GEOLOGICAL SURVEY CIRCULAR 727

Summary of Miscellaneous Potassium-Argon Age Measurements, U.S. Geological Survey, Menlo Park, California, for the Years 1972–74

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Compiled and edited by A. L. Berry, G. B. Dalrymple, M. A. Lanphere, and J. C. Von Essen, in cooperation with H. C. Berg, R. H. Campbell, S. H. B. Clark, H. R. Cornwall, M. D. Crittenden, Jr., Béla Csejtey, Jr., G. D. Eberlein, K. F. Fox, Jr., W. E. Hall, B. C. Hearn, Jr., J. M. Hoare, D. M. Hopkins, E. M. MacKevett, Jr., R. May, T. P. Miller, J. C. Moore, C. D. Rinehart, and D. W. Scholl

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ABSTRACT

Potassium-argon age measurements are reported for 61 mineral separates and rock samples from Alaska, Arizona, California, Idaho, Utah, and Washington. The age report for each sample gives location, analytical data, and a brief geologic interpretation.

INTRODUCTION

This compilation contains the results of potassium-argon age measurements completed by the Geochronology (Menlo Park) Project for other Survey geologists during the years 1972–74. It is not a compilation of all age measurements made in the Menlo Park laboratory during that period, only those for which the scientific participation by Branch of Isotope personnel was insufficient to warrant a joint publication. The purposes of the compilation are to make these data available as soon as possible, to ensure uniform and complete publication of analytical results, and to provide an easy reference that can be used, in lieu of publication of complete analytical results, by the geologist when writing reports. Most of the age measurements made by the Branch of Isotope Geology are published in topical reports authored or co-authored by branch personnel; a bibliography of these publications is available on request from the Chief, Branch of Isotope Geology, U.S. Geological Survey, Denver Federal Center, Denver, Colo. 80225.

Conventional argon measurements were made by isotope dilution mass spectrometry. Potassium was determined by flame photometry using lithium metaborate fusion. Detailed descriptions of the analytical methods are given by Dalrymple and Lanphere (1969) and by Ingamells (1970). The techniques for $^{40}Ar/^{39}Ar$ measurements are described by Dalrymple and Lanphere (1971). Constants used in the data reduction are $\lambda_\epsilon = 0.585 \times 10^{-10}\ yr^{-1}$, $\lambda_\beta = 4.72 \times 10^{-10}\ yr^{-1}$, $^{40}K/K_{total} = 1.19 \times 10^{-4}$ mole/mole.

Potassium measurements were made by L. B. Schlocker. Argon measurements and data reduction were made by A. H. Atkinson, A. L. Berry, G. B. Dalrymple, S. J. Kover, M. A. Lanphere, B. M. Myers, and J. C. Von Essen.

Users of this compilation are cautioned that the data are presented with only a brief description of the geologic setting and with little or no interpretation of the geologic significance or meaning of the calculated age. It is strongly advised that the geologist cited in the sample description be consulted before an age measurement is cited in another publication or otherwise used. Questions concerning technical details of the age analyses should be directed to the Geochronology Project, Branch of Isotope Geology, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025.

ALASKA

68 ABg 247
(Biotite)299±9 m.y.

Description and location: Central Metlakatla pluton. Foliated leucocratic quartz diorite. (Lat 55°04.2′ N., long 131°33.8′ W.; Ketchikan A–5 quadrangle, Alaska, from outcrop just above high-tide line on the west shore of Tamgas Harbor, Annette Island.)

Analytical data; K_2O=8.81, 8.83 percent, $^{40}Ar_{rad}$/gm=4.228×10^{-9} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.94.

Geologist: H. C. Berg, U.S. Geological Survey, Menlo Park. Calif.

Collected by: Berg.

Geologic setting and comment: Metlakatla Peninsula, a southwestern projection of Annette Island, is underlain by a structurally complex assemblage of ultramafic and metamorphosed bedded and intrusive rocks. The premetamorphic age of the recrystallized bedded rocks is unknown. They are intruded by two foliated plutons, the South Metlakatla pluton and the Central Metlakatla pluton. Because the dated mineral was metamorphic biotite, the resultant age may be intermediate between the crystallization age of the pluton and one or more later thermal events or may even date the thermal events. The ultramafic body, which is in fault contact with the enclosing metamorphic units, is thought to correlate with upper Mesozoic zoned ultramafic bodies in nearby areas (Taylor and Noble, 1960; Lanphere and Eberlein, 1966). The assemblage is in fault contact with better dated rocks on mainland Annette Island that range in age from Silurian or older to Jurassic and Cretaceous. To this time, efforts to correlate the two have not been successful.

Reference: Berg

68 ABg 727
(Biotite)178±5 m.y.

Description and location: South Metlakatla pluton. Foliated quartz diorite and diorite. (Lat 55°01.3′ N., long 131°34.1′ W.; Ketchikan A–5 quadrangle, Alaska, from outcrop just above high-tide line, south coast of Metlakatla Peninsula, Annette Island, about 1 mile west of mouth of Tamgas Harbor.)

Analytical data: K_2O=8.83, 8.80 percent, $^{40}Ar_{rad}$ /gm = 2.428×10^{-9} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$ =0.94.

Geologist: H. C. Berg, U.S. Geological Survey, Menlo Park, Calif.

Collected by: Berg.

Geologic setting and comment and reference: See 68 ABg 247.

70 ACs 423
(Hornblende) 33.9±2.0 m.y

Description and location: Unnamed felsic to intermediate hypabyssal rocks. Dacite porphyry. (Lat 61°03.9′ N., long 149°47.8′ W.; Anchorage quadrangle, Alaska.)

Analytical data: K_2O = 0.130, 0.133 percent, $^{40}Ar_{rad}$/gm = 6.649×10^{-12} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.17.

Geologist: S. H. B. Clark, U.S. Geological Survey, Reston, Va.

Collected by: Clark.

Geologic setting and comment: Dike or sill adjacent to strongly deformed low-grade metamorphic rocks of the McHugh Complex of Late Jurassic or Cretaceous age. Other similar small intrusive bodies, including dike swarms, cut the Valdez (?) Group of Jurassic (?) and Cretaceous (Maestrichtian) age in the western Chugach Mountains.

Reference: Clark (1972).

