United States
Department of the Interior
Geological Survey

Open-File Report
82-140

Map and tables showing preliminary results of K-Ar age studies in the Ugashik quadrangle, Alaska Peninsula

by
Frederic H. Wilson

Reported here are 15 new potassium-argon age determinations on igneous and altered igneous rocks from the Ugashik quadrangle. These determinations are part of an ongoing petrographic and K-Ar geochronologic study of igneous rocks and mineralized areas in the Ugashik and Karluk quadrangles. The new age determinations reported here provide support data for preliminary conclusions in Wilson and Shew (1981). They are also in close agreement with results from studies in the Chignik and Sutwik Island quadrangles to the south (Wilson and others, 1981; Wilson, 1980).

The dates reported here include three ages determined on rocks from the Meshik Formation (Detterman and others, 1981; Knappen, 1929). These determinations are in the same range as ages from the Meshik Formation in the Chignik and Sutwik Island quadrangles to the south (Wilson and others, 1981).

Also reported here are four age determinations on three Pleistocene igneous intrusions. Two of these intrusions are from magmatic centers that may have been active during Holocene time. The age of 1.78 my B.P. from a sample that may be related to Yantarni Volcano contrasts with an age of 0.62 my B.P. reported previously (Wilson and others, 1981) and suggests an eruptive history spanning at least 1.1 m.y. The two Yantarni(?) samples are very similiar petrographically. The dated sample (79AWs 17) associated with Kialagvik volcano is an unusual rock, in which thin section study (Table 2) suggests a mixing process was important in its formation. The sample from Blue Mountain yielded discordant results on plagioclase and impure hornblende separates. The impurity (< 10%) in the hornblende is plagioclase and no explanation for the discordance can be advanced at this time. Blue Mountain was indicated to be Jurassic in age by Beikman (1980), however the dates reported here indicate that the volcanic center is Pleistocene. Burk (1965) had reported Blue Mountain to be a Tertiary intrusive.

Three samples from the Rex Prospect yielded early Oligocene ages on both mineralized and unmineralized rocks. Samples R-41358A and R-4130 were collected, described, and analyzed by M.L. Silberman. Reconnaisance mapping of the Rex prospect by Silberman, D.P. Cox, and this author indicates a multi-event history and further dating work is in progress in an attempt to clearly define this history.

One sample from the Mike prospect, a molybdenum-rich system, yielded concordant ages on biotite and plagiclase of 3.48 and 3.42 m.y. resectively. These ages are interpretated to be hydrothermal alteration ages.

Finally, a concordant Late Jurassic age on a granite cobble collected from conglomerate in the Upper Jurassic Naknek Formation is reported here. This sample was analyzed to place a maximum age on the Naknek Formation at this locality.

Potassium was determined by flame photometry using a lithium metaborate fusion technique (Engels and Ingamells, 1970). Potassium analysts were Byron Lai, D. Vivit, and Paul Klock. Argon extraction and measurement was accomplished using standard techniques of isotope dilution mass spectrometry, essentially as described by Dalrymple and Lanphere (1969). The analytical error assigned to each age reported here (Table 1) is an estimate of the standard deviation of analytical precision using the method of Cox and Dalrymple (1967) together with the author's calculated estimates of uncertainties in the concentration of 38-Ar tracer and potassium measurements. Sample preparation, argon extraction and data reduction was by the author with assistance from Nora Shew, Rita Taylor, Brian Ho, and Leda Beth Gray, except for the two samples (R-41358A and R-41360) by M.L. Silberman

Analytical data is listed in Table 1, rock sample descriptions in Table 2 and sample locations are plotted on the map.

