, with approximately 5% biotite contamination.

From granodiorite

(115A) Details as for K-Ar no. 2577

The rock is a light to mid grey, coarse medium grained, homogeneous, unfoliated, porphyritic (orthoclase), hornblende biotite granodiorite. It consists of quartz (27%), plagioclase (54%), orthoclase (4%), biotite (10%), hornblende (3%), and accessory chlorite, sphene, apatite and rarer opaque ore(s) and zircon. Biotite forms clotted, subhedral, slightly deformed and chloritized flakes, and is fairly inclusion free. Hornblende is little altered or deformed, and contains few inclusions. Plagioclase occurs as stout, subhedral, complexly zoned laths and is unaltered. Fresh, perthitic orthoclase is present interstitially and as euhedral to subhedral phenocrysts (up to 2 cm). Small well-shaped crystals of apatite are plentiful. It is a grab sample from the northern part of the Coast Plutonic Complex.

K-Ar no. 2579 Biotite, K-Ar age **45.4 ± 2.4 Ma**

K = 7.37%, radiogenic Ar = 1.317 x 10^{-5} cm^3/g, atmos. Ar = 25.6%.

Concentrate: Clean, fresh and unaltered, reddish brown biotite, with no visible contamination.

From tonalite

(115C) From small, isolated nunatak, in central part of Seward Glacier, some 20 km SSE of summit of Mt. Logan, Mt. St. Elias map area, Yukon, 60°25'05"N, 140°15'46"W. Map unit lTg, Geological Survey of Canada Open File 830. Sample 72-CAc-74-1 collected by R.B. Campbell and interpreted by C.J. Dodds.

See K-Ar no. 2580 for description and interpretation.

K-Ar no. 2580 Hornblende, K-Ar age **51.5 ± 3.0 Ma**

K = 0.626%, radiogenic Ar = 1.271 x 10^{-6} cm^3/g, atmos. Ar = 42.4%.

Concentrate: Clean, fresh and unaltered, pleochroic, light brown to olive-green hornblende, with no visible contamination.

From tonalite

(115C) Details as for K-Ar no. 2579.

The rock is a pinkish grey, medium grained, homogeneous, equigranular hornblende biotite tonalite. It consists of quartz (30%), pinkish, occasionally intensely saussuritized plagioclase (40%), very fresh, slightly deformed biotite (20%), fresh prisms of hornblende (7%), abundant epdiote (11%) rare K-feldspar, and accessory opaque ore(s) and apatite.

It is from a small, isolated nunatak composed entirely of granitic rock in the icefields of upper Seward Glacier. The size and intrusive relationships of the body are not known. It is similar in age and lithology to other plutons occurring in Chugach Terrane and is included with the Seward plutonic suite.

2581 297
K-Ar no. Hornblende, K-Ar age **± 20 Ma**
2581(2) 288

$$K = 0.572\%, \text{radiogenic Ar} = \frac{7.178 \times 10^{-6}}{6.942 \times 10^{-6}} \text{cm}^{-3}$$

$$\text{atmos. Ar} = \frac{16.1\%}{18.3\%}$$

Concentrate: Clean, fresh and unaltered, pleochroic, light brown to green hornblende, with no visible contamination.

From quartz monzodiorite

(115B) At approx. 2133 m (7000 ft.) on ridge crest E side of Hubbard Glacier, 10 km WNW of summit Mt. Hubbard, Mt. St. Elias map area, Alaska, 60°19'53"N, 139°15'14"W. Sample 54-CAc-74-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a grey, medium grained, fairly equigranular, homogeneous, fresh biotite hornblende quartz monzodiorite. It consists of quartz (5%), plagioclase (51%), microcline (8%), biotite (3%), hornblende (25%), chlorite (1%), sphene (4%), apatite (1%) with accessory epidote and opaque ore(s). Hornblende is unaltered and little deformed. Biotite is chloritized and commonly intergrown with hornblende. Plagioclase is saussuritized and complexly zoned. Microcline is entirely interstitial, perthitic, and mildly clouded by incipient alteration. Sphene is ubiquitous and commonly rims opaque ore(s). Small, well-shaped crystals of apatite are plentiful.

The sample is from the more melanocratic phase of Mt. Hubbard pluton, a diorite-quartz diorite agmatite complex. This complex is intruded by two discrete, sharply discordant, light grey weathering, undated granitic bodies, the larger of which is Mt. Alverstone pluton. Collectively these plutons form Cathedral Glacier batholith which underlies much of the rugged massif of Mounts Hubbard, Alverstone, Kennedy and Weisshorn, and outcrops mainly within Yukon part of the map area. It is emplaced in amphibolite (?early Paleozoic) and marble (?mid Paleozoic) within Alexander Terrane.

Mt. Hubbard pluton is typical of the Icefields Ranges plutonic suite, and confirmed by these and two more hornblende ages of 279 ± 8 and 284 ± 7 Ma* from close by (Hudson et al., 1977).

K-Ar no. 2582 Biotite, K-Ar age **135 ± 5 Ma**

K = 7.46%, radiogenic Ar = 4.065 x 10^{-5} cm^3/g, atmos. Ar = 8.8%.

Concentrate: Relatively clean, fresh and unaltered, light brown biotite, with a slight trace of chlorite contamination.

From granodiorite

(115B) Approximately 3.5 km W of Snowshoe Peak, Mt. St. Elias map area, Yukon, 60°37'54"N, 138°23'08"W. Map unit JKg, Geological Survey of Canada Open File 830. Sample 73-CAc-74-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

See K-Ar no. 2583 for description and interpretation.

K-Ar no. 2583 Hornblende, K-Ar age **154 ± 7 Ma**

K = 0.796%, radiogenic Ar = 4.974 x 10^{-6} cm^3/g, atmos. Ar = 24.6%.

Concentration: Clean, fresh and unaltered, pleochroic, light brown to bluish green hornblende, with no visible contamination.

From granodiorite

(115B) Details as for K-Ar no. 2582.

The rock is a light to mid grey, fine coarse grained, very weakly foliated, homogeneous, porphyritic, hornblende biotite granodiorite. It contains quartz (18%); fresh, normal zoned, stout subhedral plagioclase (53%); interstitial and distinctly euhedral, megacrystic microcline (19%); fresh, olive brown biotite (4%); stout, subhedral hornblende (2.4%); and anhedral clinopyroxene (1.7%). The clinopyroxene is generally associated with hornblende. Accessories include apatite, opaque ore(s), and epidote.

The specimen is from Snowshoe batholith. It is a large, fault dislocated, multiphase granitic body emplaced in sedimentary rocks of Paleozoic and (?) younger age (Alexander Terrane). It is unconformably overlain by Neogene Wrangell lava. This distinctive megacrystic phase is also present in the southern part of the batholith. Foliated granodiorite and diorite are also reported from this batholith, but the overall distribution of these phases is not well known. This granitic body is characteristic of the Saint Elias plutonic suite. These determinations and a previously reported biotite-hornblende age pair of 144 ± 5 and 141 ± 6 Ma (Stevens et al., 1982), are further evidence for this.

K-Ar no. 2584 Biotite, K-Ar age **144 ± 5 Ma**

K = 6.95%, radiogenic Ar = 4.049 x 10^{-5} cm^3/g, atmos. Ar = 6.7%.

Concentrate: Olive brown biotite, with approximately 2% chlorite alteration.

From granodiorite

(115A) S side Alsek R., 1.2 km above confluence with Bates R., Dezadeash map area, Yukon, 60°06'33"N, 137°56'55"W. Map unit JKgd, Geological Survey of Canada Open File 831. Sample 45-CAc-74-1, collected by R.B. Campbell and interpretated by C.J. Dodds.

See K-Ar no. 2585 for description and interpretation.

K-Ar no. 2585 Hornblende, K-Ar age **131 ± 7 Ma**

K = 0.482%, radiogenic Ar = 2.546 x 10^{-6} cm^3/g, atmos. Ar = 46.8%.

Concentrate: Clean, fresh and unaltered, pleochroic, dark olive green to green hornblende, with no visible contamination.

From granodiorite

(115A) Details as for K-Ar no. 2584.

The specimen is from a light to mid grey, homogeneous, medium grained equigranular, biotite hornblende granodiorite. It is composed of quartz (22%); subhedral, oscillatorily zoned, locally saussuritized plagioclase (46%); interstitial, perthitic orthoclase (14%); somewhat ragged, bent and chloritized biotite (5.6%); fresh, subhedral hornblende (6%); and sphene (1.2%). Accessories are of chlorite, epidote, apatite and opaque ore(s).

The sample is from Alsek pluton, a small discordant, lenticular-shaped body. It intruded and contact metamorphosed, a sequence of laminated carbonates and limestones of early to mid-Paleozoic age (Alexander Terrane). Lithologically it is typical of smaller plutons included with Saint Elias suite. The biotite-hornblende age pair concurs.

K-Ar no. 2586 Biotite, K-Ar age **130 ± 5 Ma**

K = 6.18%, radiogenic Ar = 3.238 x 10^{-5} cm^3/g, atmos. Ar = 8.1%.

Concentrate: Olive brown biotite, with approximately 6% chloritic alteration.

From granodiorite

(115B) At 1676 m (5500 ft.) on E side South Lowell Glacier, approx. 21 km ESE Weisshorn, Mt. St. Elias map area, Yukon, 60°13'52"N, 138°31'36"W. Map unit JKg, Geological Survey of Canada Open File 830. Sample 52-CAc-74-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

See K-Ar no. 2587 for description and interpretation.

K-Ar no. 2587 Hornblende, K-Ar age **145 ± 6 Ma**

K = 0.745%, radiogenic Ar = 4.372 x 10^{-6} cc/gm, atmos. Ar = 23.8%.

Concentrate: Clean, fresh and unaltered, pleochroic, brown to dark green hornblende, with no visible contamination.

From granodiorite

(115B) Details as for K-Ar no. 2586.

The rock is a light to mid grey, medium grained, homogeneous, biotite hornblende granodiorite. It is composed of quartz (22%); mildy saussuritized, oscillatorily zoned, subhedral plagioclase (51%); cloudy, interstitial microcline (11%); mildly chloritized, subhedral to euhedral (hexagonal shaped) biotite (5%); and fresh, slender, subhedral prisms of hornblende (8%). Accessories include chlorite, epidote, opaque ore(s), sphene, and apatite.

It is a grab sample from Lowell Glacier pluton. This elongate pluton is emplaced in a sequence of dark grey argillite and siltstone, believed mainly late Paleozoic and (?) younger in age (Alexander Terrane). The composition of this body is largely unknown. However, this particular phase is typical of the Saint Elias plutonic suite. These ages concur.

K-Ar no. 2588 Biotite, K-Ar age **134 ± 5 Ma**

K = 7.13%, radiogenic Ar = 3.855 x 10^{-5} cm^3/g, atmos. Ar = 9.3%.

Concentrate: Relatively clean, light greenish brown biotite, with approximately 2% chlorite alteration.

From granodiorite

(115B) West side Kluane Glacier, 1981 m (6500 ft.), approximate 12.9 km from its terminus, Mt. St. Elias map area, Yukon, 60°52'34"N, 139°20'52"W. Map unit JKgd, Geological Survey of Canada Open File 830. Sample 37-CAc-74-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

See K-Ar no. 2589 for description and interpretation.

K-Ar no. 2589 Muscovite, K-Ar age **123 ± 4 Ma**

K = 9.22%, radiogenic Ar = 4.562 x 10^{-5} cm^3/g, atmos. Ar = 18.4%.

Concentrate: Clean, fresh and unaltered muscovite, with no visible contaminaton.

From granodiorite

(115B) Details as for K-Ar no. 2588.

The sample is of a light grey, coarse medium grained, leucocratic muscovite hornblende biotite granodiorite. It consists of quartz (21%), plagoclase (53%), microcline (14%), biotite (2.4%), hornblende (1.5%), epidote (2.5%), minor muscovite with accessory sphene, apatite, and opaque ore(s). Biotite occurs as subhedral to euhedral (hexagonal-shaped), slightly chloritized and deformed flakes. Hornblende forms slender, subhedral prisms, but is scarce. Muscovite was not observed in the thin section. Plagioclase is mildly saussuritized, and complexly zoned. Microcline is largely interstitial, with only incipient alteration. Abundant epidote is both primary and secondary (alteration product of plagioclase).

The rock is from Kluane Glacier pluton, a small body which discordantly intruded complexly deformed argillites and siltstones of Paleozoic age (Alexander Terrane). The pluton imprinted a narrow thermal aureole on these sediments. It is characteristic of the smaller, discrete, fairly high-level plutons grouped with the Saint Elias suite. The biotite age supports this.

K-Ar no. 2590 Hornblende, K-Ar age **146 ± 6 Ma**

K = 0.874%, radiogenic Ar = 5.166 x 10^{-6} cm^3/g, atmos. Ar = 20.6%.

Concentrate: Clean, fresh and unaltered, pleochroic brown to dark green hornblende, with no visible contamination.