72 ACy 127
(Biotite) 64.8±2 m.y.; (Hornblende) 62.7±2 m.y.

Description and location: Unnamed pluton within the Talkeetna Mountains batholith. Coarse-grained biotite-hornblende tonalite. (Lat 62°08.8′ N., long 149°18.5′ W.; Talkeetna Mts. quadrangle, Alaska.)

Analytical data: biotite, K_2O = 9.30 percent, $^{40}Ar_{rad}$/gm = 9.055×10^{-10} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$ =0.87; hornblende, K_2O=0.781, 0.783 percent, $^{40}Ar_{rad}$/ gm = 7.371×10^{-11} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.78.

Geologist: B. Csejtey, Jr., U.S. Geological Survey, Menlo Park, Calif.

Collected by: Csejtey.

Geologic setting and comment: The tonalite forms a separate pluton within the western part of the Talkeetna Mountains batholith. The new ages (see also 72 ACy 117) suggest that the bulk of the complex is made up of rocks of Late Cretaceous and early Tertiary age rather thar Jurassic age, as postulated by earlier workers. As most mineral despoits in south-central Alaska are associated with Late Cretaceous and early Tertiary plutons (Reed and Lanphere, 1969), the Talkeetna Mountains batholith may be an area favorable for mineral exploration.

References: Csejtey (1974); Reed and Lanphere (1969).

72 ACy 117
(Biotite) 65.6±2 m.y.; (Hornblende) 63.0±2 m.y.

Description and location: Pluton (eastern pluton) within Talkeetna Mountains batholith. Coarse-grained foliated biotite-hornblende

quartz diorite. (Lat 62°09.0′ N., long 149°13.5′ W.; Talkeetna Mts., A–5 quadrangle, Alaska.)

Analytical data: biotite, K_2O=9.33 percent, $^{40}Ar_{rad}$/gm=9.207×10^{-10} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.79; hornblende, K_2O=1.043, 1.042 percent, $^{40}Ar_{rad}$/gm=9.869×10^{-11} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.77.

Geologist: B. Csejtey, Jr., U.S. Geological Survey, Menlo Park, Calif.

Collected by: Csejtey.

Geologic setting and comment: The quartz diorite constitutes a member in an intrusive series within the Talkeetna Mountains batholith.

Reference: See 72 ACy 127.

66 AE 91
(Amphibole) 438±13 m.y.

Description and location: Unnamed. Heterogeneous assemblage of altered mafic volcanic rocks. (Lat 55°42.5′ N., long 133°09.5′ W.; Craig C–4 quadrangle, Alaska.)

Analytical data: K_2O=0.676, 0.672 percent, $^{40}Ar_{rad}$/gm=4.904×10^{-10} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.51.

Geologist: G. D. Eberlein, U.S. Geological Survey, Menlo Park. Calif.

Collected by: G. D. Eberlein and M. Churkin, Jr.

Geologic setting and comment: Age measurement was made on pyrogenic amphibole-bearing phase of a heterogeneous assemblage of epidotized mafic volcanic rocks (mainly breccia) believed to represent part of an early Paleozoic volcanic island arc terrane that furnished volcanic material to adjacent Early Silurian and possible Late Ordovician arc troughs. The age data (see also 65 AE 31) indicate that these rocks are coeval with part of the Descon Formation and are consistent with paleontologic evidence from limestone interbedded with the volcanic rocks that underlie Staney Cone (see also 65 AE 31).

Reference: Churkin and Eberlein (1975).

65 AE 31
(Amphibole) 442±13 m.y.

Description and location: Unnamed. Heterogeneous assemblage of altered mafic volcanic rocks. (Lat 55°37.2′ N., long 133°00.2′ W.; Craig C–4 quadrangle, Alaska.)

Analytical data: K_2O=0.596, 0.593 percent, $^{40}Ar_{rad}$/gm=4.379×10^{-10} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.85.

Geologist: G. D. Eberlein, U.S. Geological Survey, Menlo Park, Calif.

Collected by: G. D. Eberlein and M. Churkin, Jr.

Geologic setting and comment and reference: See 66 AE 91.

71 AE 67
(Amphibole) 281±9 m.y.

Description and location: Unnamed. Heterogeneous assemblage of altered mafic volcanic rocks. (Lat 55°32.0′ N., long 132°51.5′ W.; Craig C–3 quadrangle, Alaska.)

Analytical data: K_2O=0.651, 0.655 percent, $^{40}Ar_{rad}$/gm=2.921×10^{-10} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.79.

Geologist: G. D. Eberlein, U.S. Geological Survey, Menlo Park, Calif.

Collected by: G. D. Eberlein and M. Churkin, Jr.

Geologic setting and comment: Mineral dated is from same unit as 66 AE 91 and 65 AE 31. The calculated age is about 35 percent younger than the amphibole ages of these samples and may reflect thermal resetting during emplacement of the hornblende quartz diorite of Pin Peak, exposed about 0.8 km northeast (see 71 AE 68).

Reference: none.

71 AE 68
(Amphibole) 112±3 m.y.

Description and location: Quartz diorite of Pin Peak. Quartz diorite. (Lat 55°32.5′ N., long 132°50.7′ W.; Craig C–3 quadrangle, Alaska.)

Analytical data: K_2O=0.843, 0.841 percent, $^{40}Ar_{rad}$/gm=1.432×10^{-10} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.67.

Geologist: G. D. Eberlein, U.S. Geological Survey, Menlo Park, Calif.

Collected by: Eberlein.

Geologic setting and comment: Dated material is from pegmatitic phase of the hornblende quartz diorite of Pin Peak intrusive into a heterogeneous assemblage of andesitic to basaltic volcanic rocks, mainly breccia, the age of which ranges from late Middle Ordovician (Caradocian) to Upper Silurian (Ludlovian) on the basis of paleontologic evidence and other potassium-argon age measurements (see 65 AE 31 and 66 AE 91 comments). This date confirms mid-Cretaceous calcalkaline plutonism on central Prince of Wales Island with associated base-

metal mineralization and establishes a minimum age for the volcanic host rocks.

Reference: none.

69 ACk 1008
(Biotite) 65.6±2 m.y.

Description and location: Unnamed granitic intrusive rock. (Lat 60°29.5′ N., long 158°4′ W.; Taylor Mountain, B–6 quadrangle, Alaska, northeast sill of Shotgun Hills.)