References

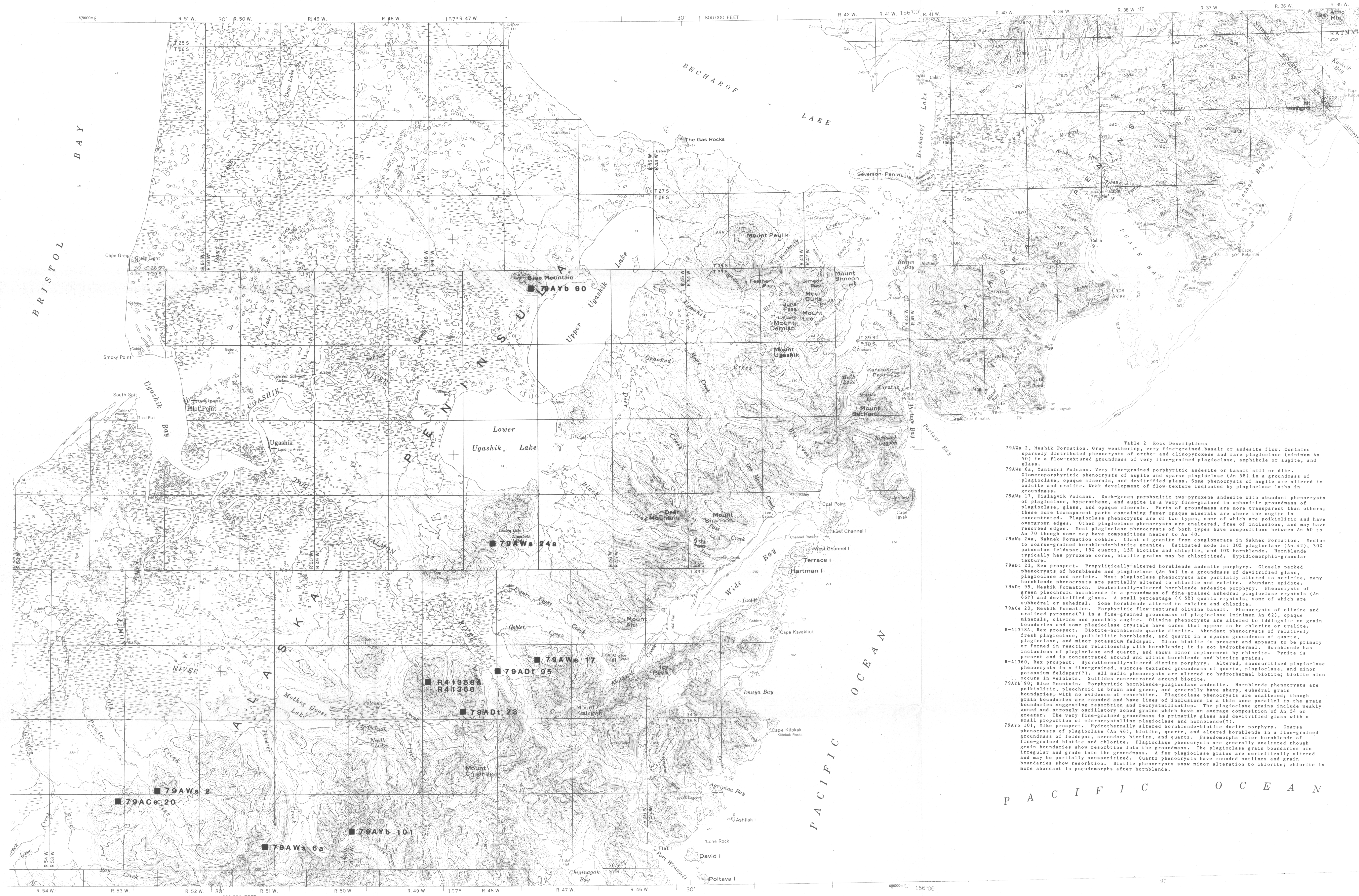
Beikman, H.M., 1980, Geologic map of Alaska: U.S. Geol. Survey, scale 1:2,500,000, 2 sheets.
Burk, C.A., 1965, Geology of the Alaska Peninsula - island arc and continental margin: Geol. Society of America Memoir 99, 250p., 2 maps, scales 1:250,000 and 1:500,000.
Cox, Allan, and Dalrymple, G.B., 1967, Statistical analysis of geomagnetic reversal data and the precision of potassium-argon dating: Journal of Geophysical Research, v. 72, p. 2603-2614.
Dalrymple, G.B. and Lanphere, M.A., 1969, Potassium-argon dating, principles, techniques, and applications to geochronology: W.H. Freeman and Co., San Francisco, California, 258p.
Detterman, R.L., Miller, T.P., Yount, M.E., and Wilson, F.H., 1981, Geologic map of the Chignik and Sutwik Island quadrangles, Alaska: U.S. Geol. Survey Misc. Geologic Investigations Map I-1229, scale 1:250,000.
Engels, J.C. and Ingamells, C.O., 1970, Effect of sample inhomogenity in K-Ar dating: Geochimica et Cosmochimica Acta, v. 34, p. 1007-1017.
Knappen, R.S., 1929, Geology and mineral resources of the Aniakchak district (Alaska), in Smith, P.S., Mineral resources of Alaska, report on progress of investigations in 1926: U.S. Geol. Survey Bull. 797-F, p. 161-227.
Wilson, F.H., 1980, Late Mesozoic and Cenozoic tectonics and the age of porphyry copper prospects; Chignik and Sutwik Island quadrangles, Alaska Peninsula: U.S. Geol. Survey Open-file Report 80-543, 94p., 5 plates, scales 1:250,000 and 1:12,000.
Wilson, F.H., and Shew, Nora, 1981, Preliminary results of potassium-argon age determinations from the Ugashik quadrangle, Alaska Peninsula, in Coonrad, W.L., ed., The U.S. Geological Survey in Alaska, Accomplishments during 1980: U.S. Geol. Survey Circular 843B, in press.
Wilson, F.H., Gaum, W.C., and Herzon, P.L., 1981, Map and tables showing geochronology and whole-rock geochemistry of the Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Misc. Field Studies Map MF-1053-M, 3 sheets, scale 1:250,000.