From quartz monzodiorite

(115B) At 2468 m (8100 ft.) on ridge at head of Disappointment Glacier, Mt. St. Elias map area, Yukon, 60°26'34"N, 138°45'40"W. Map unit JKg, Geological Survey of Canada Open File 830. Sample 62-CAc-74-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The sample is from a light to mid grey, fairly homogeneous, medium grained, porphyritic biotite hornblende quartz monzodiorite. It comprises quartz (15%), oscillatorily zoned, mildly saussuritized plagioclase (53%); megacrystic and interstitial microcline (14%); ragged, chloritized biotite (0.6%); fresh, undeformed hornblende (10%); and opaque ore(s) (1.4%). Accessories include chlorite, sphene, apatite and epidote. Myrmekite commonly borders plagioclase. Small, microcline megacrysts (4%) are somewhat indistinct.

The rock is from Disappointment Glacier pluton, a rounded body which discordantly intruded fine clastic sediments believed to be late Paleozoic in age (Alexander Terrane). Lithologically it is typical of the Saint Elias plutonic suite and this age concurs.

K-Ar no. 2591 Biotite, K-Ar age **142 ± 5 Ma**

K = 6.33%, radiogenic Ar = 3.635 x 10^{-5} cm^3/g, atmos. Ar = 7.9%.

Concentrate: Olive brown biotite, with approximately 10% chlorite alteration.

From granodiorite

(114P) Peak 1802 m (5913 ft.), Icefield Ranges, extreme NW corner Tatshenshini River map area, British Columbia, 59°59'13"N, 137°56'37"W. Map unit JKg, Geological Survey of Canada Open File 926. Sample 57-CAc-74-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

See K-Ar no. 2592 for description and interpretation.

K-Ar no. 2592 Hornblende, K-Ar age **195 ± 8 Ma**

K = 0.480%, radiogenic Ar = 3.842 x 10^{-6} cm^3/g, atmos. Ar = 28.3%.

Concentrate: Clean, fresh and unaltered, moderately pleochroic light to dark green hornblende, with no visible contamination.

From granodiorite

(114P) Details as for K-Ar no. 2591

The rock is a light grey, homogeneous, equigranular, medium grained hornblende biotite granodiorite. It consists of quartz (28%); stout, subhedral, oscillatorily zoned plagioclase (53%); fresh, commonly interstitial, perthitic microcline (11%); slightly to moderately chloritized, subhedral biotite (4%); and subhedral hornblende (2%). Accessories include chlorite, sphene, apatite, and opaque ore(s). Myrmekite commonly borders plagioclase.

The sample is from a small, rounded, discordant body (Easy pluton). It intruded and thermally metamorphosed laminated carbonates of early to mid-Paleozoic age (Alexander Terrane). It is very typical of the Saint Elias plutonic suite. The biotite age agrees with this; the hornblende age is much older than expected and could perhaps result from excess argon.

K-Ar no. 2593 Hornblende, K-Ar age **281 ± 12 Ma**

K = 0.554%, radiogenic Ar = 6.547 x 10^{-6} cm^3/g, atmos. Ar = 12.4%.

Concentrate: Clean, fresh, unaltered, pleochroic, yellow- brown to green hornblende, with no visible contamination.

From monzodiorite

(115B) At about 2590 m (8500 ft.) on small nunatak, some 12.5 km N of summit Mt. Queen Mary, Mt. St. Elias map area, Yukon, 60°44'29"N, 139°44'57"W. Map unit PPydi, Geological Survey of Canada Open File 830. Sample 71-CAc-74-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The sample is of a mid- to dark-grey, fine medium grained, homogeneous biotite hornblende monzodiorite. It contains quartz (2%); saussuritized and complexly zoned plagioclase (52%); cloudy interstitial microcline (13%); strongly chloritized, ragged, bent biotite (7%); fresh undeformed hornblende (11%); secondary chlorite (5.5%); abundant sphene (4.7%); apatite (1.7%), opaque ore(s) (1.4%), epidote (1.1%) and rarer calcite. It is sparsely and finely veined by calcite, zeolite, and epidote.

The rock is from Divide batholith, a syenodiorite complex which is exposed in this and adjacent nunataks. Much of the intrusive relatonships and the exact areal extent of the complex is obscured by extensive ice cover. On the basis of type, composition and age, it is grouped with the Icefield Ranges plutonic suite, and is emplaced in pelitic and carbonate rocks of mainly Paleozoic age (Alexander Terrane).

K-Ar no. 2594 Hornblende, K-Ar age **140 ± 6 Ma**

K = 1.09%, radiogenic Ar = 6.168 x 10^{-6} cm^3/gm, atmos. Ar = 22.1%.

Concentrate: Clean, fresh, unaltered, pleochroic, yellow-brown to dark green hornblende, with no visible contamination.

From quartz monzodiorite

(115G) At 1615 m (5300 ft.), between Donjek River valley and Bighorn Creek, about 9.7 km SE of mouth of Bighorn Creek, Kluane Lake map area, Yukon, 61°04'45"N, 139°18'06"W. Map unit JKgd, Geological Survey of Canada Open File 829. Sample 190-CAd-74-1 collected and interpreted by C.J. Dodds.

The rock is a light grey, weakly foliated, homogeneous, medium grained, porphyritic hornblende quartz monzodiorite. It is composed of quartz (7%), sodic plagioclase (57%), microcline (16%), hornblende (13%), sphene (1%), opaque ore(s) (1%), and accessory apatite, chlorite, epidote and calcite. The small (up to 7 mm) subhedral megacrysts are of microcline (3%).

The sample is from the west side of Bighorn Creek pluton which intrudes (?) early Paleozoic clastics and Devonian limestones and argillites. This pluton imprints a narrow contact metamorphic aureole on these sediments. The body is typical of the Saint Elias plutonic suite. The age concurs with this.

K-Ar no. 2595 Biotite, K-Ar age **117 ± 4 Ma**

K = 6.99%, radiogenic Ar = 3.284 x 10^{-5} cm^3/g, atmos. Ar = 7.1%.

Concentrate: Brown biotite, with approximately 8% chlorite alteration.

From granodiorite

(115B) At 1676 m (5500 ft.), on E side of South Arm, Kaskawulsh Glacier, some 4 km from confluence with main Kaskawulsh Glacier, Mt. St. Elias map area, Yukon, 60°39'43"N, 138°46'17"W. Map unit JKgd, Geological Survey of Canada Open File 830. Sample 440-CAd-74-1, collected and interpreted by C.J. Dodds.

The rock is a light grey, leucocratic, well foliated, medium grained biotite granodiorite. It comprises quartz (29%), mildly saussuritized and oscillatorily zoned plagioclase (45%), interstitial microcline (20%), and deformed, ragged, mildy chloritized, clotted, reddish brown biotite (3%). Myrmekite (3%) commonly borders plagioclase. Accessories include scarce epidote, minor chlorite and rare apatite. The strong foliation results from moderate deformation; whether this is late or post-emplacement is uncertain.

The sample is from Maxwell Glacier pluton, a discordant, lenticular shaped granitic body. It intruded and thermally metamorphosed, a complexly deformed siliceous and calcareous argillite-siltstone sequence which includes dark grey limestone. These sediments are regionally metamorphosed to low greenschist grade and believed to be late Paleozoic to (?) earliest Mesozoic.

Although field observations are limited, lithologically it appears distinctly different to smaller plutons grouped with the St. Elias suite in lower Icefield Ranges. Further, it is only one of two granitic bodies (see K-Ar no. 3067) within the Alexander Terrane of Saint Elias Mountains yielding ages somewhat younger than the 130-160 Ma range. However, it is still uncertain whether this biotite determination reflects the age of intrusion or resetting by late- or post-emplacement deformation. Tentatively it is grouped with the Saint Elias plutonic suite.

K-Ar no. 2596 Biotite, K-Ar age **138 ± 5 Ma**

K = 7.38%, radiogenic Ar = 4.114 x 10^{-5} cm^3/g, atmos. Ar = 8.9%.

Concentrate: Olive brown biotite, with approximately 2% chlorite alteration.

From granodiorite

(115B) At 1584 m (5200 ft.), close to S edge of Dusty Glacier, some 18 km up from its terminus, Mt. St. Elias map area, Yukon, 60°22'07"N, 138°26'49"W. Map unit JKgd, Geological Survey of Canada Open File 830. Sample 437-CAd-74-1, collected and interpreted by C.J. Dodds.

See K-Ar no. 2597 for description and interpretation.

K-Ar no. 2597 Hornblende, K-Ar age **142 ± 6 Ma**

K = 0.73%, radiogenic Ar = 4.192 x 10^{-6} cm^3/g, atmos. Ar = 24.4%.

Concentrate: Clean, fresh and unaltered, pleochroic light green to olive green hornblende, with no visible contam-ination.

From granodiorite

(115B) Details as for K-Ar no. 2596.

The specimen is of a light to mid grey, fresh, homogeneous, medium grained hornblende biotite granodiorite. It contains quartz (24%); complexly zoned, somewhat saussuritized plagioclase (44%); mildly altered and interstitial microcline (16%), slightly altered and deformed biotite (7%); fresh, subhedral to euhedral hornblende (5%); and epidote (1%). Accessories include chlorite, sphene, opaque ore(s), apatite and zircon.

The rock is from a small, discordant, unnamed pluton that intruded and thermally metamorphosed fine clastic sediments and locally dark limestone, considered to be late Paleozoic and(?) younger (Alexander Terrane). It is grouped with the Saint Elias plutonic suite on the basis of lithology and these ages.

K-Ar no. 2598 Biotite, K-Ar age **133 ± 5 Ma**

K = 7.33%, radiogenic Ar = 3.932 x 10^{-5} cm^3/g, atmos. Ar = 6.4%.

Concentrate: Clean, fresh unaltered, light greenish brown biotite, with no visible contaminaton.

From granodiorite

(115B) At approx. 2133 m (7000 ft.), north side Kaskawulsh Glacier, some 10 km NW of its confluence with Stairway Glacier, Mt. St. Elias map area, Yukon, 60°47'52"N, 139°04'38"W. Map unit JKgd, Geological Survey of Canada Open File 830. Sample 439-CAd-74-1, collected and interpreted by C.J. Dodds.

See K-Ar no. 2599 for description and interpretation.

K-Ar no. 2599 Hornblende, K-Ar age **144 ± 6 Ma**

K = 1.11%, radiogenic Ar = 6.467 x 10^{-6} cm^3/g, atmos. Ar = 12.6%.

Concentrate: Clean, fresh and unaltered, pleochroic, bluish green to olive-green hornblende, with no visible contamination.

From granodorite

(115B) Details as for K-Ar no. 2598.

The rock is a light grey, homogeneous, fine coarse grained hornblende biotite granodiorite. It consists of quartz (22%), plagioclase (45%), microcline (12%), biotite (8%), hornblende (5%), epidote (3.5%), myrmekite (2%), with accessory sphene, opaque ore(s), and apatite. Biotite forms euhedral (hexagonal shaped) to subhedral, slightly deformed and chloritized flakes. Hornblende is fresh, little altered and with few inclusions. Plagioclase is complexly zoned and sporadically saussuritized. Microcline occurs

interstitially and is unaltered. Epidote is primary and generally associated with the mafic minerals.

The sample is from Shield pluton which intruded dark grey, graphitic and siliceous argillites and siltstones questionably of late Paleozoic age (Alexander Terrane). These sediments are complexly deformed and regionally metamorphosed to low greenschist grade. The pluton is subrounded, highly discordant, and imprints a distinct, narrow contact aureole on the host rocks. From distant observation, it appears uniform in composition. The body is typical of the fairly high-level plutons included with the Saint Elias suite. These ages concur with this.

K-Ar no. 2600 Biotite, K-Ar age **128 ± 5 Ma**

K = 7.16%, radiogenic Ar = 3.692 x 10^{-5} cm^3/g, atmos. Ar = 9.1%.

Concentrate: Clean, fresh and unaltered, light green biotite, with no visible contamination.

From granodiorite

(115B) At approx. 1828 m (6000 ft.), west side of Stairway Glacier, some 2 km to S of its confluence with Kaskawulsh Glacier, Mt. St. Elias map area, Yukon, 60°42'49"N, 138°59'36"W. Map unit JKgd, Geological Survey of Canada Open File 830. Sample 438-CAd-74-1, collected and interpreted by C.J. Dodds.

See K-Ar no. 2601 for description and interpretation.

K-Ar no. 2601 Hornblende, K-Ar age **146 ± 6 Ma**

K = 1.10%, radiogenic Ar = 6.502 x 10^{-6} cm^3/g, atmos. Ar = 7.9%.

Concentrate: Clean, fresh and unaltered, pleochroic, brown to green hornblende, with no visible contamination.

From granodiorite

(115B) Details as for K-Ar no. 2600.

The sample is from a light to medium grey, homogeneous, medium grained slightly porphyritic hornblende biotite granodiorite. It consists of quartz (19%), plagioclase (42%), microcline (14%), biotite (8%), hornblende (7%), epidote (5%) and accessory chlorite, sphene, opaque ore(s), apatite and zircon. Hornblende occurs as undeformed, unaltered subhedral prisms. Biotite flakes are generally ragged, little chloritized, and commonly form in clotted intergrowths with hornblende and epidote. Plagioclase is complexly zoned and locally saussuritized. Microcline is finely perthitic, and occurs interstitially, and as discrete crystals and small megacrysts (1%). Primary epidote is ubiquitous.