Analytical data: $K_2O = 8.65$, 8.69 percent, $^{40}Ar_{rad}$/ gm$=8.556\times10^{-10}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}=0.78$.

Geologist: J. M. Hoare, U.S. Geological Survey, Menlo Park, Calif.

Collected by: J. M. Hoare and A. L. Clark.

Geologic setting and comment: Intrudes the Kuskokwim Group (Early and Late Cretaceous). The biotite age is younger than other dates obtained on plutonic intrusive rocks in southwest Alaska. It is approximately the same as ages determined on hypabyssal and volcanic rocks in the Yukon-Koyukuk region.

Reference: none.

73 AHp 47
(Basalt) 2.84±0.14 m.y.

Description and location: Unnamed basalt. Tertiary and Quaternary lava flows of western Alaska. (Lat 65°25.3′ N., long 166°32.6′ W.; Nome quadrangle, Alaska, from an erosional escarpment at top of east wall of California River valley, 9 km above the river mouth.)

Analytical data: $K_2O=0.859$, 0.865, 0.867, 0.875 percent, $^{40}Ar_{rad}/gm = 3.633\times10^{-12}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}=0.40$.

Geologist: D. M. Hopkins, U.S. Geological Survey, Menlo Park, Calif.

Collected by: Hopkins.

Geologic setting and comment: Basaltic lava flow resting on an erosion surface planed across limestone of early Paleozoic or Precambrian age and truncated on its seaward side by the shoreline of the York Terrace. The York Terrace at this point has an Anvilian (early Pleistocene) mollusk fauna. The terrace extends seaward to the wave-cut scarp of the Lost River Terrace of Sangamon age. The age of the lava flow provides a maximum limit on the age of the York Terrace and on the age of the Anvilian transgression. The age of the flow also indicates the time of a major reorganization of the regioral drainage resulting from blocking by volcanic accumulations.

References: Steidtman and Cathcart (1922); Sainsbury (1967); Hopkins, Rowland, Echols, and Valentine (1974).

70 AMk 15D
(Hornblende) 64.2±2 m.y.; (Biotite) 55.5±2 m.y.

Description and location: Unnamed plutonic rock. A late phase of the Coast Range batholith. Leucogranodiorite. (Lat 59°35.1′ N., long 136°01.8′ W.; Skagway, C–3 quadrangle, Alaska.)

Analytical data: hornblende, $K_2O=1.593$, 1.595 percent, $^{40}Ar_{rad}/gm = 1.538\times10^{-10}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}=0.70$; biotite, $K_2O=8.70$, 8.73 percent, $^{40}Ar_{rad}/gm=7.250\times10^{-10}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}=0.46$.

Geologist: E. M. MacKevett, Jr., U.S. Geological Survey, Menlo Park, Calif.

Collected by: MacKevett.

Geologic setting and comment: Probably youngest phase of Coast Range batholith in nearby area. A medium- to coarse-grained granitic rock that contains sodic plagioclase, quartz, microcline, minor amounts of hornblende and biotite, and rare minor accessories and alteration products. Forms a small stock with locally gradational, but generally obscure, contacts with older batholithic rocks.

Reference: MacKevett, Robertson, and Winkler (1974).

70 AMk 14A–2
(Biotite) 111±3 m.y.

Description and location: Unnamed pluton. Hornblende-biotite granodiorite. (Lat 59°16.6′ N., long 136°26.3′ W.; Skagway, B–4 quadrangle, Alaska.)

Analytical data: $K_2O = 7.70$, 7.73 percent, $^{40}Ar_{rad}/gm = 1.306\times10^{-9}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}=0.91$.

Geologist: E. M. MacKevett, Jr., U.S. Geological Survey, Menlo Park, Calif.

Collected by: MacKevett.

Geologic setting and comment: Intrudes metamorphosed Paleozoic rocks that are part of the Alexander terrane (Berg and others, 1972). A fine- to medium-grained foliated granitic rock that contains plagioclase (mainly oligoclase), quartz, K-feldspar, biotite, and minor

hornblende and minor accessory minerals.
Reference: MacKevett, Robertson, and Winkler (1974).

70 AMk 10B
(Hornblende) 119±4 m.y.

Description and location: Unnamed pluton. Diorite or amphibolite. (Lat 59°21.2′ N., long 136°20.7′ W.; Skagway, B–4 quadrangle, Alaska.)
Analytical data: $K_2O = 0.417$ percent, $^{40}Ar_{rad}$ / gm $= 7.587 \times 10^{-11}$ moles, $^{40}Ar_{rad} / {}^{40}Ar_{total} = 0.66$.
Geologist: E. M. MacKevett, Jr., U.S. Geological Survey, Menlo Park, Calif.
Collected by: MacKevett.
Geologic setting and comment: Forms an intervening zone between Cretaceous granodiorite and metamorphosed Paleozoic rocks. Probably represents an early (border) phase of the Cretaceous pluton that has partly assimilated and invaded wallrock. A fine-grained foliated rock that consists mainly of plagioclase and hornblende, in addition to alteration products, chiefly epidote.
Reference: MacKevett, Robertson, and Winkler (1974).

70 AMk 8A–2
(Hornblende) 105±3 m.y.; (Biotite) 108±3 m.y.

Description and location: Unnamed pluton. Hornblende-biotite quartz diorite. (Lat 59°16.7′ N., long 136°15.6′ W.; Skagway, B–4 quadrangle, Alaska.)
Analytical data: hornblende, $K_2O = 0.857$, 0.860 percent, $^{40}Ar_{rad}$ / gm $= 1.374 \times 10^{-10}$ moles, $^{40}Ar_{rad} / {}^{40}Ar_{total} = 0.72$; biotite, $K_2O = 8.27$, 8.33 percent, $^{40}Ar_{rad}$/gm $= 1.363 \times 10^{-9}$ moles, $^{40}Ar_{rad} / {}^{40}Ar_{total} = 0.85$.
Geologist: E. M. MacKevett, Jr., U.S. Geological Survey, Menlo Park, Calif.
Collected by: MacKevett.
Geologic setting and comment: Part of a large pluton that intrudes Paleozoic metamorphic rocks. A medium-grained rock that consists of plagioclase (zoned andesine-oligoclase), quartz, minor K-feldspar, fairly abundant hornblende and biotite, and lesser amounts of minor accessories and alteration products.
Reference: MacKevett, Robertson, and Winkler (1974).

