SAMPLE LOCALITY MAP AND ANALYTICAL DATA FOR POTASSIUM-ARGON AGES IN THE PORT MOLLER, STEPOVAK BAY, AND SIMEONOF ISLAND QUADRANGLES, ALASKA PENINSULA

By Frederic H. Wilson, Nora Shew, Gregory D. DuBois, and Scott W. Bie

INTRODUCTION AND PREVIOUS WORK

Potassium-argon age determinations for 84 volcanic, intrusive, and hydrothermally altered rocks from the Port Moller, Stepovak Bay, and Simeonof Island quadrangles are reported here. Of these age determinations, 78 samples were analyzed as part of Alaska Mineral Resource Assessment Program (AMRAP) studies in the Port Moller, Stepovak Bay, and Simeonof Island quadrangles. Age determinations for 6 of the samples have been previously published (Burk, 1965; Kienle and Turner, 1976; Wilson and others, 1981). This report consists of a sample location map, analytical data (table 1), and rock descriptions (table 2).

In earlier studies in the map area, Burk (1965), Moore (1974), and Kienle and Turner (1976) reported age determinations on samples (samples 405M and 406, sample 62AGz 7, and samples 75088 and 75092 respectively, table 1) from the Shumagin Islands batholith (Tg). Armstrong and others (1976) reported an age determination (sample "Pyramid", table 1) on a hydrothermally altered sample from the Pyramid porphyry prospect. Finally, Wilson and others (1981) reported an age on a volcanic rock sample (77AWs 102, table 1) from the Meshik Volcanics (Tm).

Previous geochronologic studies on the Alaska Peninsula (Wilson and others, 1981; Wilson and Shew, 1992; Shew and Lanphere, 1992) have shown that most ages cluster in late Eocene to earliest Miocene (about 30 to 40 Ma) or late Miocene to Quaternary (less than 10 Ma) times. In particular, samples yielding middle Miocene ages (12-21 Ma) are rare and samples yielding ages of greater than approximately 47 Ma absent, except for ages determined on plutonic rocks of the Alaska-Aleutian Range batholith and plutons (Tg) of the Kodiak, Shumagin, and Sanak Islands. Geochronologic studies in the Aleutian Islands (see Wilson and others, 1991) display a similar pattern, except for an event in the range of 9.0±0.6 to 15.6±0.8 Ma in the western Aleutians on the Near Islands and on Amchitka Island (Scholl and others, 1976; Marlow and others, 1973).

INTRODUCTION (Geologic base)

Geologic mapping of the Port Moller, Stepovak Bay, and Simeonof Island 1° by 2° (1:250,000 scale) quadrangles on the Alaska Peninsula was conducted as part of the Alaska Mineral Resource Assessment Program (AMRAP). The mapping of Burk (1965), Kennedy and Waldron (1955), and Moore (1974) provided an excellent base for the AMRAP mapping. The geology on this map incorporates both Moore's (1974) map of the Outer Shumagin Islands and Kennedy and Waldron's (1955) map of the Pavlof Volcano area with minor additions. However, significant changes were made to Burk's (1965) pioneering work.

The geologic data on this map was compiled on 1:63,360-scale topographic maps and digitized using an extensively modified edition of GSMAP version 3.0 (Selner and others, 1986). This digital data was then transferred to ARC/INFO* for editing and compilation into a 1:250,000-scale geologic map (Environmental Systems Research Institute, 1987; Wilson, 1989b). The digitized geology was then generalized for this map and composited with a nondigital mosaic of the 1:250,000-scale topographic base maps.

Assistance to the authors in preparing the geologic map was provided by R.L. Detterman for Cenozoic and Mesozoic stratigraphy, J.W. Miller for Mesozoic paleontology and stratigraphy, and J.E. Case for geophysical interpretation and stratigraphy. F.R. Weber contributed significantly to the mapping of Quaternary geologic units. Louie Marincovich, Jr., contributed many Tertiary megafauna determinations and valuable paleoenvironment data.