The rock is from a lobate granitic body (Stairway Glacier pluton), which discordantly intruded and contact metamorphosed, late Paleozoic argillite and siltstone (Alexander Terrane). On the basis of composition, intrusive type, and this age pair, it is grouped with the Saint Elias plutonic suite.

K-Ar no. 2602 Biotite, K-Ar age **135 ± 5 Ma**

K = 7.00%, radiogenic Ar = 3.814 x 10^{-5} cm^3/g, atmos. Ar = 10.9%.

Concentrate: Relative clean, fresh and unaltered, orange brown biotite, with a slight trace of chlorite contamination.

From diorite

(115A) Same locality and details as for K-Ar no. 2512. Sample 435-CAd-74-1, collected and interpreted by C.J. Dodds.

See K-Ar no. 2603 for description and interpretation.

K-Ar no. 2603 Hornblende, K-Ar age **142 ± 6 Ma**

K = 0.945%, radiogenic Ar = 5.426 x 10^{-6} cm^3/g, atmos. Ar = 14.1%.

Concentrate: Clean, fresh and unaltered, pleochroic, olive brown to yellow green hornblende, with no visible contamination.

From diorite

(115A) Details as for K-Ar no. 2602.

The rock is a dark grey, coarse medium grained, homogeneous, clinopyroxene biotite hornblende diorite. It consists of quartz (1.3%), plagioclase (47%), clinopyroxene (7%), biotite (16%), hornblende (20%), opaque ore(s) (3.4%), apatite (2%) and sphene (1.3%). Accessories include epidote, calcite, chlorite and rare zircon. Biotite is ragged; clinopyroxene commonly forms cores in hornblende.

It is a grab sample from Shaft Creek pluton, and is from the same location as K-Ar no. 2512. Locally there, this diorite phase is intruded and veined by the porphyritic quartz monzonite. This elongate body is reported (Kindle, 1953) to be composed mainly of porphyritic hornblende granite with minor granodiorite and diorite. In part it discordantly intruded greywacke, laminated carbonate and limestone of early to mid-Paleozoic age (Alexander Terrane). However, much of its southwest edge may be faulted. The pluton is nonconformably overlain by Paleogene fluvial sediments and Neogene Wrangell lava.

This body is lithologically similar to others grouped with the Saint Elias plutonic suite. These ages are further evidence for this.

K-Ar no. 2604 Biotite, K-Ar age **128 ± 5 Ma**

K = 7.59%, radiogenic Ar = 3.913 x 10^{-5} cm^3/g, atmos. Ar = 7.9%.

Concentrate: Clean, fresh and unaltered, greenish brown biotite, with no visible contamination.

From granodiorite

(115B) At 1524 m (5000 ft.), SE side of lower Kaskawulsh Glacier, approx. 7 km W of Mt. Maxwell, Mt. St. Elias map area, Yukon, 60°44'20"N, 138°44'36"W. Map unit JKgd, Geological Survey of Canada Open File 830. Sample 441-CAd-74-1, collected and interpreted by C.J. Dodds.

See K-Ar no. 2605 for description and interpretation.

K-Ar no. 2605 Hornblende, K-Ar age **140 ± 7 Ma**

K = 0.95%, radiogenic Ar = 5.375 x 10^{-6} cm^3/g, atmos. Ar = 17.0%.

Concentrate: Clean, fresh and unaltered, pleochroic, green to brown hornblende, with no visible contamination.

From granodiorite

(115B) Details as for K-Ar no. 2604.

The rock is a light to mid grey, very weakly foliated, homogeneous coarse medium grained biotite hornblende granodiorite. It is composed of quartz (26%), plagioclase (46%), microcline (10%), biotite (5.5%), hornblende (9%), epidote (2%), and accessory sphene, apatite, and opaque ore(s). Biotite is undeformed, commonly euhedral, and unaltered. Hornblende is subhedral and little deformed or altered. Plagioclase is sporadically saussuritized and complexly zoned. Microcline is fresh, and occurs both interstitially and as discrete crystals. Epidote is plentiful and primary.

The specimen is from Mt. Maxwell pluton, which discordantly intruded and thermally metamorphosed, low greenschist-grade early Paleozoic and younger clastic sediments (Alexander Terrane). The pluton is typical of the Saint Elias suite in the lower parts of the Icefield Ranges. This biotite-hornblende age pair substantiates this.

K-Ar no. 2606 Hornblende, K-Ar age **141 ± 6 Ma**

K = 0.680%, radiogenic Ar = 3.876 x 10^{-6} cm^3/g, atmos. Ar = 17.6%.

Concentrate: Clean, fresh and unaltered, pleochroic, olive green to dark green hornblende, with no visible contamination.

From quartz monzonite/granodiorite

(115B) At 2011 m (6600 ft.) on ridge top between lower Dusty and Lowell Glaciers, approx. 6.5 km S of start of Dusty River, Mt. St. Elias map area, Yukon, 60°22'56"N, 138°08'27"W. Map unit JKg, Geological Survey of Canada Open File 830. Sample 436-CAd-74-1, collected and interpreted by C.J. Dodds.

The rock is a light grey, homogeneous, fine coarse grained, porphyritic biotite hornblende quartz monzonite/granodiorite. It consists of quartz (20%); slightly saussuritized, subhedral andesine (48%); interstitial and euhedral, megacrystic orthoclase (25%); ragged, chloritized biotite (4%); and fresh, subhedral hornblende (7%). Large (to 2.5 cm), euhedral, simple twinned pink, orthoclase megacrysts (8%) characterize this phase. Accessories include chlorite, sphene, opaque ore(s), and zircon.

The specimen is a grab sample from a granitic body of largely unknown composition, outcropping south of lower Dusty Glacier. It is probably the southern extension of Snowshoe batholith, and may be fault offset. On the basis of lithology and this hornblende age, it is grouped with the Saint Elias plutonic suite. It is emplaced in fine clastic sediments of questionable late Paleozoic age (Alexander Terrane).

K-Ar no. 2612 Hornblende, K-Ar age **159 ± 22 Ma***

K = 0.115%, radiogenic Ar = 7.430 x 10^{-7} cm^3/g, atmos. Ar = 69.3%.

Concentrate: Light greenish brown, non pleochroic hornblende, with a trace of chlorite contamination.

From gabbro/diorite

(115B) At 1493 m (4900 ft.), N side Silver Creek, Mt. St. Elias map area, Yukon, 60°55'06"N, 138°21'05"W. Sample MV-74-197, collected by J.W.H. Monger and interpreted by C.J. Dodds.

The sample is from a small gabbro-diorite body intruding very complexly folded and faulted late Paleozoic and (?) younger sediments and volcanics close to Duke River Fault. These rocks are a "mélange" of Alexander Terrane and Wrangellia, W2. Structural complexity results from the combined transcurrent activity along Duke River and Denali faults. Based on this hornblende age, the body is included with the Late Jurassic to earliest Cretaceous Saint Elias suite.

K-Ar no. 2889 Hornblende, K-Ar age **159 ± 8 Ma**

K = 0.558%, radiogenic Ar = 3.605 x 10^{-6} cm^3/g, atmos. Ar = 25.8%.

Concentrate: Clean, fresh, pleochroic brown to green hornblende, with no visible contamination.

From quartz diorite

(115C) At 2286 m (7500 ft.), 3 km to approx. E of location of sample 112-CAc-77-1, Mt. St. Elias map area, Yukon, 60°47'16"N, 140°14'03"W. Map unit JKg, Geological Survey of Canada Open File 830. Sample 110-CAc-77-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a fresh, darkish grey, weakly foliated, homogeneous, coarse medium grained biotite hornblende quartz diorite. The mafics include stout, well shaped, prisms of hornblende (25%), some cored by clinopyroxene, and clusters of ragged, chloritized and deformed biotite (5%). The remainder of the rock consists chiefly of slightly altered calcic plagioclase, with minor interstitial microcline and quartz, and accessory opaque ore(s), apatite, epidote and sphene. It is from the same pluton as K-Ar no. 2891.

See K-Ar no. 2891 for interpretation.

K-Ar no. 2890 Biotite, K-Ar age **156 ± 6 Ma**

K = 6.03%, radiogenic Ar = 3.819 x 10^{-5} cm^3/g, atmos. Ar = 4.9%.

Concentrate: Brown biotite, with approximately 15% chlorite alteration.

From granodiorite

(115C) At 2316 m (7600 ft.), just east of divide (N side) of Logan and Hubbard Gl., and 16 km NE McArthur Peak, Mt. St. Elias map area, Yukon, 60°43.1'N, 140°02'W. Map unit JKg, Geological Survey of Canada Open File 830. Sample 16-CAc-77-1 collected by R.B. Campbell and interpreted by C.J. Dodds.

See K-Ar no. 2891 for description and interpretation.

K-Ar no. 2891 Hornblende, K-Ar age **150 ± 11 Ma**

K = 0.77%, radiogenic Ar = 4.681 x 10^{-6} cm^3/g, atmos. Ar = 16.0%.

Concentrate: Clean, unaltered, pleochroic, brown to dark green hornblende, with no visible contamination.

From granodiorite.

(115C) Details as for K-Ar no. 2890

The rock is a mildly deformed, slightly foliated, fairly homogeneous, pinkish grey, medium grained biotite hornblende granodiorite. Mafic minerals consist of subhedral, slightly corroded hornblende (12%) and somewhat chloritized biotite (8%). Biotite intergrowth in hornblende is common. Felsic minerals include complexly zoned plagioclase, interstitial microcline and strained quartz. Accessories are of opaques, sphene, apatite, epidote, and fine zircon.

The specimen is from the southeast corner of Logan Glacier pluton, a multiphase granitic body. It occurs between the upper parts of the Logan and Walsh Glaciers and is composed of quartz diorite, diorite, granodiorite and porphyritic quartz monzonite-granodiorite. Little is known of the overall distribution and relationships of these phases. The body is emplaced mainly in limestones of Silurian to Devonian age (Alexander Terrane). Its western extremities adjoin and intrude volcaniclastics and argillites of the Pennsylvanian to Early Permian Skolai Group (Wrangellia, Wl). The Hubbard Fault (the bounding fault between these two terranes) is apparently cut by the northwestern most part of this pluton.

The four samples from granodiorite, quartz diorite, and diorite phases of this pluton all yield very consistent Late Jurassic ages (150-159 Ma). On this basis it is grouped with the Saint Elias plutonic suite. Motion on this part of Hubbard Fault, is apparently pre Late Jurassic.

K-Ar no. 2892 Biotite, K-Ar age **35.8 ± 2.1 Ma**

K = 6.76%, radiogenic Ar = 9.500 x 10^{-6} cm^3/g, atmos. Ar = 20.5%.

Concentrate: Light brown biotite, with approximately 2% chlorite alteration.

From quartz diorite

(115C) From moraine on low ridge near head of Libbey Glacier, some 9 km due S of the summit of Mt. St. Elias, Alaska, 60°12.9'N, 140°56.1'W. Sample 138-CAc-77-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

See K-Ar no. 2893(2) for description and K-Ar no. 3066 for interpretation.

2893 K-Ar no. 2893(2) Hornblende, K-Ar age **60.5 ± 8.2 Ma** **63.6 ± 8.7**

K = 0.38%, radiogenic Ar = $\frac{9.087 \times 10^{-7}}{9.561 \times 10^{-7}}$ cm^3/g

atmos. Ar = $\frac{56.3}{57.1}$ %

Concentrate: Clean, unaltered, pleochroic, brown to green hornblende with no visible contamination.

From quartz diorite

(115C) Details as for K-Ar no. 2892.

The rock is a fresh, medium grey, homogeneous, medium grained biotite hornblende quartz diorite. It consists of fresh, unaltered, subhedral hornblende (15%), subhedral slightly chloritized biotite (5%), complexly zoned plagoclase, and minor quartz, with accessory opaque ore(s), sphene, epidote, apatite, and rare zircon. Minor (<1%) rounded, elongate, ghosted, hornblende-rich xenoliths are present. The rock is from moraine debris shedding from a small pluton which occurs at an elevation of about 3960 m (13,000 ft.) on the precipitous, 4267 m (14,000 ft.), south face of Mt. St. Elias.

See K-Ar no. 3066 for interpretation.

K-Ar no. 2895 Biotite, K-Ar age **50.0 ± 2.4 Ma**

K = 7.37%, radiogenic Ar = 1.452 x 10^{-5} cm^3/g, atmos. Ar = 17.2%.

Concentrate: Brownish orange biotite, with approximately 3% chloritic alteration.

From tonalite

(115C) Nunatak, Quintino Sella Glacier, some 12.5 km WNW of King Peak, Mt. St. Elias map area, Yukon, 60°36.3'N, 140°51.9'W. Map unit lTg, Geological Survey of Canada Open File 830. Sample 106-CAc-77-1 collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a light grey, weakly foliated, fresh medium grained biotite tonalite. It comprises mildly chloritized and bent, clustered flakes of biotite (10%), stout, subhedral, complexly zoned plagioclase, quartz, rarer interstitial K-feldspar, with accessory, apatite, opaque ore(s) and zircon. It is from a granitic body which forms part of one or more narrow, lobate pluton(s) occurring along the northern headwalls of Quintino Sella Glacier, and underlying King Peak and part of the precipitous southwest flank of Mt. Logan massif.