Table 1. Potassium-argon age determinations from the Ugashik quadrangle.

Sample No. and name	Location Latitude Longitude Quadrangle	Rock type	Mineral or component dated*	% K_2O	$\bar{x}$	$^{40}Ar_{rad}$ $\times 10^{-11}$ moles/gm	% $^{40}Ar_{rad}$	Age and $\pm 1_{\sigma}$ (m.y.)**
79AWs2 Meshik Fm.	57°06.5'N 157°38.2'W Ugashik A-5	Andesite	WR	1.564 1.547 1.534 1.543	1.547	6.2488 6.2912	80.0 79.0	27.85 ± .25 28.03 ± .25 $\bar{x}$ = 27.94 ± .38
79AWs6a Yantarni Volcano	57°02.7'N 157°24.2'W Ugashik A-5	Andesite or basalt	WR	1.04 1.03 1.04	1.04	0.2647 .2676	7.2 9.3	1.77 ± .024 1.79 ± .019 $\bar{x}$ = 1.78 ± .034
79AWs17 Kialagvik Volcano	57°15.6'N 156°49.4'W Ugashik B-3	Andesite	Plag	0.429 .430 .429	0.429	.0589 .0551	3.3 7.6	0.90 ± .109 .89 ± .029 $\bar{x}$ = .90 ± .113
79AWs24a Clast in Naknek Fm.	57°23.9'N 156°54.8'W Ugashik B-3	Granite	Hbl	.840 .842 .843	.842	20.35 19.54	78.6 71.3	161. ± .65 155. ± .71 $\bar{x}$ = 158. ± 4.4
			Bio	8.73 8.72 8.72 8.70	8.72	202.3 198.4	84.2 90.1	154. + .59 152. + .61 $\bar{x}$ = 153. ± 2.2
79ADt23 Rex prospect	57°12.1'N 156°58.8'W Ugashik A-3	Altered andesite porphyry	Hbl	.502 .503 .504 .504	.503	2.475 2.563	44.1 36.1	33.9 ± .17 35.0 ± .16 $\bar{x}$ = 34.5 ± .87
79ADt95 Meshik Fm.	57°14.9'N 156°54.6'W Ugashik A-3	Andesite porphyry	Hbl	.732 .738 .725 .732	.732	3.670 3.811	48.6 44.1	34.5 ± .29 35.8 ± .29 $\bar{x}$ = 35.2 ± 1.01
79ACe20 Meshik Fm.	57°05.9'N 157°43.1'W Ugashik A-6	Basalt	WR	.563 .565 .561	.563	2.007 2.060	52.5 40.0	24.6 ± .15 25.2 ± .13 $\bar{x}$ = 24.9 ± .49
R41358A Rex prospect	57°14.2'N 157°03.0'W Ugashik A-4	Quartz diorite	Hbl	1.056 1.050 1.037	1.048	5.298 5.367	52. 57.	34.8 ± .45 35.2 ± .45 $\bar{x}$ = 35.0 ± 0.7
			Bio	8.67 8.77 8.67	8.70	39.67	77.	31.4 ± 0.9
R41360 Rex prospect	57°14.2'N 157°03.0'W Ugashik A-4	Altered diorite porphyry	Bio (secondary)	7.20 7.22	7.21	38.84	68.	37.0 ± 1.1
79AYb90 Blue Mountain	57°41.5'N 156°50.0'W Ugashik C-3	Andesite	Plag	.418 .421 .420 .420	.420	.1014 .0992	9.9 10.2	1.68 ± .048 1.64 ± .048 $\bar{x}$ = 1.66 ± .072
			Hbl with plag	.95 .97 .96 .98	.97	.0736 .0797	2.3 2.4	.53 ± .021 .57 ± .020 $\bar{x}$ = .55 ± .042
79AYb101 Mike prospect	57°03.8'N 157°13.3'W Ugashik A-5	Dacite	Plag	1.008 1.016 1.028 1.002	1.014	.474 .524	17.7 19.0	3.25 ± .09 3.59 ± .09 $\bar{x}$ = 3.42 ± .28
			Bio	8.82 8.79 8.87	8.83	4.815 4.024	11.7 14.3	3.79 ± .08 3.16 ± .03 $\bar{x}$ = 3.48 ± .45

*WR = whole rock, Plag = plagioclase (WR and plagioclase are HF treated, see Wilson 1980), Hbl = hornblende, Bio = biotite.

**$\lambda_{\varepsilon} = 5.72 \times 10^{-11} yr^{-1}$, $\lambda_{\varepsilon}1 = 8.78 \times 10^{-13} yr^{-1}$, $\lambda_{\beta} = 4.963 \times 10^{-10} yr^{-1}$, $^{40}K/K = 1.167 \times 10^{-4}$ mol/mol.



SCALE 1:250000

CONTOUR INTERVAL 200 FEET

Table 2 Rock Descriptions

79AWs 2, Meshik Formation. Gray weathering, very fine-grained basalt or andesite flow. Contains sparsely distributed phenocrysts of ortho- and clinopyroxene and rare plagioclase (minimum An 50) in a flow-textured groundmass of very fine-grained plagioclase, amphibole or augite, and glass.

79AWs 6a, Yantarni Volcano. Very fine-grained porphyritic andesite or basalt sill or dike. Glomeroporphyritic phenocrysts of augite and sparse plagioclase (An 58) in a groundmass of plagioclase, opaque minerals, and devitrified glass. Some phenocrysts of augite are altered to calcite and uralite. Weak development of flow texture indicated by plagioclase laths in groundmass.

79AWs 17, Kialagvik Volcano. Dark-green porphyritic two-pyroxene andesite with abundant phenocrysts of plagioclase, hypersthene, and augite in a very fine-grained to aphanitic groundmass of plagioclase, glass, and opaque minerals. Parts of groundmass are more transparent than others; these more transparent parts containing fewer opaque minerals are where the augite is concentrated. Plagioclase phenocrysts are of two types, some of which are poikiolitic and have overgrown edges. Other plagioclase phenocrysts are unaltered, free of inclusions, and may have resorbed edges. Most plagioclase phenocrysts of both types have compositions between An 60 to An 70 though some may have compositions nearer to An 40.