MESHIK MAGMATIC ARC

The Meshik arc (Wilson, 1985) was defined on the Alaska Peninsula and adjacent islands on the basis of field mapping and the geochronologic data presented in Wilson and others (1981) and Wilson and Shew (1992). The Meshik magmatic arc (Wilson, 1985) as defined consists of Eocene to early Miocene volcanic, volcaniclastic, and related sedimentary rocks of the Alaska Peninsula (units Tm, Tp, Ts, and part of unit Tt). Prior to its definition, all Cenozoic igneous rocks on the Alaska Peninsula and in the Aleutians were classified as the Aleutian arc. As originally conceived, the Meshik arc is roughly comparable to the early series of Marlow and others (1973) and the Aleutian arc is directly comparable to the late series of Marlow and others (1973). Usage herein restricts the application of the term "Aleutian arc" to magmatic rocks of late Miocene and younger age. Igneous rocks included in the Meshik arc (Wilson, 1985) were mapped in the Port Moller study area as two units, the formally defined Meshik Volcanics (Tm) on the mainland and the informally defined Popof volcanic rocks (unit Tp, Wilson and others, in press), a lithologic and temporal equivalent of the Meshik Volcanics, in the Shumagin Islands.

DISCUSSION OF AGES

METHODOLOGY

Samples were collected from early Tertiary plutonic and hypabyssal rocks of the Shumagin Islands (map sheet), Eocene and Oligocene volcanic and hypabyssal rocks of the Meshik magmatic arc (Wilson, 1985), and late Miocene and younger volcanic, hypabyssal, and plutonic rocks of (Tv, Ti, QTv, Qv) the Aleutian magmatic arc. The volcanic and hypabyssal rocks (including unit Tvu) range in composition from basalt to rhyolite, whereas the plutonic rocks tend to have a more restricted range of composition from quartz diorite to granodiorite (including unit Tiu).

* Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Geological Survey.

All ages (table 1) have been calculated or were recalculated using decay and isotope abundance constants recommended by Steiger and Jager (1977). Most age determinations completed as part of this study were done in replicate because past experience indicates Alaska Peninsula volcanic rocks tend to be inhomogeneous, possibly as a result of low-grade hydrothermal alteration. Samples for which multiple mineral phases were analyzed generally had only one phase analyzed in replicate if other phases yielded concordant ages. Potassium was determined using lithium metaborate fusion and flame photometry, generally following the methods of Engels and Ingamells (1970). All potassium analyses were in duplicate; samples containing very low levels of potassium were analyzed in quadruplicate. Argon extraction and measurement were done using isotope-dilution mass spectrometry as generally described by Dalrymple and Lanphere (1969), with modifications presented by Wilson (1980). All argon extractions were completed at the USGS laboratory in Anchorage, Alaska. Mass spectrometry was completed at the USGS laboratory in Menlo Park, California and the University of Alaska laboratory in Fairbanks, Alaska. The age reported is a mean age where multiple argon extractions were performed on a single sample. The analytical error assigned to each age determination is an estimate of the standard deviation of analytical precision using the method of Cox and Dalrymple (1967), together with our adaptation of modifications to this method described by Mahood (1980), and our calculated estimate of uncertainty in the concentration of ^{38}Ar tracer and potassium measurements. Rock descriptions from hand specimens and thin sections for each sample are contained in table 2. Hand specimen colors were assigned using Goddard (1948) except where noted that the Munsell Soil Color Chart (1975) was used.

On the Alaska Peninsula, in cases where multiple mineral phases including plagioclase have been dated, plagioclase frequently yields the oldest apparent age (Wilson and Shew, 1987; 1992). An ongoing study on the Seward Peninsula of northwestern Alaska (Paul Layer, University of Alaska, written commun., 1991) has shown excess argon sufficient to yield 20-Ma apparent ages can be present in plagioclase in Quaternary volcanic rocks. Similar indications of excess argon in plagioclase have been reported by C.J. Nye from dating studies on volcanos in southcentral Alaska (oral commun., 1989). Finally, the extreme discordance shown by sample 83AWs 131 (table 1), where the plagioclase age is too old based on other geological data, results in suspicion on our part as to the validity of some age determinations on plagioclase. The above studies cause us to view the oldest ages reported here with some skepticism. However, plagioclase age determinations, such as on many samples of this study, yield apparent ages that are geologically reasonable.