The King Peak pluton is emplaced in metasediments considered equivalent to the Cretaceous Valdez Group. It is one of several plutons of Eocene or older age which occur in Chugach Terrane and is grouped with the Seward plutonic suite. Two

segments of this pluton crosscut the Border Ranges Fault indicating that motion on this part of the fault is pre-Eocene.

K-Ar no. 2896 Hornblende, K-Ar age **153 ± 7 Ma**

K = 0.98%, radiogenic Ar = 6.082 x 10^{-6} cm^3/g, atmos. Ar = 12.1%.

Concentrate: Clean, unaltered, pleochroic, brown to dark green hornblende, with no visible contamination.

From quartz diorite

(115C) At 2468 m (8100 ft.) on narrow (N-S) ridge near head of Logan Glacier, 4.5 km NW McArthur Peak, Mt. St. Elias map area, Yukon, 60°38.3'N, 140°15.2'W. Map unit JKg, Geological Survey of Canada Open File 830. Sample 45-CAc-77-1 collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a grey, well foliated, coarse medium grained biotite hornblende quartz diorite. It consists of deformed, stout, occasionally clinopyroxene cored hornblende (18%), ragged, chloritized biotite (6%), andesine, rarer quartz and accessory, apatite, opaque ore(s), epidote, and rare sphene and zircon. Biotite intergrowth in hornblende is common.

The sample is from a large elongate batholithic complex which underlies much of the Mt. Logan massif. Due to extreme, rugged relief, high elevation and abundant ice-cover, very little is known of its composition. The southern edge of this granitic body is marked by Border Ranges Fault which juxtaposes metamorphosed flyschoid rocks considered Cretaceous (Chugach Terrane). To the north contacts are concealed by Logan Glacier. However, late Paleozoic to early Mesozoic sedimentary and volcaniclastic- volcanic rocks (Wrangellia, W1) outcrop in vicinity of Logan and Walsh glaciers. From this, Mt. Logan batholith is considered to lie in a segment of Wrangellia, W1 separated to south from Chugach Terrane by Border Ranges Fault and to the north from Alexander Terrane by Hubbard Fault. It is grouped with the Saint Elias plutonic suite on the basis of this age.

K-Ar no. 2903 Hornblende, K-Ar age **147 ± 8 Ma**

K = 0.558%, radiogenic Ar = 3.322 x 10^{-6} cm^3/g, atmos. Ar = 27.0%.

Concentrate: Clean, unaltered, pleochroic, green to yellowish green hornblende, with no visible contamination.

From granodiorite

(115C) Upper reaches of Logan Glacier (NE side), at 2286 m (7500 ft.), 8.5 km approximately N of McArthur Peak, Mt. St. Elias map area, Yukon, 60°40.8'N, 140°10.1'W. Map unit JKgd, Geological Survey of Canada Open File 830. Sample 82-CAc-77-1 collected by R.B. Campbell interpreted by C.J. Dodds.

The rock is a grey, fairly fresh, homogeneous, medium grained biotite hornblende granodiorite. It contains unaltered, subhedral hornblende (7%), highly chloritized biotite (5%), saussuritized andesine, orthoclase, anhedral quartz, with accessory epidote, sphene, opaque ore(s), apatite and zircon.

The sample is from moraine debris shedded from a fairly narrow, sill-like body of quartz diorite and granodiorite east of the Mt. Logan massif (see also K-Ar no. 2904). The pluton is emplaced mainly in carbonates (Silurian-Devonian), but may locally intrude volcaniclastics of Skolai Group. It is included with the Saint Elias plutonic suite.

K-Ar no. 2904 Hornblende, K-Ar age **132 ± 9 Ma**

K = 0.86%, radiogenic Ar = 4.578 x 10^{-6} cm^3/g, atmos. Ar = 12.7%.

Concentrate: Clean, unaltered, pleochroic, yellowish green to green hornblende, with no visible contamination.

From granodiorite/quartz diorite

(115B) E side of upper Hubbard Glacier at 2286 m (7500 ft.), 7 km NW of Mt. King George, Mt. St. Elias map area, Yukon, 60°34.3'N, 139°53'W. Map unit JKqd, Geological Survey of Canada Open File 830. Sample 33-CAc-77-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a fresh, grey, medium grained, weakly foliated, biotite hornblende granodiorite/quartz diorite. Mafics include stout, subhedral, hornblende (15%) and subhedral, chloritized biotite (5%). It is from a granitic body, similar in shape and lithology to that sampled for K-Ar no. 2903, and possibly the southeast extension of that body. Although they are directly aligned, any possible physical connection between them is obscured by Hubbard Glacier.

If these bodies are indeed one and the same, it is not fully corroborated by the two hornblende ages (K-Ar no. 2903 yielded 147 ± 8 Ma). Tentatively, however, they are treated here as a single pluton (Hubbard Glacier pluton), and on the basis of both lithology and age, grouped with the Saint Elias suite.

K-Ar no. 2905 Hornblende, K-Ar age **158 ± 7 Ma**

K = 0.757%, radiogenic Ar = 4.859 x 10^{-6} cm^3/g, atmos. Ar = 12.1%.

Concentrate: Clean, unaltered, pleochroic yellowish green to bluish green hornblende, with no visible contamination.

From leucocratic quartz monzonite/ granodiorite

(115F) N side of upper Chitina Glacier at 1828 m (6000ft.), about 14 km west northwest of Mt. Lucania, Kluane Lake map area, Yukon 61°02.6'N, 140°43.1'W. Map unit JKgd, Geological Survey of Canada Open File 829. Sample 102-CAc-77-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a light grey, unfoliated, fairly equigranular, fine medium grained hornblende biotite quartz monzonite/granodiorite. It contains moderately chloritized biotite (3%), fresh subhedral hornblende (1%), fresh interstitial

microcline, finely saussuritized plagioclase, strained anhedral quartz, and accessory epidote, apatite, sphene, opaque ore(s), and zircon. It is weakly deformed and mildly altered.

The specimen is from Ham pluton which forms a discrete light grey weathering body at the western edge of and is included within Chitina Glacier batholith (see K-Ar no. 2911(3)). On an age basis it is grouped with the Saint Elias plutonic suite. It occurs within Alexander Terrane.

K-Ar no. 2909 Biotite, K-Ar age **8.4 ± 0.6 Ma**

K = 7.5%, radiogenic Ar = 2.454 x 10^{-6} cm^3/g, atmos. Ar = 38.7%.

Concentrate: Dark brown biotite, with approximately 5% chloritic alteration.

From granodiorite

(115F) At foot of E ridge Mt. Steele, at 2560 m (8400 ft.), approx. 5.5 km ENE of the summit, Kluane Lake map area, Yukon, 61°06'14"N, 140°13'02"W. Map unit Mg, Geological Survey of Canada Open File 829. Sample 100-CAc-77-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

See K-Ar no. 2910 for description and interpretation.

K-Ar no. 2910 Hornblende, K-Ar age **8.4 ± 3.2 Ma**

K = 0.38%, radiogenic Ar = 1.244 x 10^{-7} cm^3/g, atmos. Ar = 88.4%.

Concentrate: Unaltered, pleochroic, green to brown hornblende, with no visible contamination.

From granodiorite

(115F) Details as for K-Ar no. 2909.

The rock is a light creamy grey, fresh, undeformed, homogeneous, unfoliated, medium grained hornblende biotite granodiorite. It contains fresh subhedral biotite (5%), somewhat corroded prisms of hornblende (3%), complexly zoned plagioclase, cloudy orthoclase, plentiful quartz, and accessory opaque ore(s), apatite, sphene and zircon. Texturally it is hypidiomorphic-granular.

The specimen is from a light grey weathering pluton which may underlie much of the Mt. Steele massif. Due to extensive ice cover, and high, rugged relief, however, the extent, overall composition, and intrusive relationships of the granitic body are largely unknown. A major fault is located just to the northeast of Mounts Wood, Steele, and Walsh. The dramatic rise in relief of these massifs and the apparent truncation of almost flat-lying Neogene Wrangell lava to the northeast, suggests considerable southwest uplift by this fault. The rock is from some 2438 m (8000 ft.) below the summit of Mt. Steele, in the upper plate of the fault. It yields a surprisingly young and concordant age pair.

As very young tectonism affected Saint Elias Mountains (Souther and Stanciu, 1975; Eisbacher and Hopkins, 1977), this late Miocene age could be the real age of pluton emplacement. The body may represent a deeper level, plutonic phase of subvolcanics apparently present in Mt. Steele (K-Ar no. 2542) and known to occur to the northwest, both of which have been exhumed by the fault. Alternatively, the age pair may reflect an uplift and/or reset date resulting from young faulting and possibly related subvolcanic intrusion.

Although sparse field observations indicate that Mt. Steele pluton is lithologically similar to many granitic bodies grouped with the Saint Elias plutonic suite, on the basis of this age pair it is tentatively included with the Wrangell plutonic suite. It is emplaced in mid-Paleozoic carbonates (Alexander Terrane).

K-Ar no. 2911(3) Hornblende, K-Ar age **153 ± 11 Ma**

K = 0.81%, radiogenic Ar = 5.027 x 10^{-6} cm^3/g, atmos. Ar = 20.8%.

Concentrate: Fresh, pleochroic bluish green to pale yellowish green hornblende, with no visible contamination.

From quartz monzonite

(115F) N side upper Chitina Glacier, at 2377 m (7800 ft.), some 7.5 km NW of Mt. Lucania, Kluane Lake map area, Yukon, 61°04'16"N, 140°33'06"W. Map unit JKg, Geological Survey of Canada Open File 829. Sample 101-CAc-77-1 collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a light grey, weakly foliated, fresh, coarse medium grained porphyritic biotite hornblende quartz monzonite. It consists of fresh, stout, slightly corroded prisms of hornblende (10%), scarce (<1%) chloritized biotite, fresh plagioclase, stout microcline, and quartz with accessory sphene, apatite and opaque(s). Megacrysts (4%) are of K-feldspar (?microcline).

The sample is from Mt. Lucania pluton, a poorly understood and delineated dark green grey veined agmatite complex. It is from the more leucocratic veining within this body. This complex together with Mt. Steele and Ham plutons form Chitina Glacier batholith. Little is known of the composition and intrusive relationships within this batholithic complex, which appears to underlie much of the very high, rugged, extensively ice covered massifs of Mts. Wood, Slaggard, Steele and Lucania. It is emplaced in Alexander Terrane.

Mt. Lucania pluton is similar to those grouped with the Icefield Ranges plutonic suite, however due to this hornblende age it has been included with the Saint Elias suite.

K-Ar no. 2929 Biotite, K-Ar age **48.7 ± 2.7 Ma**

K = 6.64%, radiogenic Ar = 1.274 x 10^{-5} cm^3/g, atmos. Ar = 22.4%.

Concentrate: Light brownish orange biotite, with approximately 10-15% chlorite alteration.

From granitoid gneiss

(115C) At 2133 m (7000 ft.), north side Seward Glacier, 13.5 km SE of King Peak and 11.9 km SSW of summit Mt. Logan, Mt. St. Elias map area, Yukon, 60°28.7'N, 140°31.0'W. Map unit KVgn, Geological Survey of Canada Open

File 830. Sample 51-CAc-77-1 collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a yellow-orange buff weathering, well-foliated, medium grained biotite granitoid gneiss. Mafic and felsic-rich components are thinly and fairly distinctly segregated. Mafics are entirely of slightly deformed, and moderately chloritized biotite. Felsics include variably sized and saussuritized plagioclase, cloudy potash-feldspar and partially recrystallized quartz. Accessories comprise muscovite, apatite, opaque ore(s), and zircon.

The sample is from a series of brown weathering schists and granitoid gneisses which are locally intruded by granitic dykes, sills and small plutons, and occur along the north and northeast sides of the icefields of upper Seward Glacier. These form part of a belt of south and southwestward prograding metamorphic rocks, bounded by Columbus and Border Ranges faults, which are believed correlative with flyschoid sediments of Valdez Group (Chugach Terrane). This Eocene metamorphic age is very similar to ages from plutons within parts of this belt and other segments of Chugach Terrane.

K-Ar no. 2930 Biotite, K-Ar age **146 ± 4 Ma**

K = 6.94%, radiogenic Ar = 4.102 x 10^{-5} cm^3/g, atmos. Ar = 6.3%.

Concentrate: Brown biotite, with approximately 3% chloritic alteration.

From granodiorite

(115C) At 2438 m (8000 ft.) elevation, head of Dennis Glacier (NW side), 12.3 km east of Mt. Newfoundland, Mt. St. Elias map area, Yukon, 60°58.7'N, 140°19.7'W. Map unit JKg, Geological Survey of Canada Open File 830. Sample 118-CAc-77-1 collected by R.B. Campbell and interpreted by C.J. Dodds.

See K-Ar no. 2931 for description and interpretation.

K-Ar no. 2931 Hornblende, K-Ar age **149 ± 14 Ma**

K = 0.54%, radiogenic Ar = 3.260 x 10^{-6} cm^3/g, atmos. Ar = 20.4%.

Concentrate: Clean, unaltered, pleochroic, brown to green hornblende, with no visible contamination.