79AWs 24a, Naknek Formation cobble. Clast of granite from conglomerate in Naknek Formation. Medium to coarse-grained hornblende-biotite granite. Estimated mode is: 30% plagioclase (An 42), 30% potassium feldspar, 15% quartz, 15% biotite and chlorite, and 10% hornblende. Hornblende typically has pyroxene cores, biotite grains may be chloritized. Hypidiomorphic-granular texture.

79ADt 23, Rex prospect. Propylitically-altered hornblende andesite porphyry. Closely packed phenocrysts of hornblende and plagioclase (An 54) in a groundmass of devitrified glass, plagioclase and sericte. Most plagioclase phenocrysts are partially altered to sericite, many hornblende phenocrysts are partially altered to chlorite and calcite. Abundant epidote.

79ADt 95, Meshik Formation. Deuterically-altered hornblende andesite porphyry. Phenocrysts of green pleochroic hornblende in a groundmass of fine-grained anhedral plagioclase crystals (An 66?) and devitrified glass. A small percentage (< 5%) quartz crystals, some of which are subhedral or euhedral. Some hornblende altered to calcite and chlorite.

79ACe 20, Meshik Formation. Porphyritic flow-textured olivine basalt. Phenocrysts of olivine and uralized pyroxene(?) in a fine-grained groundmass of plagioclase (minimum An 62), opaque minerals, olivine and possibly augite. Olivine phenocrysts are altered to iddingsite on grain boundaries and some plagioclase crystals have cores that appear to be chlorite or uralite.

R-41358A, Rex prospect. Biotite-hornblende quartz diorite. Abundant phenocrysts of relatively fresh plagioclase, poikiolitic hornblende, and quartz in a sparse groundmass of quartz, plagioclase, and minor potassium feldspar. Minor biotite is present and appears to be primary or formed in reaction relationship with hornblende; it is not hydrothermal. Hornblende has inclusions of plagioclase and quartz, and shows minor replacement by chlorite. Pyrite is present and is concentrated around and within hornblende and biotite grains.

R-41360, Rex prospect. Hydrothermally-altered diorite porphyry. Altered, saussuritized plagioclase phenocrysts in a fine-grained, sucrose-textured groundmass of quartz, plagioclase, and minor potassium feldspar(?). All mafic phenocrysts are altered to hydrothermal biotite; biotite also occurs in veinlets. Sulfides concentrated around biotite.

79AYb 90, Blue Mountain. Porphyritic hornblende-plagioclase andesite. Hornblende phenocrysts are poikiolitic, pleochroic in brown and green, and generally have sharp, euhedral grain boundaries, with no evidence of resorbtion. Plagioclase phenocrysts are unaltered; though grain boundaries are rounded and have lines of inclusions in a thin zone parallel to the grain boundaries suggesting resorbtion and recrystallization. The plagioclase grains include weakly zoned and strongly oscillatory zoned grains which have an average composition of An 54 or greater. The very fine-grained groundmass is primarily glass and devitrified glass with a small proportion of microcrystalline plagioclase and hornblende(?).

79AYb 101, Mike prospect. Hydrothermally altered hornblende-biotite dacite porphyry. Coarse phenocrysts of plagioclase (An 46), biotite, quartz, and altered hornblende in a fine-grained groundmass of feldspar, secondary biotite, and quartz. Pseudomorphs after hornblende of fine-grained biotite and chlorite. Plagioclase phenocrysts are generally unaltered though grain boundaries show resorbtion into the groundmass. The plagioclase grain boundaries are irregular and grade into the groundmass. A few plagioclase grains are sericitically altered and may be partially saussuritized. Quartz phenocrysts have rounded outlines and grain boundaries show resorbtion. Biotite phenocrysts show minor alteration to chlorite; chlorite is more abundant in pseudomorphs after hornblende.

Map and tables showing preliminary results of K-Ar age studies in the Ugashik quadrangle, Alaska Peninsula

by
Frederic H. Wilson

1982