RESULTS

Shumagin Islands batholith (Tg)

Previous geochronologic studies have determined ages on 5 samples of biotite-bearing granodiorite (table 1, unit Tg) from the Shumagin Islands batholith. Potassium-argon age determinations on biotite yielded an age range of 57.4±2.9 to 60.7±1.8 Ma. A single age determination on muscovite from one sample yielded an age slightly discordant to the biotite of 65.6±3.3 Ma. We dated a biotite-bearing dacite dike intruding the Shumagin Formation near the contact with the batholith; it yielded an age of 59.0±0.9 Ma, indicating the dike was probably coeval and comagmatic with the batholith.

Meshik Volcanics (Tm)

Rocks of the Meshik Volcanics in the study area have yielded ages in the range of 30.2±1.2 to 54.8±1.8 Ma. The three westernmost samples of the Meshik Volcanics yielded the oldest ages, two of these samples had plagioclase ages of 51.7±5.5 and 54.8±1.8 Ma. The oldest age previously determined on a rock sample from the Meshik arc was 48.1±0.89 Ma, on plagioclase from an andesite dike in the Sutwik Island quadrangle (Wilson and others, 1981). As these ages are all on plagioclase, they should be viewed with some skepticism. The typical range of ages elsewhere in rocks of the Meshik arc is 30 to 40 Ma. Samples of the Meshik Volcanics in the study area consistently exceed or are at the upper end of that range as only a single sample has yielded an age younger than 36 Ma.

Popof volcanic rocks (Tp)

Samples of the Popof volcanic rocks, from highly mineralized Unga and Popof Islands, may be younger than rocks of the Meshik Volcanics of the mainland in the study area. The Popof volcanic rocks typically yield apparent ages in the range of 30.9±1.1 to 37.1±1.2 Ma; only a single sample yielded an age greater than 36 Ma. A single sample from Andronica Island (83ADt 167) yielded a 24.6±4.2 Ma age; this rock may not actually belong to the Popof volcanics rock unit. Unpublished data suggests that the Popof volcanic rocks are in general more siliceous than rocks of the Meshik Volcanics, and include more dacite and the only rhyolite in the study area.

Middle Miocene rocks (parts of units Tlu, Tvu)

On Unga Island and the Pavlof Islands to the west, a number of samples yield apparent ages in the range 14.3±0.1 to 21.2±0.5 Ma. Previous studies on the Alaska Peninsula (Wilson and others, 1981; Wilson and Shew, 1992; Shew and Lanphere, 1992) have shown a conspicuous absence of rocks yielding apparent ages within this range. In the past, the very few samples that had yielded ages within this range were viewed with suspicion and presumed as either reset or containing inherited argon. However, fossil determinations (L.M. Marincovich Jr., written communs. 1984, 1985, 1987) from Unga Island and the Pavlof Islands on rocks interbedded with, or bracketing the igneous rocks confirm the validity of these ages. Rocks of this age don't appear to continue far into the adjacent Cold Bay and False Pass 1:250,000-scale quadrangles on the west and therefore have a limited spatial distribution. We believe that the lahar deposits of the Unga Formation (part) and the tuff and tuffaceous sedimentary rocks of the Belkofski Formation (part) are derived from this

magmatic phase. This Miocene event is newly recognized as significant in the study area.

Aleutian arc rocks

Nearly continuous in age with the above middle Miocene rocks are latest Miocene volcanic rocks we associate with the earliest phase of the modern Aleutian arc. Elsewhere on the Alaska Peninsula, late Miocene igneous rocks are primarily plutons (Devils batholith, Wilson and others, 1981; plutons at Mount Becharof, Wilson and Shew, 1992; plutons in the Cape Douglas area, Shew and Lanphere, 1992) occurring at or near the Pacific coast. Erosion in the Port Moller study area has not been as extensive as elsewhere on the Alaska Peninsula, resulting in the preservation of the volcanic rocks. However, latest Miocene and Pliocene plutonic rocks are also present. Late Pliocene and Quaternary volcanic rocks are distributed widely over the study area, ranging from the newly discovered volcanos of Stepovak Bay (Wilson, 1989a) in the northeast to remnant flows and domes in the central part of the area, and to the Pavlof group of volcanos (Kennedy and Waldron, 1955) in the southwest.