From granodiorite

(115C) Details as for K-Ar no. 2930.

The rock is a light medium grey, homogeneous, fresh, medium grained hornblende biotite granodiorite. It consists of moderately saussuritized plagioclase, microcline, orthoclase, quartz, subhedral biotite (7%) scarce hornblende (1%), with accessory sphene, apatite, epidote and opaque ore(s). Texturally it is hypidiomorphic-granular and is only weakly deformed and altered.

It is from Mt. Lucania pluton (see K-Ar no. 2911(3)). This concordant pair is further indication that much of the southwest segments of Chitina Glacier batholith are part of the Late Jurassic-earliest Cretaceous Saint Elias plutonic suite.

K-Ar no. 2932 Biotite, K-Ar age **144 ± 4 Ma**

K = 6.01%, radiogenic Ar = 3.502 x 10^{-5} cm^3/g, atmos. Ar = 8.0%.

Concentrate: Brown biotite, with approximately 10% chlorite alteration.

From quartz monzonite

(115F) At 2895 m (9500 ft.) elevation at head of Spring Glacier (SE side), 3 km NW of Mt. Walsh and 16 km SE of Mt. Steele, Kluane Lake map area, Yukon, 61°01.5'N, 140°02.9'W. Map unit JKqm, Geological Survey of Canada Open File 829. Sample 164-CAc-77-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

See K-Ar no. 2933 for description and interpretation.

K-Ar no. 2933 Hornblende, K-Ar age **147 ± 10 Ma**

K = 0.84%, radiogenic Ar = 5.000 x 10^{-6} cm^3/g, atmos. Ar = 12.3%.

Concentrate: Clean, unaltered, pleochroic, brown to dark green hornblende, with no visible contamination.

From quartz monzonite

(115F) Details as for K-Ar no. 2932.

The sample is of a fresh light grey, homogenous, medium grained, porphyritic biotite hornblende quartz monzonite. It contains distinctive pinkish, subhedral, simple twinned, orthoclase megacrysts (6%) up to 1 cm. Subhedral, fresh hornblende (4%), somewhat chloritized and ragged biotite (2%), weakly saussuritized andesine, anhedral orthoclase (rarer microcline), and anhedral quartz comprise the matrix.

The rock is from a pluton in the vicinity of Mt. Walsh which is emplaced in a thick, deformed sequence of carbonates considered Silurian-Devonian in age (Alexander Terrane). The Mt. Walsh pluton is grouped with Saint Elias suite.

K-Ar no. 2934 Hornblende, K-Ar age **139 ± 12 Ma**

K = 0.61%; radiogenic Ar = 3.426 x 10^{-6} cm^3/g, atmos. Ar = 63.2%.

Concentrate: Clean, unaltered, pleochroic, brown to dark green hornblende, with no visible contamination.

From diorite

(115F) At 2286 m (7500 ft.), 12.5 km ESE of Mt. Lucania, and 12 km W of Mt. Walsh, Kluane Lake map area, Yukon, 61°00.4'N, 140°15.2'W. Map unit MTg, Geological Survey of Canada Open File 829. Sample 90-CAc-77-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a darkish grey, homogeneous, medium grained hornblende biotite diorite. It consists of complexly zoned plagioclase, chloritized and deformed biotite (13%), subhedral

hornblende (10%), minor quartz, rarer K-feldspar, and accessory sphene, epidote, apatite, and opaque ore(s).

It is from a small nunatak considered to be part of Mt. Lucania pluton. From this age, and those of K-Ar no. 2911(3), 2930, 2931, this pluton is included with the Saint Elias suite.

K-Ar no. 2935 Biotite, K-Ar age **270 ± 9 Ma**

K = 7.07%, radiogenic Ar = 8.004 x 10^{-5} cm^3/g, atmos. Ar = 2.6%.

Concentrate: Dark brown biotite, with approximately 6% chlorite alteration.

From quartz monzonite

(115B) At 1676 m (5500 ft.), near head of Fisher Glacier, some 25 km SSE of Mt. Seattle, Mt. St. Elias map area, Yukon, 60°03'N, 138°45.6'W. Map unit PPqm, Geological Survey of Canada Open File 830. Sample 155-CAc-77-1 collected by R.B. Campbell and interpreted by C.J. Dodds.

See K-Ar no. 2936 for description and interpretation.

K-Ar no. 2936 Hornblende, K-Ar age **290 ± 15 Ma**

K = 0.559%, radiogenic Ar = 6.836 x 10^{-6} cm^3/g, atmos. Ar = 15.2%.

Concentrate: Clean, unaltered, pleochroic, brown to dark green hornblende, with no visible contamination.

From quartz monzonite

(115B) Details as for K-Ar no. 2935.

The rock is a light buff grey, homogeneous, equigranular, medium grained hornblende biotite quartz monzonite. Mafics are of mildly deformed and chloritized biotite (5%), and fresh, subhedral hornblende (1%). Felsic minerals include subhedral, mildly saussuritized and complexly zoned plagioclase, cloudy, subhedral to anhedral orthoclase, and quartz. Accessories are of white mica, sphene, apatite, epidote, opaque ore(s) and rare zircon.

This specimen is from Fisher pluton, a discordant body intruding dark argillite and siltstone considered possibly to be mainly late Paleozoic and younger (Alexander Terrane). Lithologically this and Steele Glacier pluton (see K-Ar no. 2557, no. 2558) are not typical of the 270-290 Ma suite. Both are more characteristic of the Saint Elias plutonic suite. However, on the basis of this unexpected, fairly concordant age pair, this pluton is grouped with the Icefield Ranges plutonic suite.

K-Ar no. 2937(2) Hornblende, K-Ar age **150 ± 10 Ma**

K = 0.91%, radiogenic Ar = 5.532 x 10^{-6} cm^3/g, atmos. Ar = 22.5%.

Concentrate: Clean, unaltered, pleochroic brown to dark green hornblende, with no visible contamination.

From quartz diorite

(115B) At 1676 m (5500 ft.) on small nunatak, NE side of Hubbard Glacier, 18.5 km SE of Mt. King George, Mt. St. Elias map area, Yukon, 60°25.4'N, 139°31.7'W. Map unit IPvs, Geological Survey of Canada Open File 830. Sample 6-CAc-77-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a dark grey, well foliated, medium grained biotite hornblende quartz diorite. Slightly chloritized and deformed hornblende (30%) and chloritized biotite (2%) comprise the mafics. Saussuritised plagioclase, anhedral quartz, and minor interstitial orthoclase and microcline constitute the felsics. Apatite, epidote, opaque ore(s) and zircon occur as accessories.

The sample is from an amphibolite-quartz diorite complex, poorly exposed in a small isolated nunatak. It is from the extreme southeast (exposed) end of a sequence of greenstone, amphibolite and metasedimentary rocks which underlie much of the massif and adjoining southeast ridges of Mt. King George. These rocks are believed to be early Paleozoic in age and occur within Alexander Terrane. Intrusion and metamorphism in this belt was considered to be possibly late Paleozoic in age.

This hornblende age is therefore somewhat surprising. It indicates for this area at least, that plutonism and possibly metamorphism is related to the Late Jurassic-earliest Cretaceous event.

K-Ar no. 2938 Biotite, K-Ar age **151 ± 5 Ma**

K = 6.84%, radiogenic Ar = 4.187 x 10^{-5} cm^3/g, atmos. Ar = 5%.

Concentrate: Clean, unaltered, brown biotite, with no visible contamination.

From granodiorite

(115B) At 2286 m (7500 ft.) on small nunatak, 11.75 km NW of Mt. Queen Mary, Mt. St. Elias map area, Yukon, 60°42.6'N, 139°51.9'W. Map unit JKg, Geological Survey of Canada Open File 830. Sample 13-CAc-77-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

See K-Ar no. 2939 for description and interpretation.

K-Ar no. 2939 Hornblende, K-Ar age **189 ± 10 Ma**

K = 0.581%, radiogenic Ar = 4.500 x 10^{-6} cm^3/g, atmos. Ar = 26.9%.

Concentrate: Slightly altered, pleochroic, brown to dark green hornblende.

From granodiorite

(115B) Details as for K-Ar no. 2938.

The rock is a light grey, fresh, coarse medium grained, porphyritic hornblende biotite granodiorite. It contains mildly chloritized, clotted subhedral hornblende (3%), weakly deformed, slightly chloritized biotite (4%), moderately saussuritized andesine, microcline, and quartz. Accessories include sphene, apatite, epidote, opaques, and rare zircon. The well shaped megacrysts are of potash feldspar (10%). It is from a small

nunatak some 7 km WSW of the site sampled for K-Ar no. 2593, but the relationships with this adjacent complex (270- 290 Ma suite) are concealed by ice.

The discordancy in the biotite, hornblende ages is enigmatic, and the reason(s) for it uncertain. Possibly the older hornblende age may be the result of excess argon. Lithologically this granitic body is very similar to some of the Saint Elias plutonic suite. Based on this and the biotite age, it is tentatively grouped with this suite.

K-Ar no. 2962(2) Hornblende, K-Ar age **364 ± 37 Ma**

K = 0.43%, radiogenic Ar = 6.741 x 10^{-6} cm^3/g, atmos. Ar = 32.5%.

Concentrate: Clean, unaltered, pleochroic, brown to light green hornblende, with no visible contamination.

From gabbro

(115F) At 2315 m (7600 ft.), 2 km NNE Mt. Constantine, approx. 7 km E of confluence of Klutlan and Brabazon glaciers, Kluane Lake map area, Yukon, 61°25.4'N, 140°33.1'W. Map unit Pb, Geological Survey of Canada Open File 829. Sample 126-CAc-77-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a fresh, medium grained, weakly foliated, hypidiomorphic-granular clinopyroxene hornblende gabbro from a gabbro, gabbro-pegmatite, diabase complex. The Mt. Constantine complex is faulted to the north against Pennsylvanian-Early Permian volcaniclastic and flow rocks of the Station Creek Formation (Wrangellia, W2). To the south it is separated from Siluro- Devonian carbonates (Alexander Terrane) by the Duke River Fault.

The complex is lithologically similar to the Steele Creek complex described by Read and Monger (1976). Field evidence reported by them indicates the complex to be pre-Permian and they suggested that it is possibly the basement for the Station Creek Formation. This mid-Paleozoic hornblende age concurs with the field relationships.

K-Ar no. 2963 Biotite, K-Ar age **108 ± 4 Ma**

K = 7.44%, radiogenic Ar = 3.219 x 10^{-5} cm^3/g, atmos. Ar = 19.3%.

Concentrate: Brown biotite, with approximately 2% chloritic alteration.

From quartz diorite

(115G) Lake shore on point at S end Kluane Lake, 8.2 km SE of Mt. Wallace and 9 km NW of Outpost Mountain, Kluane Lake map area, Yukon, 61°00.3'N, 138°27.2'W. Map unit Kdi, Geological Survey of Canada Open File 829. Samples 359-CAd-77-1 collected and interpreted by C.J. Dodds.

See K-Ar no. 2964 for description and interpretation.

K-Ar no. 2964 Hornblende, K-Ar age **109 ± 8 Ma**

K = 0.82%, radiogenic Ar = 3.581 x 10^{-6} cm^3/g, atmos. Ar = 67.3%.

Concentrate: Clean, unaltered, pleochroic, light yellow-green to dark green hornblende, with no visible contamination.

From quartz diorite

(115G) Details as for K-Ar no. 2963.

The rock is a fresh, medium grey, weakly foliated, homogeneous, medium grained biotite hornblende quartz diorite. It contains fresh subhedral hornblende (15%), weakly deformed and chloritized biotite (5%), mildly saussuritized plagioclase, and minor orthoclase and quartz.

The sample is from Outpost Mountain pluton, a fault bounded lensoid body composed of diorite and quartz diorite. It occurs in highly faulted and folded late Paleozoic-early Mesozoic volcanics and sediments (Wrangellia, W2) which are closely bounded by Duke River and Denali faults. It is grouped with the Kluane Ranges plutonic suite.

K-Ar no. 2967(2) Hornblende, K-Ar age **154 ± 12 Ma**

K = 0.72%, radiogenic Ar = 4.499 x 10^{-6} cm^3/g, atmos. Ar = 72.7%.

Concentrate: Clean, unaltered, pleochroic, pale to dark green hornblende, with no visible contamination.

From diorite

(115C) At 2286 m (7500 ft.), on north side upper Logan Glacier, 16 km N of McArthur Peak, Mt. St. Elias map area, Yukon, 60°44.7'N, 140°09.6'W. Map unit JKg, Geological Survey of Canada Open File 830. Sample 111-CAc-77-1 collected by R.B. Campbell and interpreted by C.J. Dodds.

The sample is of a fresh dark grey, homogeneous, medium grained, biotite hornblende diorite. Mafics consists of slender, randomly oriented, fresh, subhedral to euhedral prisms of hornblende (15%), and chloritized biotite (8%) which commonly forms as intergrowths in the hornblende. Felsic minerals are predominently of calcic plagioclase, with minor microcline and quartz. The rock is from the same pluton as K-Ar no. 2891.

See K-Ar no. 2891 for interpretation.