70 AWk 6A
(Biotite) 29.3±1 m.y.

Description and location: Unnamed pluton. Biotite-hornblende granodiorite. (Lat 59°15.9′ N., long 136°01.1′ W.; Skagway, B–3 quadrangle, Alaska.)
Analytical data: $K_2O = 7.20$, 7.25 percent, $^{40}Ar_{rad}$ / gm $= 3.147 \times 10^{-10}$ moles, $^{40}Ar_{rad} / {}^{40}Ar_{total} = 0.60$.
Geologist: E. M. MacKevett, Jr., U.S. Geological Survey, Menlo Park, Calif.
Collected by: G. R. Winkler, U.S. Geological Survey, Menlo Park, Calif.
Geologic setting and comment: Part of a pluton that intrudes metamorphosed Paleozoic rocks. A fine-grained granodiorite with local mafic clots; locally fractured and altered. Consists of plagioclase, quartz, K-feldspar, hornblende, and biotite. Less abundant minor accessories and alteration products, including prehnite. Isotopic dates on this and similar rocks (see also 70 AMk 5D, 3A, 3C, 2A) document previously unrecognized Tertiary granitic plutons in the Skagway B–3 quadrangle. These plutons are probable counterparts of similar granitic masses in the northern part of Glacier Bay National Monument.
Reference: MacKevett, Robertson, and Winkler (1974)

70 AWk 5D
(Biotite) 30.6±1 m.y.

Description and location: Unnamed pluton. Biotite granodiorite. (Lat 59°15.7′ N., long 136°00.0′W.; Skagway, B–3 quadrangle, Alaska.)
Analytical data: $K_2O = 7.10$, 7.16 percent, $^{40}Ar_{rad}$/gm $= 3.246 \times 10^{-10}$ moles, $^{40}Ar_{rad} / {}^{40}Ar_{total} = 0.69$.
Geologist: E. M. MacKevett, Jr., U.S. Geological Survey, Menlo Park, Calif.
Collected by: MacKevett.
Geologic setting and comment: Part of a pluton that intrudes Paleozoic metamorphic rocks. A fine-grained granodiorite that contains a few mafic clots. See 70 AWk 6A.
Reference: MacKevett, Robertson, and Winkler (1974).

70 AMk 3C
(Hornblende) 33.0±1 m.y.

Description and location: Unnamed pluton. Hornblende-biotite quartz diorite. (Lat 59°19.1′

N., long 135°48.7′ W.; Skagway B–3 quadrangle, Alaska.)

Analytical data: K_2O=0.480 percent, $^{40}Ar_{rad}$/gm =2.360×10 $^{-11}$ moles, $^{40}Ar_{rad}$ / $^{40}Ar_{total}$=0.35.

Geologist. E. M. MacKevett, Jr., U.S. Geological Survey, Menlo Park, Calif.

Collected by: MacKevett.

Geologic setting and comment: Part of a pluton that intrudes Paleozoic metamorphic rocks. A weakly gneissic medium-grained quartz diorite. Contains abundant quartz and plagioclase, chiefly andesine, less abundant hornblende and biotite, and minor accessories and alteration products. See 70 AMk 6A.

Reference: MacKevett, Robertson, and Winkler (1974).

70 AMk 3A
(Biotite) 22.7±1 m.y.

Description and location: Unnamed pluton. Biotite-hornblende quartz diorite. (Lat 59°19.8′ N., long 135°48.7′ W.; Skagway, B–3 quadrangle, Alaska.)

Analytical data: K_2O=8.70, 8.68 percent, $^{40}Ar_{rad}$ /gm= 2.928 × 10 $^{-10}$ moles, $^{40}Ar_{rad}$ /$^{40}Ar_{total}$ =0.20.

Geologist: E. M. MacKevett, Jr., U.S. Geological Survey, Menlo Park, Calif.

Collected by: MacKevett.

Geologic setting and comment: Part of a Tertiary pluton that intrudes Paleozoic metamorphic rocks. The sample is a deformed locally cataclastic medium-grained gneissic quartz diorite. As its site is near the Chilkat River–Lynn Canal fault, the isotopic age may be too low because of cataclasis and related effects of faulting. See 70 AMk 6A.

Reference: MacKevett, Robertson, and Winkler (1974).

70 AWk 2A
(Hornblende) 111±3 m.y.; (Biotite) 110±3 m.y.

Description and location: Unnamed pluton. Hornblende-biotite quartz diorite. (Lat 59°27.8′ N., long 136°18.1′ W.; Skagway, B–4 quadrangle, Alaska.)

Analytical data: hornblende, K_2O = 0.933, 0.935 percent, $^{40}Ar_{rad}$/gm = 1.574 × 10^{-10} moles, $^{40}Ar_{rad}$/$^{40}Ar_{total}$ = 0.87; biotite, K_2O = 8.87 percent, $^{40}Ar_{rad}$/gm = 1.480 × 10^{-9} moles, $^{40}Ar_{rad}$ /$^{40}Ar_{total}$ =0.93.

Geologist: E. M. MacKevett, Jr., U.S. Geological Survey, Menlo Park, Calif.

Collected by: G. R. Winkler, U.S. Geological Survey, Menlo Park, Calif.

Geologic setting and comment: The sample is from a large pluton that intrudes Paleozoic metamorphic rocks. It is medium grained and contains abundant plagioclase (andesine) and quartz, fairly abundant hornblende and biotite, and minor quantities of K-feldspar, accessory minerals, and alteration products.

Reference: MacKevett, Robertson, and Winkler (1974).

71 AMk 26A
(Hornblende) 142±4 m.y.

Description and location: Unnamed pluton. Fine-grained biotite hornblende granodiorite. (Lat 61°44.4′ N., long 143°49.6′ W.; McCarthy, C–8 quadrangle, Alaska.)

Analytical data: K_2O=0.813 percent, $^{40}Ar_{rad}$/gm =1.766×10^{-10} moles, $^{40}Ar_{rad}$/$^{40}Ar_{total}$=0.76.

Geologist: E. M. MacKevett, Jr., U.S. Geological Survey, Menlo Park, Calif.

Collected by: MacKevett.

Geologic setting and comment: Part of a pluton that cuts the Nikolai Greenstone (Triassic) and Skolai Group (Permian).

Reference: none.