The recognition of middle Miocene volcanic rocks on Unga Island and in the Pavlof Islands (see section above, parts of units Tiu and Tvu) suggests that modern Aleutian arc magmatism began earlier than previously thought (Marlow and others, 1973; Wilson, 1980). The location of these rocks on Pacific islands offshore and south of the mainland is consistent with the suggestion (Wilson, 1980) that the locus of volcanism migrated to the northwest during the life of the Aleutian magmatic arc.

Alteration

A number of attempts were made to date alteration minerals in the study area. These met with limited success, typically due to our failure to obtain samples containing sufficient potassium. Dating of adularia from the Apollo Mine (sample 89AWw 130) at 34.0±0.5 Ma shows that hydrothermal alteration, mineralization, and faulting were concurrent with volcanism. A sericite date from altered rocks (31.8±0.6 Ma, sample 82AWs 15) to the west of Acheredin Bay on Unga Island, in combination with the adularia date and other geologic data indicates that Oligocene hydrothermal alteration was widespread on Unga Island. Similarly, a sericite date (sample 88AWs 28) of 14.63±0.27 Ma at the Zachary prospect (PM048, Wilson and others, 1988) on Unga Island shows that hydrothermal alteration was concurrent with Miocene magmatism; however, the sericite is slightly younger in age than most surrounding igneous rocks, suggesting that hydrothermal activity occurred as a late stage process. Armstrong and others (1976) reported a date of 6.4±0.2 Ma on hydrothermal biotite (sample "Pyramid") at the Pyramid prospect. A chlorite date on an altered volcanic rock sample from Outer Iliasik Island (sample 82AWs 48a, 5.44±0.48) supports the suggestion of latest Miocene alteration in the study area. The above dates indicate that all phases of magmatism in the study area have some associated mineralization or hydrothermal activity. East of Mount Dana and at Mount Dana itself, late Quaternary (including Holocene) hydrothermal alteration is present, though not dated.

REFERENCES CITED

Armstrong, R.L., Harakal, J.E., and Hollister, V.F., 1976, Age determination of late Caenozoic porphyry copper deposits of the North American Cordillera: Institute of Mining and Metallurgy Transactions, Section B, v. 85, p. 239-244.

Burk, C.A., 1965, Geology of the Alaska Peninsula -- island arc and continental margin: Geological Society of America Memoir 99, pt. 1, 250 p., scales 1:250,000 and 1:500,000, 3 sheets.

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, n. 10, p. 2603-2604.

Dalrymple, G.B., and Lanphere, M.A., 1969, Potassium-argon dating: San Francisco, W.H. Freeman and C., 258 p.

Detterman, R.L., 1978, Interpretation of depositional environments in the Chignik Formation, Alaska Peninsula, *in* Johnson, K.M., ed., The United States Geological Survey in Alaska: accomplishments during 1977: U.S. Geological Survey Circular 772-B, p. B62-B63.

Detterman, R.L., Case, J.E., Miller, J.W., Wilson, F.H., and Yount, M.E., in press, Stratigraphic framework of the Alaska Peninsula: U.S. Geological Survey Bulletin 1969.

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. Geological Survey Miscellaneous Investigations Series Map I-1229, scale 1:250,000.

Detterman, R.L., and Reed, B.L., 1980, Stratigraphy, structure, and economic geology of the Iliamna quadrangle, Alaska: U.S. Geological Survey Bulletin 1368-B, 86 p.

DuBois, G.D., Wilson, F.H., and Shew, N.B., 1987, Potassium-argon age determinations from the Port Moller and Stepovak Bay quadrangles, Alaska Peninsula: U.S. Geological Survey Open-File Report 87-191, scale 1:250,000. (superseded by this report).

Engels J.C., and Ingamells, C.O., 1970, Effect of sample inhomogeneity in K-Ar dating: Geochimica et Cosmochimica Acta, v. 34, p. 1007-1017.

Environmental Systems Research Institute, Inc., 1987, ARC/INFO, The Geographic Information System Software, Users Guide: Redlands, Calif.

Fairchild, D.T., 1977, Paleoenvironments of the Chignik Formation, Alaska Peninsula: Fairbanks, University of Alaska, M.S. thesis, 168 p.