K-Ar no. 2973(2) Hornblende, K-Ar age **159 ± 11 Ma**

K = 0.83%, radiogenic Ar = 5.362 x 10^{-6} cm^3/g, atmos. Ar = 19.0%.

Concentrate: Clean, unaltered, pleochroic, brown to dark green hornblende, with no visible contamination.

From granodiorite

(115C) At 2286 m (7500 ft.), on NW edge of tributary glacier of upper Logan Glacier (N side), 21.5 km NNW McArthur Peak, Mt. St. Elias

map area, Yukon, 60° 47.5'N, 140°16.9'W. Map unit JKg, Geological Survey of Canada Open File 830. Sample 112-CAc-77-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The specimen is of a medium grey, fresh homogeneous, medium grained biotite hornblende granodiorite. The mafics comprise subhedral to anhedral mildly deformed and corroded hornblende (10%) and rare, chloritized, bent flakes of biotite (1%). Feldspars include mildly saussuritized plagioclase, orthoclase and microcline. Accessories are sphene, apatite, epidote and opaque ore(s). This rock is from the northwest extremity of the same pluton as K-Ar no. 2891.

See K-Ar no. 2891 for interpretation.

K-Ar no. 3055 Biotite, K-Ar age **32.0 ± 1.9 Ma**

K = 7.11%, radiogenic Ar = 8.922 x 10^{-6} cm^3/g, atmos. Ar = 22.5%.

Concentrate: Red brown, biotite, with approximately 4% chloritic alteration.

From quartz monzonite/granite

(1140) At approx. 762 m (2500 ft.), NW side unnamed glacier, 3.5 km SW of B.C./Alaska boundary near Alsek R., Yakutat map area, Alaska, 59°28.9'N, 138°09.2'W. Sample 53-CAc-78-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a light creamy grey, homogeneous, fine coarse grained, leucocratic, biotite quartz monzonite or granite. Biotite (5%) is sporadically deformed and chloritized. Plagioclase is fresh and complexly zoned. Microcline is unaltered and abundant. Accessories include apatite, opaque ore(s), rutile, and zircon. It is from Alsek River pluton.

See K-Ar no. 3087 for interpretation.

K-Ar no. 3056 Hornblende K-Ar age **27.4 ± 22.9 Ma**

K = 0.10%, radiogenic Ar = 1.070 x 10^{-7} cm^3/g, atmos. Ar = 96.3%.

Concentrate: Clean, unaltered, pleochroic, olive-green to light brown hornblende, with no visible contamination.

From gabbro/diorite

(115C) From talus at about 2743 m (9000 ft.), upper Newton Glacier (north side), Mt. St. Elias map area, Yukon, (?) 60°19'N, 140°50'W. Map unit lTg, Geological Survey of Canada Open File 830. Sample 69 APr-48A, collected by G. Plafker and interpreted by C.J. Dodds.

The rock is a mid- to dark-greenish grey, well foliated, fine coarse grained, homogeneous, hornblende gabbro/diorite. It consists of stubby, fresh, subhedral hornblende (35%), unaltered calcic plagioclase and minor quartz. The sample is from Mt. Newton pluton, a small wedge-shaped body which is emplaced in Cretaceous amphibolites within the upper plate of St. Elias Fault. It occurs in the same stratigraphy and tectonic setting as Mt. St. Elias pluton.

The large error factor, due to low potassium and radiogenic argon content, renders this hornblende age suspect. Mt. Newton pluton is very tentatively grouped with the plutons of Oligocene age.

K-Ar no. 3059(2) Biotite, K-Ar age **52.4 ± 1.8 Ma**

K = 6.17%, radiogenic Ar = 1.275 x 10^{-5} cm^3/g, atmos. Ar = 20.3%.

Concentrate: Relatively clean, unaltered, orange brown biotite, with a trace of hornblende contamination.

From granodiorite

(114P) At approx 1219 m (4000 ft.) above W side of tributary to Melbern Glacier, some 7 km S of confluence, Tatshenshini River map area, British Columbia, 59°21.6'N, 137°38.2'W. Map unit lTg, Geological Survey of Canada Open File 926. Sample 114-CAc-78-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a mid grey, homogeneous, equigranular, fine medium grained, porphyritic hornblende biotite granodiorite. Biotite (10%), and chloritized, yellowish green hornblende (8%) comprise the mafics. Quartz is plentiful. Plagioclase is fresh, complexly zoned, abundant and forms as small subhedral megacrysts (3%). K-feldspar is minor.

The sample is from Konamoxt Glacier pluton. It discordantly intruded and contact metamorphosed a sequence of metaflyschoid rocks. These rocks are considered equivalent to the Cretaceous Valdez Group (Chugach Terrane), and regional metamorphism is mainly sub- to low-greenschist grade. This pluton is grouped with the Seward plutonic suite.

K-Ar no. 3060 Hornblende, K-Ar age **156 ± 19 Ma**

K = 0.36%, radiogenic Ar = 2.280 x 10^{-6} cm^3/g, atmos. Ar = 32.4%.

Concentrate: Clean, unaltered, pleochroic, brown to green hornblende, with no visible contamination.

From quartz diorite

(114P) At 1371 m (4500 ft.), near toe of small glacier, some 6 km NNW of peak 2046 m (6715 ft.), Tatshenshini River map area, British Columbia, 59°40.7'N, 137°19.5'W. Map unit JKg, Geological Survey of Canada Open File 926. Sample 77-CAc-78-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a mid to dark greenish grey, homogeneous, equigranular, medium grained, hornblende quartz diorite. Mafics are entirely fresh subhedral, hornblende (40%). Plagioclase is very fresh, and commonly oscillatorily zoned. K-feldspar and quartz are minor. Accessories include opaque ore(s), apatite, epidote and sphene.

The sample is from Not Yet pluton, a discordant, lenticular shaped body that intruded and thermally metamorphosed a sequence of dark argillite and siltstone, believed late Paleozoic and/or earliest Mesozoic (Alexander Terrane). It is

included with the Saint Elias plutonic suite on the basis of this determination.

K-Ar no. 3061 Biotite, K-Ar age **67.9 ± 2.7 Ma**

K = 7.11%, radiogenic Ar = 1.912 x 10^{-5} cm^3/g, atmos. Ar = 17.8%.

Concentrate: Clean, unaltered, dark olive brown biotite, with no detected chlorite.

From granodiorite/quartz diorite

(114P) About 4.8 km E of Reilly Mountain, NE of Kelsall Lake, Tatshenshini River map area, British Columbia, 59°51.1'N, 136°21.9'W. Map unit KTg, Geological Survey of Canada Open File 926. Sample 90-CAc-78-1, collected by R.B. Campbell and interpretated by C.J. Dodds.

See K-Ar no. 3062 for description.

K-Ar no. 3062 Hornblende, K-Ar age **57.9 ± 3.7 Ma**

K = 1.08%, radiogenic Ar = 2.470 x 10^{-6} cm^3/g, atmos. Ar = 54.5%.

Concentrate: Clean, unaltered, pleochroic, dark green to yellowish green hornblende, with no visible contamination.

From granodiorite/quartz diorite

(114P) Details as for K-Ar no. 3061.

The rock is a mid to dark grey, fine coarse grained, weakly foliated, fairly homogeneous, porphyritic biotite hornblende granodiorite/quartz diorite. Megacrysts (up to 2 cm) are of hornblende (3%). Mafic minerals comprise mildly deformed and chloritized biotite (10%) and subhedral, fairly fresh hornblende (15%). Plagioclase forms stubby, subhedral, crystals and is little altered. Quartz is plentiful and K-feldspar minor. It is a grab sample from the northern part of the Coast Plutonic Complex.

K-Ar no. 3063(2) Biotite, K-Ar age **136 ± 5 Ma**

K = 7.31%, radiogenic Ar = 4.014 x 10^{-5} cm^3/g, atmos. Ar = 12.9%.

Concentrate: Clean, unaltered, brown biotite, with no detected chlorite.

From quartz diorite

(114P) At approx. 1524 m (5000 ft.), W of lower Tats Creek, Noisy Range, Tatshenshini River map area, British Columbia, 59°32.7'N, 137°31.1'W. Map unit JKg, Geological Survey of Canada Open File 926. Sample 80-CAc-78-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

See K-Ar #3064 for description and interpretation.

K-Ar no. 3064 Hornblende, K-Ar age **141 ± 8 Ma**

K = 1.18%, radiogenic Ar = 6.726 x 10^{-6} cm^3/g, atmos. Ar = 35.1%.

Concentrate: Clean, unaltered, pleochroic, brown to dark green, hornblende, with no visible contamination.

From quartz diorite

(114P) Details as for K-Ar no. 3063(2).

The rock is a waxy grey, very weakly foliated, fairly homogeneous, coarse grained, biotite hornblende quartz diorite. Mafics include deep brown biotite (7%) and subhedral, brown olive green hornblende (10%). Both are somehwat deformed, but are unaltered. Abundant calcic plagioclase is also deformed, but little altered. Quartz and K-feldspar are scarce. Apatite, sphene, epidote and opaque ore(s) form accessories.

The sample is from moraine debris shedding from Noisy Range batholith. Field data for this large, elongate batholith is scarce and its composition essentially unknown. The northeast edge of this body juxtaposes early to mid-Paleozoic laminated carbonate and limestone, and late Paleozoic and (?) younger argillite and siltstone (Alexander Terrane). The extreme south end of the batholith appears cut by Hubbard Fault. However, whether this fault bounds the southwest edge or is cut by this body is uncertain due to drift and ice cover.

It is included with the Saint Elias plutonic suite as a result of this concordant age pair.

K-Ar no. 3065 Biotite, K-Ar age **38.4 ± 2.2 Ma**

K = 5.85%, radiogenic Ar = 8.825 x 10^{-6} cm^3/g, atmos. Ar = 17.8%.

Concentrate: Dark brown biotite, with approximately 8% chlorite alteration.

From quartz diorite

(115C) Same location as for K-Ar no. 2892. Sample 31-CAc-78-1 collected by R.B. Campbell and interpreted by C.J. Dodds.

See K-Ar no. 3066 for description and interpretation.

K-Ar no. 3066 Hornblende, K-Ar age **67.2 ± 10.7 Ma**

K = 0.31%, radiogenic Ar = 8.250 x 10^{-7} cm^3/g, atmos. Ar = 68.8%.

Concentrate: Clean, unaltered, pleochroic, olive-green to pale green hornblende, with no visible contamination.

From quartz diorite

(115C) Details as for K-Ar no. 3065.

The sample is of a fresh, grey, homogeneous, medium grained biotite hornblende quartz diorite. It is from moraine debris very close to the site of sample 138-CAc-77-1 and was collected as a further, independent check of the age of Mt. St. Elias pluton. The rock is compositionally and texturally similar to the

previous sample, but is slightly more heterogeneous and mafic-rich. It contains hornblende (20%) and biotite (6%).

The first K-Ar determination on Mt. St. Elias pluton (Hudson et al., 1977) gave highly discordant biotite and hornblende dates of 87.2 ± 3 and 188 ± 6 Ma*. On the basis of the hornblende date, they assigned a Triassic age to this pluton. Since it occurs in amphibolitic rocks considered equivalent to Cretaceous volcanics (Valdez Group), this body was interpreted as being allochthonous. The considerable age discordancy, however, left doubt as to the true age, and the stratigraphic and tectonic setting of this pluton. Consequently, two independent samples from this body were run (this report). Check runs on the same concentrates of one of these samples (138-CAc-77-1) were made by United States Geological Survey (Menlo Park), and a rerun of the same hornblende concentrate (no biotite was available) from the sample of Hudson et al. (1977) by both GSC and USGS laboratories. All K-Ar data from Mt. St. Elias pluton are summarized below. Those of the United States Geological Survey are courtesy of M.A. Lanphere (pers. comm.).

From the contents of the table below, the earlier reported Triassic age is now proven erroneous. There is still, however, discordancy in the biotite and hornblende ages, and a difference in hornblende ages from a sample run by both labs. The consistently older hornblende ages are enigmatic. They could be attributed to host rock contamination, since this pluton intrudes amphibolite, and all three samples contained minor patchy and ghost inclusions of hornblende-rich material. However, they also could reflect excess argon.

Mt. St. Elias pluton is now interpreted as a high-level pluton of Eocene to (?) Paleocene age (Seward plutonic suite) emplaced in Cretaceous metavolcanics. These rocks are part of a north- to northwest-dipping, thrust-imbricated sequence which includes the St. Elias and Chaix Hills (thrust) faults. The amphibolites occur in the upper plate of the St. Elias Fault, and although these rocks are included in a small, separate terrane (Saint Elias Terrane) by Monger and Berg (1984), conceivably they also could be part of the Chugach Terrane. The lower plate is bounded to the south by Chaix Hills Fault. It contains complexly deformed thrust imbricates of flyschoid, metaflyschoid, and melange of Cretaceous age (Yakutat Group) and unmetamorphosed mainly shallow marine clastics of Paleogene and locally Neogene age, and forms part of the Yakutat Terrane (of Monger and Berg, 1984).

K-Ar no. 3067 Hornblende, K-Ar age **117 ± 11 Ma**

K = 0.57%, radiogenic Ar = 2.678 x 10^{-6} cm^3/g, atmos. Ar = 29.5%.