71 AMk 19C
(Hornblende) 145±4 m.y.

Description and location: Unnamed pluton. Hornblende granodiorite. (Lat 61°37.6′ N., long 143°39.7′ W.; McCarthy, C–8 quadrangle, Alaska.)

Analytical data: K_2O = 0.680, 0.683 percent, $^{40}Ar_{rad}$/gm = 1.516 × 10^{-10} moles, $^{40}Ar_{rad}$/ $^{40}Ar_{total}$ =0.77.

Geologist: E. M. MacKevett, Jr., U.S. Geological Survey, Menlo Park, Calif.

Collected by: MacKevett.

Geologic setting and comment: Part of a pluton that cuts the Nikolai Greenstone (Triassic). A fine- to medium-grained granodiorite that contains abundant plagioclase (andesine), fairly abundant quartz, K-feldspar, and hornblende, and minor amounts of other minerals.

Reference: none.

70 AMk 61c
(Hornblende) 3.8±0.8 m.y.

Description and location: Unnamed Cenozoic felsic intrusive rock. Porphyrite hornblende-biotite

dacite. (Lat 61°37.6′ N., long 143°39.3′ W.; McCarthy, C–8 quadrangle, Alaska.)

Analytical data: K_2O=0.468 percent, $^{40}Ar_{rad}$/gm =2.588×10^{-12} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.05.

Geologist: E. M. MacKevett, Jr., U.S. Geological Survey, Menlo Park, Calif.

Collected by: MacKevett.

Geologic setting and comment: A shallow pluton that may be related to the Wrangell Lava (Miocene to Holocene). Cuts the lower part of the Wrangell Lava and older rocks. Porphyritic, with plagioclase and mafic phenocrysts in a very fine grained felty groundmass.

Reference: none.

70 AMk 60D–2
(Hornblende) 142±4 m.y.

Description and location: Unnamed pluton. Hornblende granodiorite. (Lat 61°33.7′ N., long 143°39.6′ W.; McCarthy, C–8 quadrangle, Alaska.)

Analytical data: K_2O=0.800 percent, $^{40}Ar_{rad}$/gm =1.746×10^{-10} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.77.

Geologist: E. M. MacKevett, Jr., U.S. Geological Survey, Menlo Park, Calif.

Collected by: MacKevett.

Geologic setting and comment: A granitic pluton that cuts Triassic rocks, is cut by Cenozoic hypabyssal plutons, and is nonconformably overlain by Lower Cretaceous sedimentary rocks.

Reference: none.

70 AMk 60B
(Hornblende) 134±7 m.y.

Description and location: Unnamed pluton. Hornblende granodiorite. (Lat 61°32.6′ N., long 143°42.4′ W.; McCarthy, C–8 quadrangle, Alaska.)

Analytical data: K_2O = 0.705, 0.704 percent, $^{40}Ar_{rad}$/gm = 1.448×10^{-10} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.30.

Geologist: E. M. MacKevett, Jr., U.S. Geological Survey, Menlo Park, Calif.

Collected by: MacKevett.

Geologic setting and comment: See 70 AMk 60D–2.

70 AMa 226
(Hornblende) 56.5±2 m.y.; (Biotite) 56.4±2 m.y.

Description and location: Unnamed pluton. Quartz monzonite porphyry. (Lat 62°22.0′ N., long 153°47.5′ W.; McGrath, B–2 quadrangle, Alaska.)

Analytical data: hornblende, K_2O = 1.0°7, 1.057 percent, $^{40}Ar_{rad}$/gm = 9.003×10^{-11} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.52; biotite, K_2O=7.44, 7.30 percent, $^{40}Ar_{rad}$/gm = 6.232×10^{-10} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.79.

Geologist: R. May, U.S. Geological Survey, Menlo Park, Calif.

Collected by: May.

Geologic setting and comment: Medium-grained quartz monzonite prophyry that contains abundant one-half-inch-long phenocrysts of orthoclase. This small pluton is exposed in the Sheep Creek drainage 11 miles (18 km) south of Farewell, Alaska, and intrudes limestone, shale, and phyllite of early Paleozoic age. Concordant ages on coexisting biotite and hornblende and similarities in both chemical and modal composition indicate that the pluton is genetically associated with the undifferentiated series of intrusive rocks of Late Cretaceous and early Tertiary age which have been identified in this part of the Alaska Range by Reed and Lanphere (1973).

Reference: Reed and Lanphere (1973).

67 AMa 226
(Hornblende) 57.6±2 m.y.; (Biotite) 56.6±2 m.y.

Description and location: Unnamed pluton. Quartz monzonite porphyry. (Lat 62°22.0′ N., long 153°47.5′ W.; McGrath, B–2 quadrangle, Alaska.)

Analytical data: hornblende, K_2O = 1.0°0, 1.057 percent, $^{40}Ar_{rad}$/gm = 9.151×10^{-11} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.73; biotite, K_2O=7.23, 7.22 percent, $^{40}Ar_{rad}$/ gm = 6.138×10^{-10} moles, $^{40}Ar_{rad}$/ $^{40}Ar_{total}$=0.86.

Geologist: R. May, U.S. Geological Survey, Menlo Park, Calif.

Collected by: May.

Geologic setting and comment and reference: See 70 AMa 226.

70 AMm 158b
(Hornblende) 92.8±2.6 m.y.; (Biotite) 88.3±1.5 m.y.

Description and location: Darby pluton. Quartz monzonite. (Lat 64°45.2′ N., long 162°252.2′ W.; Solomon quadrangle, Seward Peninsula, Alaska.)

Analytical data: hornblende, $K_2O = 0.893$, 0.896 percent, $^{40}Ar_{rad}/gm = 1.250 \times 10^{-10}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}=0.81$; biotite, $K_2O=7.74$, 7.87 percent, $^{40}Ar_{rad}/gm = 1.042 \times 10^{-9}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}=0.93$.

Geologist: T. P. Miller, U.S. Geological Survey, Anchorage, Alaska.

Collected by: Miller.

Geologic setting and comment: Pluton intrudes high-grade metamorphic complex of Precambrian age on the west and is in probable fault contact with a Devonian carbonate complex on the east.

Reference: Miller, Grybeck, Elliott, and Hudson (1972).

71 AMm 415A
(Biotite) 94.0±3.0 m.y.

Description and location: Darby pluton. Coarse-grained porphyritic quartz monzonite. (Lat 64°57.0′ N., long 162°19.2′ W.; Solomon quadrangle, Seward Peninsula, Alaska.)