Goddard, E.N., chairman, 1948, Rock-color chart: Washington, National Research Council [reprinted by Geological Society of America, 1979], 6 p.

Kennedy, G.C., and Waldron, H.H., 1955, Geology of Pavlof Volcano and vicinity, Alaska: U.S. Geological Survey Bulletin 1028-A, 19 p., scale 1:100,000.

Kienle, Juergen, and Turner, D.L., 1976, The Shumagin-Kodiak batholith, a Paleozoic magmatic arc?: Alaska Division Geologic and Geophysical Surveys Geologic Report 51, p. 9-11.

Mahood, G.A., 1980, The geological and chemical evolution of a late Pleistocene rhyolitic center:

The Sierra La Primavera, Jalisco, Mexico: Berkeley, Calif., University of California, Ph.D. dissertation, 245 p.

Marlow, M.S., Scholl, D.W., Buffington, E.C., and Alpha, T.R., 1973, Tectonic history of the central Aleutian arc: Geological Society of America Bulletin, v. 84, p. 1555-1574.

Marvin, R.F., and Dobson, S.W., 1979, Radiometric ages: Compilation B, U.S. Geological Survey: Isochron/West, no. 26, p. 3-6.

McLean, Hugh, 1979, Observations on the geology and petroleum potential of the Cold Bay-False Pass area, Alaska Peninsula: U.S. Geological Survey Open-File Report 79-1605, 34 p.

Moore, J.C., 1974, Geologic and structural map of part of the Outer Shumagin Islands, southwestern Alaska: U.S. Geological Survey Miscellaneous Investigations Series Map I-815, scale 1:63,360.

Munsell Soil Color Chart, 1975: Munsell Color, Macbeth Division, Kollmorgen Corporation, Baltimore, 8 pls.

Nilsen, T.H., 1984, Miocene back-arc tidal deposits of the Bear Lake Formation, Alaska Peninsula, *in* Reed, K.M., and Bartsch-Winkler, Susan, eds., The United States Geological Survey in Alaska: accomplishments during 1982: U.S. Geological Survey Circular 939, p. 85-88.

Scholl, D.W., Marlow, M.S., MacLeod, N.S., and Buffington, E.C., 1976, Episodic Aleutian ridge igneous activity: implications of Miocene and younger submarine volcanism west of Buldir Island: Geological Society of America Bulletin, v. 87, p. 547-554.

Selner, G.I., Taylor, R.B., and Johnson, B.R., 1986, GSDRAW and GSMAP version 3.0: prototype programs for the IBM PC or compatible microcomputers to assist compilation and publication of geologic maps and illustrations: U.S. Geological Survey Open-File Report 86-447, 53 p., 1 (5 1/4 in.) disk.

Shew, Nora, and Lanphere, M.A., 1992, Map and table showing K-Ar ages from the Mount Katmai and adjacent parts of Naknek and Afognak quadrangles, Alaska Peninsula, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-2021-E, scale 1:250,000.

Steiger, R.H., and Jager, E., 1977, Subcommission on Geochronology: Convention on the use of decay constants in geo- and cosmochronology: Earth and Planetary Science Letters, v. 36, p. 359-362.

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. Geological Survey Open-File Report 80-543, 94 p., 5 pls., scales 1:250,000 and 1:12,000.

Wilson, F.H., 1985, The Meshik arc -- an Eocene to earliest Miocene magmatic arc on the Alaska Peninsula: Alaska Division of Geological and Geophysical Surveys Professional Report No. 88, 14 p.

Wilson, F.H., 1989a, Geologic setting, petrology, and age of Pliocene to Holocene volcanoes of the Stepovak Bay area, western Alaska Peninsula, *in* Dover, J.H., and Galloway, J.P., eds., Geologic studies in Alaska by the U.S. Geological Survey, 1988: U.S. Geological Survey Bulletin 1903, p. 96-103.

_____ 1989b, Creation of a full color geologic map by computer: a case history from the Port Moller project resource assessment, Alaska Peninsula, *in* Dover, J.H., and Galloway, J.P., eds., Geologic studies in Alaska by the U.S. Geological Survey, 1988: U.S. Geological Survey Bulletin 1903, p. 96-103.