Concentrate: Clean, unaltered, pleochroic, bluish-green to yellowish-green hornblende, with no visible contamination.

From quartz diorite

(114P) At approx. 975 m (3200 ft.), E side Carroll Glacier, some 1.5 km N of B.C./Alaska boundary, Tatshenshini River map area,

Sample No.	Mineral	Age (Ma)	Lab./No.
138-CAc-77-1	biotite	35.8 ± 2.1	GSC (K-Ar no. 2892)
		34.7 ± 1.1	USGS (Menlo Park)
	hornblende	60.5 ± 8.2	GSC (K-Ar no. 2893)
		63.6 ± 8.7	GSC (K-Ar no. 2893(2))
		55.1 ± 1.8	USGS (Menlo Park)
31-CAc-78-1	biotite	38.4 ± 2.2	GSC (K-Ar no. 3065)
	hornblende	67.2 ± 10.7	GSC (K-Ar no. 3066)
69APr-54A	hornblende	56.1 ± 9.5	GSC
		54.1 ± 1.7	USGS (Menlo Park)

British Columbia, 59°10.5'N, 136°43.9'W. Map unit JKg, Geological Survey of Canada Open File 926. Sample 109-CAc-78-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a mid grey, homogeneous, fairly equigranular, medium grained, biotite hornblende quartz diorite. Biotite (10%) is deep brown, moderately deformed and chloritized. Hornblende (20%) is subhedral, and commonly cored by clinopyroxene. Plagioclase is oscillatorily zoned and spotted with saussuritic alteration. Quartz is minor, K-feldspar scarce.

The sample is from the northwest end of a large, elongate batholith outcropping mainly in southeastern Alaska. Its composition is not well documented. It intruded laminated carbonate, limestone and clastic rocks of (?) early and mid Paleozoic age.

This is one of only two granitic bodies (see K-Ar no. 2595) within Alexander Terrane in Saint Elias Mountains yielding ages somewhat younger than the 130-160 Ma range. Tentatively it is included with the Saint Elias plutonic suite.

K-Ar no. 3068 Biotite, K-Ar age **27.6 ± 1.3 Ma**

K = 7.02%, radiogenic Ar = 7.589 x 10^{-6} cm^3/g, atmos. Ar = 39.6%

Concentrate: Clean, unaltered, deep brown biotite, with no detected chlorite.

From granite

(114P) At approx. 1371 m (4500 ft.), SE side Samuel Glacier, close to head of North Fork O'Connor River, Tatshenshini River map area, British Columbia, 59°40.4'N, 136°47'W. Map unit Og, Geological Survey of Canada Open File 926. Sample 99-CAc-78-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a light pinkish grey, homogeneous, medium grained, hornblende biotite granite. Biotite (6%) is subhedral and very mildly chloritized; hornblende is rare. Abundant orthoclase is slightly altered; plagioclase is oscillatorily zoned, but fresh. Quartz is smoky grey, well rounded and plentiful.

The sample is from Samuel Glacier pluton. This granitic body is discordant, appears composite, and metamorphosed its host rocks along the contact. The latter comprise complexly deformed clastic and carbonate rocks of late Paleozoic and earliest Mesozoic age, and greenstone-gabbro-diorite complex of uncertain age (Alexander Terrane).

On the basis of lithology, intrusive type, and this biotite age, the pluton is grouped with the Oligocene, Tkope plutonic suite.

K-Ar no. 3070 Hornblende, K-Ar age **31.1 ± 2.8 Ma**

K = 0.665%, radiogenic Ar = 8.108 x 10^{-7} cm^3/g, atmos. Ar = 63.5%.

Concentrate: Clean, unaltered, pleochroic, light green to dark green hornblende, with no visible contamination.

From granite

(114P) At approx. 1158 m (3800 ft.),NW side of small glacier, some 6.5 km NE of upper Tkope River, Tatshenshini River map area, British Columbia, 59°30'N, 136°53.1'W. Map unit Ogr, Geological Survey of Canada Open File 926. Sample 30-CAc-78-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a light pinkish grey, homogeneous, fine medium grained, biotite hornblende granite. Biotite (2%) is orange brown, ragged and chloritized. Hornblende (3%) is corroded and somewhat chloritised. Abundant orthoclase is clouded with alteration; sodic plagioclase is fresher.

The sample is from Tkope River batholith. This elongate, multiphase, granitic body intruded and metamorphosed clastic, carbonate and locally volcanic rocks of Paleozoic and younger age (Alexander Terrane). It is composed of granite-quartz monzonite, with lesser microgabbro-gabbro, granodiorite, granodiorite porphyry, quartz diorite and granophyre.

The batholith has been examined in some detail by Jacobson et al. (1980). That study reported dates of 26.9 ± 0.9 Ma (K-Ar, hornblende from gabbro), 24.7 ± 0.9 Ma (K-Ar, biotite from quartz diorite), 26.6 ± 0.7 Ma and 25.6 ± 0.8 Ma (Rb-Sr, mineral isochrons from quartz diorite and granite) and 25.2 ± 2.8 Ma (fission track, zircon from quartz diorite). The biotite age (K-Ar no. 3107) and this hornblende determination are in close agreement. Collectively these dates indicate a Late Oligocene age for various phases of this batholith.

K-Ar no. 3071 Whole-rock, K-Ar age **128 ± 7 Ma**

K = 1.13%, radiogenic Ar = 5.826 x 10^{-6} cm^3/g, atmos. Ar = 16.9%.

Concentrate: Crushed whole-rock.

From pillow metabasalt

(114P) At 1402 m (4600 ft.), N side Tsirku Glacier, between Herbert and Boundary Glaciers, Tatshenshini River map area, British Columbia, 59°19.9'N, 136°30.1'W. Map unit Pv, Geological Survey of Canada Open File 926. Sample 105-CAc-78-1, collected by R.B. Campbell interpreted by C.J. Dodds.

The rock is a dark greenish grey, fine grained pillow metabasalt. It is from a single pillow. Abundant fine grained plagioclase still retain an original, mildly foliated, ophitic texture; primary mafics are largely replaced. However, greenschist-grade metamorphism has resulted in ubiquitous random fine new growth of actinolite and biotite, together with epidote, albite, calcite and quartz.

The sample is from near the base of a thick sequence of pillowed and massive basic volcanics with minor intercalated sediments (Alexander Terrane). These rocks are believed similar in age and lithology to Late Triassic and (?) younger volcanics east of Tats Glacier, in close proximity to the Windy Craggy massive sulphide deposit. This whole-rock date undoubtably reflects the age of metamorphism.

K-Ar no. 3075 Biotite, K-Ar age **149 ± 5 Ma**

K = 6.93%, radiogenic Ar = 4.184 x 10^{-5} cm^3/g, atmos. Ar = 9.8%.

Concentrate: Clean, unaltered brown biotite, with a trace of hornblende contamination.

From quartz diorite

(114O) At 1158 m (3800 ft.), W side of Vern Ritchie Glacier, some 11 km WNW Vern Ritchie Lake, Yakutat map area, British Columbia, 59°43.4'N, 138°13.1'W. Map unit JKg, Geological Survey of Canada Open File 927. Sample 115-CAc-78-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

See K-Ar no. 3076 for description and interpretation.

K-Ar no. 3076 Hornblende, K-Ar age **147 ± 14 Ma**

K = 0.54%, radiogenic Ar = 3.215 x 10^{-6} cm^3/g, atmos. Ar = 50.9%.

Concentrate: Clean, unaltered, pleochroic bluish to yellowish green hornblende, with no visible contamination.

From quartz diorite

(114O) Details as for K-Ar no. 3075

The rock is a medium grey, moderately foliated, fairly homogeneous, coarse medium grained, biotite hornblende quartz diorite. Mafics comprise very slightly chloritized, subhedral hornblende (16%) and slightly chloritized biotite (7%). Feldspars include complexly zoned plagioclase and rare orthoclase. Accessories are sphene, epidote, apatite and opaque ore(s).

The sample is from a large granitic body emplaced in limestone, marble, and amphibolite interpreted as mid- to early-Paleozoic (Alexander Terrane). Little is known of its composition. It is probably the northwest extension of Noisy Range batholith (see K-Ar no. 3063(2), and 3064), and is grouped with the Saint Elias plutonic suite on the basis of this concordant age pair.

K-Ar no. 3084 Hornblende, K-Ar age **237 ± 24 Ma**

K = 0.48%, radiogenic Ar = 4.725 x 10^{-6} cm^3/g, atmos. Ar = 12.3%.

Concentrate: Hornblende, pleochroic brown to bluish green, with a trace of chloritic alteration.

From granodiorite

(115A) At 1371 m (4500 ft.), small tributory of Pirate Creek, 9 km SSW of Dalton Post, Dezadeash map area, Yukon, 60°02'35"N, 137°03'46"W. Map unit Kg, Geological Survey of Canada Open File 831. Sample 55-CAj-78-7, collected by B. Jacobson and interpreted by C.J. Dodds.

The rock is a light creamy grey, homogeneous, equigranular, medium grained hornblende granodiorite. Mafics are entirely of subhedral to anhedral, greenish brown, mildly to moderately altered hornblende (5%). Alteration products include chlorite and a fine grained bluish green secondary amphibole. Quartz is plentiful. Feldspars are moderately to strongly saussuritized and sericitized. Accessories are opaque ore(s), apatite, epidote, and sphene.

The sample is from Mt. Beaton batholith, a very elongate, partly fault bounded, granitic body. It was reported by Kindle (1953) to be mainly granodiorite, with minor granite and diorite. The small batholith is emplaced in basaltic to andesitic volcanics and argillaceous rocks of Pennsylvanian to earliest Permian age. These rocks are considered part of Wrangellia (W2) and are closely bounded by Duke River and Denali faults.

Similar granitic bodies, grouped as the Kluane Ranges plutonic suite, occur to the northeast within this terrane. These intrusions consistently yield late Early Cretaceous ages, ranging 106- 117 Ma*. This hornblende age is therefore much older than anticipated, and could be the result of excess argon. But if real, it suggests the presence of a distinctly older plutonic event within this belt. However, no other ages comparable to this have been reported from granitic bodies within Saint Elias Mountains. Based on lithology alone this batholith is very tentatively grouped with the Kluane Ranges plutonic suite.

K-Ar no. 3086 Hornblende, K-Ar age **172 ± 23 Ma**

K = 0.33%, radiogenic Ar = 2.315 x 10^{-6} cm^3/g, atmos. Ar = 52.1%.

Concentrate: Relatively clean, unaltered, pleochroic, olive green to bluish green hornblende, with a trace of chlorite contamination.

From quartz diorite

(114O) At 487 m (1600 ft.), S. of toe of Battle Glacier, Yakutat map area, British Columbia, 59°36'04"N, 138°04'42"W. Map unit JKg, Geological Survey of Canada Open File 927. Sample 76-CAc-78-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a mid- to dark greenish grey, homogeneous, fine coarse grained biotite hornblende quartz diorite. Hornblende (35%) is subhedral, fresh and undeformed. Brown biotite (1%) is sporadically chloritized. Calcic plagioclase is slightly saussuritized and abundant; quartz is common.

See K-Ar no. 3090 for interpretation.

K-Ar no. 3087 Biotite, K-Ar age **32.8 ± 1.9 Ma**

K = 6.77%, radiogenic Ar = 8.710 x 10^{-6} cm^3/g, atmos. Ar = 36.0%.

Concentrate: Clean, unaltered, deep brown biotite, with no detected chlorite.

From quartz monzonite

(114O) At 731 m (2400 ft.), SE side of Alsek River valley, close to border, Yakutat map area, Alaska, 59°24'45"N, 138°01'30"W. Sample 49-CAc-78-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a light to mid creamy grey, homogeneous, medium grained biotite quartz monzonite. Biotite (7%) is

sporadically chloritized. Plagioclase is fresh and complexly zoned. Microcline is interstitial; quartz is somewhat strained. Accessories include epidote, opaque ore(s), apatite and zircon.

The sample is from Alsek River pluton. This leucocratic body is composed of granite and quartz monzonite and locally is garnet-bearing. It discordantly intruded a garnetifierous quartzofeldspathic schist sequence considered part of Chugach Terrane.

A biotite age of 165 ± 5 Ma* was initially reported for this pluton by Hudson et al. (1977). The same biotite concentrate from that sample has since been rerun by both the GSC and the USGS (Menlo Park) laboratories. These reruns yielded ages of 21.2 ± 2.8 Ma (GSC) and 23.1 ± 2.0 Ma (USGS), M.A. Lanphere (pers. comm.). The Jurassic age is therefore erroneous. However, due to the still significant difference between these earliest Miocene ages and the Early Oligocene ages from this determination and K-Ar no. 3055, the true age of this pluton remains uncertain. It is tentatively grouped with the Oligocene plutons.

K-Ar no. 3088 Biotite, K-Ar age **41.0 ± 2.2 Ma**

K = 6.14%, radiogenic Ar = 9.897 x 10^{-6} cm^3/g, atmos. Ar = 15.5%.

Concentrate: Impure, deep brown biotite, with 15-20% chlorite alteration.