Analytical data: $K_2O=8.96$, 8.96 percent, $^{40}Ar_{rad}/gm = 1.275 \times 10^{-9}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}=0.78$.

Geologist: T. P. Miller, U.S. Geological Survey, Anchorage, Alaska.

Collected by: Miller.

Geologic setting and comment and reference: See 70 AMm 158b.

71 AGk 259
(Biotite) 93.9±3.0 m.y.

Description and location: Nepheline syenite dike. (Lat 64°43.5′ N., long 162°53.1′ W.; Solomon quadrangle, Seward Peninsula, Alaska.)

Analytical data: $K_2O=7.12$, 7.12 percent, $^{40}Ar_{rad}/gm = 1.013 \times 10^{-9}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}=0.68$.

Geologist: T. P. Miller, U.S. Geological Survey, Anchorage, Alaska.

Collected by: D. Grybeck, U.S. Geological Survey, College, Alaska.

Geologic setting and comment: Nepheline syenite dike cutting granodiorite of the Kachauik pluton which intrudes metamorphic rocks of Precambrian age.

Reference: Miller, Grybeck, Elliott, and Hudson (1972).

S–70
(Biotite) 59.9±1.8 m.y.

Description and location: Sanak pluton. Granodiorite or quartz diorite. (Lat 54°29′ N., long 162°48′ W.; Sanak Island, False Pass quadrangle, Alaska.)

Analytical data: $K_2O=8.28$, 8.32 percent, $^{40}Ar_{rad}/gm = 7.460 \times 10^{-10}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}=0.85$.

Geologist: J. C. Moore, Department of Earth Sciences, University of California, Santa Cruz, Calif.

Collected by: Moore.

Geologic setting and comment: The Sanak pluton intrudes the Shumagin Formation (Maestrichtian) and crosscuts the major phase of isoclinal overturned folding. The pluton was probably intruded at a shallow depth (few kilometres). The age provides an upper limit on the deformation and uplift of the Shumagin Formation, which itself is probably less than 70 m.y. old.

Reference: Moore (1973).

54 Sn 197
(Hornblende) 11.1±3 m.y.; (Biotite) 3.4±0.2 m.y.

Description and location: Shaler pluton. Granodiorite. (Lat 53°37.7′ N., long 166°56′ W.; Unalaska Island, Aleutian Islands.)

Analytical data: hornblende, $K_2O = 0.353$, 0.355 percent, $^{40}Ar_{rad}/gm = 5.821 \times 10^{-12}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}=0.05$; biotite, $K_2O=7.49$, 7.59 percent, $^{40}Ar_{rad}/gm = 3.754 \times 10^{-11}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}=0.32$.

Geologist: D. W. Scholl, U.S. Geological Survey, Menlo Park, Calif.

Collected by: G. L. Snyder, U.S. Geological Survey, Denver, Colo.

Geologic setting and comment: The Shaler pluton is an equigranular medium- to coarse-grained granodioritic stock or small batholith exposed in the Shaler Mountains of southern Unalaska Island. It intrudes Tertiary sedimentary and volcanic rocks of the Unalaska Formation, which, based on desmostylid teeth, includes units as young as early Miocene. The biotite age is much too young and probably reflects a postintrusion heating event related to the formation of Makushin Volcano, a nearby (29 km) late Cenozoic stratocone. The hornblende age is probably close to the crystallization age as similar batholiths and stocks elsewhere along the Aleutian ridge crystallized between about 12 and 16 m.y. ago.

References: Drewes, Fraser, Snyder, and Barnett (1961); Marlow, Scholl, Buffington, and Alpha (1973).

ARIZONA

12–100
(Biotite) 17.1±1 m.y.

Description and location: Unnamed tuff in San Manuel Formation. Airfall tuff. (Lat 33°2.1′ N., long 110°59.4′ W.; Kearny quadrangle, Pinal County, Ariz.)

Analytical data: K_2O=7.48, 7.55 percent, $^{40}Ar_{rad}$ /gm = 1.902×10^{-10} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$ =0.30.

Geologist: H. R. Cornwall, U.S. Geological Survey, Menlo Park, Calif.

Collected by: M. H. Krieger, U.S. Geological Survey, Menlo Park, Calif.

Geologic setting and comment: This tuff bed is near the top of a tuffaceous sandstone and conglomerate unit in the San Manuel Formation, which is composed of alluvial and playa deposits in intermontane basins.

Reference: Cornwall and Krieger (1974).

CALIFORNIA

69 C 24
(Plagioclase) 14.6±1 m.y.

Description and location: Volcanic strata of Zuma Canyon. Porphyritic basalt. (Lat 34°00.0′ N., long 118°48.3′ W.; Point Dume quadrangle, Los Angeles County, Calif., from the southern tip of Point Dume.)

Analytical data: K_2O=0.247 percent, $^{40}Ar_{rad}$/gm =5.365×10^{-12} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.16.

Geologist: R. H. Campbell, U.S. Geological Survey, Menlo Park, Calif.

Collected by: Campbell.

Geologic setting and comment: Overlain by very thin bedded to flaggy dolomitic marl, chert, and shale of the Monterey Formation, which contains foraminifers assigned to the Luisian Stage (middle Miocene). Apparently associated with volcanic rocks in nearby structural blocks that contain interbedded mudstone locally containing foraminifers assigned to the Relizian and Luisian Stages (middle Miocene).

Reference: none.

Haiwee–1
(Biotite) 86.7±2.6 m.y.

Description and location: Biotite-hornblende quartz monzonite. (Lat 36°9.8′ N., long 117°55.2′ W.; T. 20 S., R. 37 E., sec. 25, 1 mile east of Haiwee Reservoir at altitude 4,320 ft. From drill core Haiwee–1, 735- to 750-ft interval. Inyo County, Calif.

Analytical data: K_2O=8.76, 8.80 percent, $^{40}Ar_{rad}$ /gm = 1.151×10^{-9} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$ =0.89.

Geologist: W. E. Hall, U.S. Geological Survey, Menlo Park, Calif.

Collected by: J. A. Sass, U.S. Geological Survey, Menlo Park, Calif.

Geologic setting and comment: Intrudes Keeler Canyon Formation of Pennsylvanian and Permian age and is overlain by the Coso Formation of late Pliocene or early Pleistocene age.