Wilson, F.H., Detterman, R.L., Miller, J.W., and Case, J.E., in press, Geologic map of the Port Moller, Stepovak Bay, and Simeonof Island quadrangles, Alaska: U.S. Geological Survey Miscellaneous Investigations Series Map I-2272, scale 1:250,000.

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 Miscellaneous Field Studies Map MF-1053-M, scale 1:250,000, 3 sheets.

Wilson, F.H., and Shew, Nora, 1987, K-Ar age discordancy in Quaternary volcanic rocks [abs.]: Eos (American Geophysical Union Transactions), v. 68, no. 44, p. 1287.

Wilson, F.H., and Shew, Nora, 1992, Map and tables showing geochronology and whole-rock geochemistry of selected samples, Ugashik and part of Karluk quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1539-E, scale 1:250,000.

Wilson, F.H., Shew, Nora, and DuBois, G.D., 1991, Map and table showing isotopic age data in Alaska, *in* Plafker, George, Jones, D.L., and Berg, H.C., eds., Geology of Alaska: Geological Society of America, The Geology of North America, Boulder, Colo., v. G-1, pl. 8, scale 1:2,500,000.

Wilson, F.H., White, W.H., and DuBois, G.D., 1988, Brief descriptions of mines, prospects, and mineral occurrences in the Port Moller and Stepovak Bay quadrangles, Alaska Peninsula: U.S. Geological Survey Open-File Report 88-666, 128 p.

Wisehart, R.M., 1971, Paleoenvironmental analysis of the Bear Lake Formation (upper and middle Miocene), Alaska Peninsula, Alaska: Los Angeles, University of California, M.S. thesis, 112 p.

Yount, M.E., Miller, T.P., Emanuel, R.P., and Wilson, F.H., 1985, Eruption in an ice-filled caldera, Mount Veniaminof, Alaska Peninsula, *in* Bartsch-Winkler, Susan, and Reed, K.M., eds., The United States Geological Survey in Alaska: accomplishments in 1983: U.S. Geological Survey Circular 945, p. 59-60.

Table 1. *K-Ar age determinations of rocks from the Port Moller and Stepovak Bay quadrangles*
[Age determinations calculated using the following decay constants: $\lambda_\varepsilon = 0.572 \times 10^{-10}$ year^{-1}, $\lambda_{\varepsilon'} = 8.78 \times 10^{-13}$ year^{-1}, $\lambda_\beta = 4.962 \times 10^{-10}$ year^{-1}, $^{40}K/K = 1.167 \times 10^{-4}$ atom percent. Sample preparation by Nora Shew, Greg DuBois, L.M. Angeloni, M.A. Pernokas, Stephanie Zurinski, C.L. Connor. Argon extraction by Nora Shew and Greg DuBois, mass spectrometry by authors with assistance from James E. Conrad, Leda Beth Gray, Elliot Kollman, James Saburomaru, Jarel von Essen, and Malcolm Pringle. Argon analysis and age calculation by Nora Shew and F.H. Wilson, potassium analysis by Sarah Neil, Stuart McPherson, Byron Lai, Terry Fries, and Larry Espos, all of the U.S. Geological Survey. Data for sample 77AWs 102 previously published in Wilson and others, 1981; samples 405 and 406 from Burk (1965); samples 75088 and 75092 from Kienle and Turner (1976); sample 62AGz 7 from Marvin and Dobson (1979). Published ages recalculated using decay constants above, as necessary. HF = hydrofluoric acid treated (see Wilson, 1980); Qtz = quartz; WR = whole rock]