From granite/quartz monzonite

(114P) At 914 m (3000 ft.), S side Grand Pacific Glacier, some 3 km W of its main SE bend, Tatshenshini River map area, British Columbia, 59°09'48"N, 137°17'47"W. Map unit lTg, Geological Survey of Canada Open File 926. Sample 113-CAc-78-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a light creamy grey, homogeneous, fairly equigranular, medium grained hornblende biotite granite or quartz monzonite. Mafics include variably chloritized, subhedral biotite (6%) and scarce, chloritised and corroded hornblende (1%). Feldspars comprise cloudy orthoclase and slightly saussuritized, oscillatorily zoned plagioclase. Quartz is plentiful.

The sample is from the southeast extremity of an irregularly-shaped, discordant pluton emplaced in flyschoid and metaflyschoid rocks believed equivalent to the Valdez Group (Chugach Terrane). Due to the degree of chloritic alteration, this age is somewhat suspect. This body (Jarl Glacier pluton) is included with the Seward plutonic suite.

K-Ar no. 3090 Muscovite, K-Ar age **148 ± 5 Ma**

K = 8.55%, radiogenic Ar = 5.126 x 10^{-5} cm^3/g, atmos. Ar = 14.8%.

Concentrate: Clean, unaltered, muscovite with no visible contamination.

From leucocratic granodiorite

(114P) At 304 m (1000 ft.) on W side Alsek River, some 6 km above confluence with Tatshenshini R., Tatshenshini River map area, British Columbia, 59°31'18"N, 137°48'51"W. Map unit JKg, Geological Survey of Canada Open File 926. Sample 34-CAc-78-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a light creamy grey, very weakly foliated, homogeneous, medium grained, leucocratic, garnet biotite muscovite granodiorite. Biotite (3%) is orange brown, moderately deformed and chloritized. Muscovite (4%) is bent but fresh, and contains a trace of secondary white mica. Garnet (1%) is deep red and subhedral. Plagioclase is abundant, strongly zoned and moderately saussuritized. Quartz is plentiful; K-feldspar minor.

This sample and that of K-Ar no. 3086 are from Battle Glacier batholith. It is a large, elongate, multiphase batholithic complex composed mainly of quartz diorite and diorite, with lesser granodiorite. However, the amounts and distribution of these and this distinctive leucocratic phase are not well known. Along its southwest margin, this body intrudes greenstone and metasediments (? Wrangellia, Wl). There it is close to Border Ranges Fault. The northeast extremities of the batholith are concealed by ice and drift, and relationships with Noisy Range batholith uncertain. Whether these two granitic bodies are physically connected or separated by Hubbard Fault is unknown.

Hornblende from tonalite, sampled very close to K-Ar no. 3086, yielded an age of 148 ± 4 Ma* (Hudson et al., 1977). The reason(s) for the disparity between the two ages is uncertain. However, based on the latest Jurassic hornblende and muscovite dates, this batholith is tentatively included with the Saint Elias plutonic suite.

K-Ar no. 3092 Hornblende, K-Ar age **130 ± 11 Ma**

K = 0.60%, radiogenic Ar = 3.144 x 10^{-6} cm^3/g, atmos. Ar = 47.8%.

Concentrate: Clean, unaltered, pleochroic olive brown to yellowish green, with no visible contamination.

From quartz diorite/granodiorite

(114P) At 914 m (3000 ft.), 4 km WSW Mt. Barnard, close to head of Tarr Inlet, Tatshenshini River map area, British Columbia, 59°05.3'N, 137°01.8'W. Map unit JKg, Geological Survey of Canada Open File 926. Sample 12-CAc-78-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a grey, fairly homogeneous, well foliated, medium grained biotite hornblende quartz diorite or granodiorite. Hornblende (12%) and olive brown, chloritized bioite (4%) constitute the mafics. Hornblende is commonly intergrown with biotite. Plagioclase is oscillatorily zoned and moderately saussuritized. Quartz and K-feldspar are minor.

The specimen is from Tikke Glacier batholith. The overall composition of this large, elongate granitic body is not well known. It is emplaced in fine clastics and carbonates of Paleozoic and (?) earliest Mesozoic age (Alexander Terrane). Part of the western edge of the batholith is truncated by Hubbard Fault. Physical connection between Noisy Range batholith and this body is uncertain. However, their isotopic ages are similar. Based on this hornblende age and K-Ar no. 3095, this granitic body is included with the Saint Elias plutonic suite.

3093		24.3 ± 1.6
K-Ar no.	Biotite, K-Ar age	Ma
3093(2)		28.1 ± 1.8

$$K = 4.94\%, \text{ radiogenic Ar} = \frac{4.697 \times 10^{-6}}{5.438 \times 10^{-6}} \text{ cm}^3/\text{g}$$

$$\text{atmos. Ar} = \frac{41.4}{38.0} \%$$

Concentrate: Dark brown biotite, with approx. 5 - 10% hornblende, and a trace of chloritic alteration.

From granite/quartz monzonite

(114P) At approx. 1371 m (4500 ft.), some 8 km W of Rainy Hollow, Tatshenshini River map area, British Columbia, 59°31'59"N, 136°38'17"W. Map unit Og, Geological Survey of Canada Open File 926. Sample 124-CAc-78-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

See K-Ar no. 3094 for description and interpretation.

K-Ar no. 3094 Hornblende, K-Ar age **74.7 ± 3.8 Ma**

K = 0.779%, radiogenic Ar = 2.309 x 10^{-6} cm^3/g, atmos. Ar = 54.3%.

Concentrate: Pleochroic, yellowish brown to green hornblende, with approximately 1% biotite contamination.

From granite/quartz monzonite

(114P) Details as for K-Ar no. 3093

The rock is a light creamy grey, homogeneous, coarse medium grained, hornblende biotite granite or quartz monzonite. Hornblende (5%) is subhedral to euhedral and fairly unaltered and inclusion free. Biotite (7%) is fresh and commonly intergrown with hornblende. Orthoclase is clouded with incipient alteration. Plagioclase is complexly zoned, with slight saussuritization.

The sample is from a small, lobate discordant pluton. It is the central of three very close, northwesterly aligned granitic bodies, which include Samuel Glacier and Mt. McDonell plutons. These plutons may be joined, but drift and ice conceals their possible connection. They intruded and thermally metamorphosed, deformed argillites, siltstones, and limestones of Paleozoic and (?) younger age (Alexander Terrane).

The reason(s) for the discordancy in the biotite and hornblende determinations from this pluton is uncertain. The rerun biotite date, however, corroborates the initial biotite age. The older hornblende date could reflect excess argon or less likely be due to contamination. Alternatively, this sample may represent an older granitic phase within this body (see K-Ar no. 3201) which has been reset by later (?) Oligocene intrusion. However, based on the biotite dates this pluton is tentatively included with the Tkope plutonic suite.

K-Ar no. 3095 Hornblende, K-Ar age **136 ± 10 Ma**

K = 0.77%, radiogenic Ar = 4.228 x 10^{-6} cm^3/g, atmos. Ar = 24.4%.

Concentrate: Clean, unaltered, pleochroic, bluish green to yellowish green hornblende, with no visible contamination.

From quartz diorite

(114P) At approx. 1524 m (5000 ft.), S side Tikke Glacier, some 13 km E of Melbern Glacier, Tatshenshini River map area, British Columbia, 59°17'33"N, 137°08'56"W. Map unit JKg, Geological Survey of Canada Open File 926. Sample 111-CAc-78-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a waxy grey, fairly homogeneous, weakly foliated, coarse medium grained, biotite hornblende quartz diorite. Mafics include subhedral hornblende (16%) some with clinopyroxene cores, and sporadically chloritized, deformed, anhedral deep greenish brown biotite (9%). Calcic plagioclase is fresh, but somewhat fractured. Quartz and K-feldspar are minor. The sample is from Tikke Glacier batholith.

See K-Ar no. 3092 for interpretation.

K-Ar no. 3107 Biotite, K-Ar age **27.5 ± 1.4 Ma**

K = 6.89%, radiogenic Ar = 7.421 x 10^{-6} cm^3/g, atmos. Ar = 18.6%.

Concentrate: Relatively clean, brown biotite, with approximately 1% chloritic alteration.

From granite

(114P) At approx. 1584 m (5200 ft.), E of lower Tkope River some 5 km N of peak 7566', Tatshenshini River map area, British Columbia, 59°36'28"N, 137°02'22"W. Map unit Ogr, Geological Survey of Canada Open File 926. Sample 28-CAc-78-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a light pinkish grey, homogeneous, fine medium grained, hornblende biotite granite. Mafics consist of bluish green, corroded, chloritized hornblende (1%) and biotite (3%). Orthoclase and sodic plagioclase are only very mildly altered. The sample is from Tkope River batholith.

See K-Ar no. 3070 for interpretation.

K-Ar no. 3201 Biotite, K-Ar age **27.7 ± 2.0 Ma**

K = 5.14%, radiogenic Ar = 5.577 x 10^{-6} cm^3/g, atmos. Ar = 55.9%.

Concentrate: Dark brown biotite, with approximately 15-20% chlorite alteration.

From quartz monzonite

(114P) At 944 m (3100 ft.), W side Haines Road at Tina Creek, Tatshenshini River map area, British Columbia, 59°35.1'N, 136°28.2'W. Map unit Og, Geological Survey of Canada Open

File 926. Sample 16-CAc-79-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a light pinkish grey, homogeneous, equigranular, medium grained hornblende biotite quartz monzonite. Mafics consist of moderately to strongly chloritized, subhedral biotite (5%) and scarce hornblende. K-feldspar and sodic plagioclase are mildly altered. Smoky grey quartz is abundant.

The sample is from Three Guardsmen batholith. Limited study indicates that this large, discordant granitic body is multiphase, and imprints a thermal aureole on its host rocks. It is emplaced in complexly deformed late Paleozoic and younger argillites, fine to coarser clastic rocks, and limestones (Alexander Terrane). Part of the northeast edge of the batholith is faulted against Paleogene fluvial sediments.

Cursory observations indicate that the Three Guardsmen batholith may be largely composed of this quartz monzonite and other phases which are very characteristic of the Tkope plutonic suite. However, a concordant biotite-hornblende pair of 110 ± 3 and 111 ± 3 Ma* was reported by MacKevett et al. (1974) from quartz diorite at the extreme southeast end of this granitic body. Thus, this batholithic complex could locally include older intrusive phases. Based on lithological correlation and this biotite date, however, the Three Guardsmen batholith is tentatively grouped with the Tkope plutonic suite.

K-Ar no. 3202 Hornblende, K-Ar age **168 ± 15 Ma**

K = 0.60%, radiogenic Ar = 4.106 x 10^{-6} cm^3/g, atmos. Ar = 16.0%.

Concentrate: Clean, unaltered, pleochroic, light brown to dark green hornblende, with no visible contamination.

From granodiorite

(114P) At approx. 1524 m (5000 ft.) close to small glacier on SW side Tkope River valley, about 21 km SE of confluence of Tkope and Tatshenshini rivers, British Columbia, 59°27.0'N, 137°03.1'W. Map unit JKg, Geological Survey of Canada Open File 926. Sample 15-CAc-79-1 collected by R.B. Campbell and interpreted by C.J. Dodds.

*age calculation not using decay constants of Steiger and Jager (1977).

The rock is a light to mid grey, fresh, weakly foliated, fairly equigranular, homogeneous, coarse medium grained, biotite hornblende granodiorite. Subhedral, occasionally euhedral, chloritized, olive brown biotite (7%) and slender, subhedral, mildly chloritized hornblende (20%) constitute the mafics. Plagioclase is oscillatorily zoned and moderately saussuritized. K-feldspar is mildy altered, and quartz somewhat strained.

The sample is from Tomahnous Glacier pluton. It is a small, elongate, discordant body, emplaced in dark argillites and siltstones of late Paleozoic and/or earliest Mesozoic age (Alexander Terrane). This hornblende age is somewhat older than anticipated and could reflect excess argon. However, lithologically this pluton is typical of many of the smaller bodies included with the Saint Elias plutonic suite, and on these grounds, it is tentatively grouped with that suite.

K-Ar no. 3449 Hornblende, K-Ar age **32.2 ± 6.8 Ma**
K = 0.31%, radiogenic Ar = 3.915 x 10^{-7} cm^3/g, atmos. Ar = 68.3%.

Concentrate: Clean, unaltered, pleochroic, light to dark green hornblende, with no visible contamination.

From dacite porphyry

(114P) SE end Kusawak Range, at 914 m (3000 ft.) on ridge crest to N of lower Stonehouse Creek, Tatshenshini River map area, British Columbia, 59°40.2'N, 136°21.3'W. Map unit Of, Geological Survey of Canada Open File 926. Sample 4-CAc-81-1, collected by R.B. Campbell and interpreted by C.J. Dodds.

The rock is a crowded hornblende quartz feldspar porphyry. It contains randomly oriented, fresh, euhedral phenocrysts of hornblende (5%), feldspar (15%) and rounded quartz (10%), set in a very fine grained light greenish grey matrix. The sample is from a sill intruding a thick sequence of openly folded Paleogene fluvial sediments. Collectively these rocks appear truncated by Denali Fault System.

Low radiogenic argon renders this determination somewhat suspect. Tentatively this sill is included with the subvolcanic intrusions of Oligocene age.

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