Reference: none.

H72–52
(Obsidian) 0.088±0.013 m.y.

Description and location: Obsidian of Borax Lake. Nonporphyritic rhyolite. (Lat 38°58.1′ N., long 122°38.7′ W.; Clear Lake volcanic field, Clear Lake Highlands quadrangle, Calif. From massive obsidian rib on north side of central deepest part of pumice quarry (about 12 ft above quarry floor), southeast of intersection of Arrowhead Road and Ciwa Street, Clear Lake Park, Calif.)

Analytical data: K_2O=4.74, 4.70 percent, $^{40}Ar_{rad}$ /gm = 0.618×10^{-12} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$ =0.091.

Geologist: B. C. Hearn, Jr., U.S. Geological Survey, Reston, Va.

Collected by: Hearn.

Geologic setting and comment: Overlies an olivine dacite flow; obsidian flow retains some of its pumiceous carapace and is overlain by soil rich in human-worked obsidian fragments; reported by Anderson (1936) to be one of the most recent flows in the Clear Lake volcanic field.

References: Brice (1953); Anderson (1936).

H72–1
(Obsidian) 0.466±0.015 m.y.

Description and location: Rhyolite of Thurston Creek. Porphyritic rhyolite. (Lat 38°55.4′ N., long 122°41.8′ W.; Clear Lake volcanic field, Clear Lake Highlands quadrangle, Calif. From obsidian rib with vertical flow banding on east side of narrows of bottom of canyon north of Manning Flat.)

Analytical data: K_2O=4.75, 4.73 percent, $^{40}Ar_{rad}$ /gm = 3.268×10^{-12} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$ =0.33.

Geologist: B. C. Hearn, Jr., U.S. Geological Survey, Reston, Va.
Collected by: Hearn.
Geologic setting and comment: Oldest exposed obsidian in central part of Clear Lake volcanic field; assumed to overlie pyroxene dacite of Brice (1953); overlain by porphyritic rhyodacites of Mount Konocti type.
References: Brice (1953); Anderson (1936).

H72–73DI
(Obsidian) 0.536±0.016 m.y.

Description and location: Rhyolite of Camelback Ridge. Porphyritic rhyolitic obsidian. (Lat 38°54.4′ N., long 122°47.9′ W.; Clear Lake volcanic field, Kelseyville quadrangle, Calif. From west side of Bottle Rock roadcut, 90 ft N. 7° W. from large pine tree on east side of road; sample from central horizontally banded part of S-shaped fold of banding.)
Analytical data: K_2O=4.67, 4.70 percent, $^{40}Ar_{rad}$/gm = 3.716×10^{-12} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$ =0.41.
Geologist: B. C. Hearn, Jr., U.S. Geological Survey, Reston, Va.
Collected by: Hearn.
Geologic setting and comment: Apparently overlain by lake beds and terrace gravels of southern provenance; flow subsequently upfaulted to block former drainage from the south or southwest; overlies or is faulted against serpentine on southwest side; contiguous rhyolitic obsidian to the east overlies older dacite and andesite of southern part of Clear Lake field and is overlain by basalt ("pyroxene dacite" of McNitt (1968)).
Reference: McNitt (1968).

IDAHO

A–230
(Biotite) 81.7±2.5 m.y.

Description and location: Idaho batholith. Biotite-hornblende quartz monzonite. (Lat 43°27.6′ N., long 114°21.5′ W.; NW¼SE¼ sec. 31, T. 2 N., R. 18 E., from outcrop at McCoy mine, Bellevue quadrangle, Blaine County, Idaho.)
Analytical data: K_2O=6.86, 6.95 percent, $^{40}Ar_{rad}$/gm = 8.530×10^{-10} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$ =0.89.
Geologist: W. E. Hall, U.S. Geological Survey, Menlo Park, Calif.
Collected by: Hall.
Geologic setting and comment: Intrudes Milligen Formation (Devonian) and overlain by Challis Volcanics (Eocene).
Reference: none.

UTAH

72MC–117e
(Basaltic hornblende) 570±7 m.y.

Description and location: Browns Hole Formation (volcanic member). Alkali trachyte clast from volcanic conglomerate intercalated with basaltic flows. (Lat 41°19.6′ N., long 111°44′W.; north slope Middle Fork Ogden River, 5 miles northeast of Huntsville, Utah.)
Analytical data: $^{40}Ar/^{39}Ar$ = 18.78, $^{37}Ar/^{39}Ar$= 9.617 corrected for ^{37}Ar decay; $T_{½}$= 35.1 days, $^{36}Ar/^{39}Ar$ = 0.008111, J=0.02045, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.91.
Geologist: M. D. Crittenden, Jr., U.S. Geological Survey, Menlo Park, Calif.
Collected by: Crittenden.
Geologic setting and comment: Dates the youngest presumably Precambrian unit in the allochthonous Huntsville sequence of northeastern Utah and southeastern Idaho (Crittenden and others, 1971). That sequence begins at the base with diamictite (825–925? m.y.) and extends without apparent break into the Cambrian. Browns Hole Formation rests on Mutual Formation (mainly purple quartzite) and is overlain by Geertsen Canyon Quartzite (uppermost unit of Brigham Group). Locality shown on Browns Hole quadrangle (Crittenden, 1972).
References: Crittenden, Schaeffer, Trimble, and Woodward (1971); Crittenden (1972); Crittenden and Wallace (1973).

WASHINGTON

T–152
(Hornblende) 98.5±3.0 m.y.; (Biotite) 90.1±2.7 m.y.

Description and location: Old Baldy pluton. Coarse- to medium-grained porphyritic locally gneissic granodiorite. (Lat 48°36.7′ N., long 119°56.8′ W.)
Analytical data: hornblende, K_2O= 1.265, 1.254 percent, $^{40}Ar_{rad}$/gm =1.882×10^{-10} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.83; biotite, K_2O=9.06, 9.06 percent, $^{40}Ar_{rad}$/gm = 1.236×10^{-9} moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.94.
Geologists: C. D. Rinehart and K. F. Fox, Jr., U.S. Geological Survey, Menlo Park, Calif.

Collected by: Rinehart.