Sample number (sheet 1)	Rock type (mineral dated)	Latitude ° N.	Longitude ° W.	Mean K_2O (percent)	$^{40}Ar_{rad}$ x10^{-12} (mol/gm)	Ar_{rad} (percent)	Mean age (Ma)	Error (m.y.)
Miocene and Pliocene plutons								
Miscellaneous (Ti, Tiu)								
83AWs 65	Granodiorite (Biotite)	55° 48' 59"	158° 51' 35"	9.03	125.1 120.6	68.3 64.4	9.43	±0.26
	(Hornblende)	-- do --	-- do --	.667	8.718	25.4	9.06	± .15
83APk 10b	Qtz diorite (Biotite)	55° 53' 25"	159° 25' 12"	8.47	87.50 87.23	54.8 56.1	7.15	± .14
83AYb 526	Dacite (Hornblende)	55° 47' 45"	159° 51' 02"	.302	2.597 2.686	12.4 12.9	6.07	± .23
83AWs 126	Qtz monzodiorite (Biotite)	55° 08' 04"	161° 59' 05"	9.55	42.87 45.46	35.0 32.7	3.21	± .14
American Bay pluton (Ti)								
83AAi 29	Qtz diorite (Biotite)	55° 43' 47"	160° 11' 05"	8.09	50.48 51.57	39.1 33.1	4.38	±0.09
	(Hornblende)	-- do --	-- do --	.762	3.977 4.080	13.8 11.7	3.67	± .10
83APk 25a	Qtz diorite (Plagioclase-HF)	55° 43' 26"	160° 13' 29"	1.374	7.008 7.069	58.2 56.5	3.56	± .09
	(Hornblende)	-- do --	-- do --	.617	3.245	9.5	3.65	± .10
Middle Miocene igneous rocks (Tiu, Tv, Tvu)								
56228	Andesite (Hornblende)	55° 18' 23"	160° 43' 47"	.280	7.407 6.981	20.2 21.2	17.76	± .85
85AWs 300	Andesite (Plagioclase-HF)	55° 17' 19"	160° 43' 32"	.575	11.85	72.2	14.3	± .1
85AWs 302	Leuco-basalt (Plagioclase-HF)	55° 19' 15"	160° 45' 10"	.135	4.113 3.826	50.2 46.6	20.3	±1.6
56953	Leuco-basalt (Plagioclase-HF)	55° 17' 58"	160° 45' 50"	.107	2.593 2.619	35.9 40.5	16.92	± .23
84ADt 262	Leuco-basalt (Plagioclase-HF)	55° 15' 00"	161° 31' 40"	.082	2.453 2.487	28.6 21.0	20.93	± .38
82AJm 507	Leuco-basalt (WR-HF)	55° 12' 40"	160° 50' 54"	.389	11.74 12.09	60.9 68.8	21.18	± .49
83AWs 125	Andesite (Plagioclase-HF)	55° 12' 00"	161° 37' 41"	.079	1.707 1.877	28.4 27.2	15.69	±1.61
83AWs 129a	Diorite (Plagioclase-HF)	55° 11' 25"	161° 20' 10"	.315	7.996 7.937	71.4 46.9	17.48	± .32
83AYb 573	Andesite (Plagioclase-HF)	55° 13' 22"	161° 23' 47"	0.212	5.646 5.648	50.0 51.6	18.41	± 0.55

Table 1. *K-Ar age determinations of rocks from the Port Moller and Stepovak Bay quadrangles* -- Continued