Geologic setting and comment: A member of a composite batholith underlying the Okanogan Range. Intrudes the gneissic trondhjemite of Tiffany Mountain on the west and is intruded by the granodioritic Conconully pluton on the east. Probably the same as unnamed granodiorite gneiss (sample OK–5) referred to in Menzer (1970). See also T–153, T–154, T–155, T–156.

Reference: Menzer (1970).

T–153

(Hornblende) 93.5±2.8 m.y.; (Biotite) 88.5±2.7 m.y.

Description and location: Gneissic trondhjemite of Tiffany Mountain. Trondhjemite, medium-grained weakly gneissic leucocratic rock (color index 6). (Lat 48°39.8′ N., long 119°57.9′ W.)

Analytical data: hornblende, K_2O= 0.580, 0.576 percent, $^{40}Ar_{rad}/gm = 8.196 \times 10^{-11}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.51; biotite, K_2O=9.01, 9.00 percent, $^{40}Ar_{rad}/gm = 1.206 \times 10^{-9}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.93.

Geologist: C. D. Rinehart and K. F. Fox, Jr., U.S. Geological Survey, Menlo Park, Calif.

Collected by: Rinehart.

Geologic setting and comment: Probably the largest member of a composite batholith underlying the Okanogan Range; appears to be older than plutons adjacent on the east; relations to other members of the batholith not known as yet, for this unit may underlie as much as 1,300 km^2, mostly north, west, and south of the area studied. Probably the same as unnamed trondhjemitic gneiss (samples OK–3 and OK–6) referred to in Menzer (1970). See also T–152.

T–154

(Muscovite) 88.5±2.7 m.y.; (Biotite) 91.7±2.8 m.y.

Description and location: Gneissic trondhjemite of Tiffany Mountain. Trondhjemite, medium-grained weakly gneissic leucocratic rock (color index 6). (Lat 48°29.5′ N., long 119°56.4′ W.)

Analytical data: muscovite, $K_2O = 10.26, 10.34$ percent, $^{40}Ar_{rad}/gm = 1.379 \times 10^{-9}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.77; biotite, K_2O=9.34, 9.30 percent, $^{40}Ar_{rad}/gm = 1.295 \times 10^{-9}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.94.

Geologists: C. D. Rinehart and K. F. Fox, Jr., U.S. Geological Survey, Menlo Park, Calif.

Collected by: Rinehart

Geologic setting and comment: See T–153.

T–155

(Muscovite) 94.6±2.8 m.y.; (Biotite) 108±3 m.y.

Description and location: Gneissic trondhjemite of Tiffany Mountain. Trondhjemite, medium-grained virtually directionless leucocratic rock (color index 5). (Lat 48°35.8′ N., long 120°4.5′ W.)

Analytical data: muscovite, K_2O = 10.71, 10.78 percent, $^{40}Ar_{rad}/gm = 1.540 \times 10^{-9}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.67; biotite, K_2O=9.37, 9.41 percent, $^{40}Ar_{rad}/gm = 1.543 \times 10^{-9}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}$=0.93.

Geologists: C. D. Rinehart and K. F. Fox, Jr., U.S. Geological Survey, Menlo Park, Calif.

Collected by: Rinehart.

Geologic setting and comment: See T–153.

T–156

(Hornblende) 81.2±2.4 m.y.; (Biotite) 78.8±2.4 m.y.

Description and location: Conconully pluton. Medium-grained locally seriate porphyritic massive granodiorite. (Lat 48°35.7′ N., long 119°52.1′ W.)

Analytical data: hornblende, K_2O=0.561, 0.567 percent, $^{40}Ar_{rad}/gm = 6.914 \times 10^{-11}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}$ = 0.61; biotite, K_2O = 9.16, 9.16 percent, $^{40}Ar_{rad}/gm = 1.089 \times 10^{-9}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}$ =0.90.

Geologists: C. D. Rinehart and K. F. Fox, Jr., U.S. Geological Survey, Menlo Park, Calif.

Collected by: Rinehart.

Geologic setting and comment: Probably the youngest member in the area studied of a composite batholith underlying the Okanogan Range; intrudes metamorphic rocks on the east, a hybrid granitoid unit on the north, and the Old Baldy pluton on the west. Probably the same as unnamed granodiorite and quartz monzonite (samples OK–1 and OK–4) referred to in Menzer (1970). See also T–152.

C–559

(Hornblende) 42.9±1.3 m.y.

Description and location: Dacite of Twin Peaks. Dark gray dense massive dacitic lava flow with fairly abundant hornblende crystals as long as 5 mm set in an aphanitic matrix. (Lat 48°41.2′ N., long 119°45.5′ W.)

Analytical data: K_2O = 0.556, 0.564 percent, $^{40}Ar_{rad}/gm = 3.587 \times 10^{-11}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total}$ =0.27.

Geologists: C. D. Rinehart and K. F. Fox, Jr., U.S. Geological Survey, Menlo Park, Calif.
Collected by: Rinehart.
Geologic setting and comment: The dacite is near the base of a volcanic pile, probably a few kilometres thick, that unconformably overlies batholithic rocks. Except for glacial drift and alluvium, it is the youngest geologic unit in the area.
References: Hibbard (1971); Rinehart and Fox (1976).

H–1
(Biotite) 97.7±2.9 m.y.

Description and location: Cathedral pluton. Quartz monzonite, coarse-grained, massive, locally miarolitic, leucocratic. (Lat 48°52.3′ N., long 120°01.0′ W.)
Analytical data: $K_2O = 8.88$, 8.87 percent, $^{40}Ar_{rad}/gm = 1.316 \times 10^{-9}$ moles, $^{40}Ar_{rad}/^{40}Ar_{total} = 0.90$.
Geologists: C. D. Rinehart and K. F. Fox, Jr., U.S. Geological Survey, Menlo Park, Calif.
Collected by: Rinehart.
Geologic setting and comment: One of the youngest, largest, and more homogeneous plutonic members of the composite batholith that underlies the Okanogan Range. It intrudes granitoid gneisses adjacent on both east and west. It occupies about 400 km^2 (150 mi^2) in the United States and an area perhaps half that size in Canada. About 115 km^2 (44 mi^2) of the eastern part of the pluton was mapped by Hibbard (1971), and a few tens of km^2 of the western part was mapped by Hawkins (1968); this age is concordant with a potassium-argon age reported by Hawkins (1968, p. 1789).
References: Hibbard (1971); Hawkins (1968).

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