Sample number (sheet 1)	Rock type (mineral dated)	Latitude °N.	Longitude °W.	Mean K_2O (percent)	$^{40}Ar_{rad}$ x10^{-12} (mol/gm)	Ar_{rad} (percent)	Mean age (Ma)	Error (m.y.)
			Middle Miocene igneous rocks (cont.)					
85AAi 88	Andesite (Plagioclase-HF)	55° 46' 41"	160° 15' 33"	0.171	5.057 4.958	45.7 44.9	20.3	±0.4
			Late Miocene volcanic rocks (Tv)					
82AWs 41b	Andesite (Hornblende)	55° 43' 04"	160° 12' 26"	.539	6.532 6.325	20.9 26.2	8.27	± .24
84AYb 601	Andesite (Plagioclase-HF)	55° 52' 55"	158° 48' 26"	0.593	7.762 8.381	50.9 50.1	9.44	±0.74
83ACe 54	Dacite (Plagioclase-HF)	55° 43' 38"	159° 37' 32"	.626	8.072 8.109	60.0 55.9	8.96	± .19
	(Hornblende)	-- do --	-- do --	.507	7.236	26.1	9.90	± .14
83AWs 100	Andesite (Hornblende)	55° 50' 24"	159° 54' 45"	.326	2.448 2.583	13.6 11.4	5.33	± .30
83AWs 118a	Leuco-basalt (Plagioclase-HF)	55° 32' 20"	160° 22' 25"	.808	10.90 11.32	44.1 50.1	9.53	± .29
82AWs 36	Dacite (Plagioclase-HF)	55° 33' 05"	160° 27' 39"	2.508	32.14 32.50	76.1 76.6	8.93	± .10
83AWs 116a	Dacite (Hornblende)	55° 30' 48"	160° 28' 41"	.368	4.648 4.811	18.6 23.2	8.91	± .27
82AWs 32	Andesite (Plagioclase-HF)	55° 33' 32"	160° 32' 31"	.596	7.907 8.963	58.1 66.7	9.81	± .88
83APk 40d	Dacite(?) (Hornblende)	55° 37' 54"	160° 39' 18"	.601	5.629 5.906	18.2 22.8	6.65	± .26
85ADt 341	Andesite (Plagioclase-HF)	55° 35' 19"	160° 39' 30"	.225	3.904 3.810	19.4 14.2	11.90	± .45
82AWs 10	Andesite (Plagioclase-HF)	55° 30' 02"	160° 47' 42"	.404	5.868 6.254	39.5 56.2	10.40	± .49
85AJm 781	Andesite (WR-HF)	55° 19' 17"	160° 51' 38"	.234	3.666 3.700	13.3 12.9	10.92	± .19
83AWs 131	Andesite (WR-HF)	55° 12' 00"	161° 20' 17"	.251	2.949 3.156	16.1 19.1	8.43	± .45
	(Plagioclase-HF)	-- do --	-- do --	.031	1.355 1.231	18.7 10.7	29.2	±5.2
84AJm 719a	Andesite (Plagioclase-HF)	55° 05' 54"	161° 34' 59"	.087	1.632 1.752	22.7 9.2	13.54	± .81
83APk 50a	Andesite (Plagioclase-HF)	55° 09' 15"	161° 43' 06"	.325	5.415 5.638	24.0 26.9	11.79	± .41
84AAi 86	Andesite (Plagioclase-HF)	55° 10' 07"	161° 46' 42"	.829	14.14	60.0	11.82	± .50
84ADt 253	Andesite (Plagioclase-HF)	55° 08' 29"	161° 54' 04"	.252	2.503 2.586	25.9 21.7	7.00	± .52
82AWs 48a	Andesite(?), altered (Chlorite)	55° 00' 53"	161° 53' 07"	.993	7.306 8.249	14.7 11.5	5.44	± .48
			Meshik arc					
			Meshik Volcanics (Tm)					
77AWs 102	Leuco-basalt (WR-HF)	55° 57' 00"	159° 21' 00"	1.103	65.83 63.63	83.3 79.1	40.3	±1.6

Table 1. *K-Ar age determinations of rocks from the Port Moller and Stepovak Bay quadrangles* -- Continued

Sample number (sheet 1)	Rock type (mineral dated)	Latitude ° N.	Longitude ° W.	Mean K_2O (percent)	$^{40}Ar_{rad}$ x10^{-12} (mol/gm)	Ar_{rad} (percent)	Mean age (Ma)	Error (m.y.)
			Meshik Volcanics (cont.)					
84ACe 113c	Leuco-basalt (Hornblende)	55° 53' 20"	159° 07' 10"	.327	20.66 20.19	46.9 49.1	42.9	± 1.0
83AYb 515b	Andesite (Hornblende)	55° 43' 07"	159° 23' 50"	.604	34.65 35.31	63.9 63.3	39.8	± .6
84AWs 187	Basalt (Plagioclase-HF)	55° 53' 52"	159° 41' 35"	.661	38.19 38.67	90.3 81.1	40.4	± 1.3
84ADt 206	Dacite (WR-HF)	55° 49' 52"	160° 27' 54"	1.146	61.16 59.28	87.1 86.2	36.1	± .9
84AWs 205b	Andesite (Plagioclase-HF)	55° 47' 07"	160° 30' 33"	.632	35.15 34.66	84.3 73.1	38.0	± .7
84ACe 177	Leuco-basalt (WR-HF)	55° 50' 19"	160° 32' 38"	.527	27.64 28.24	69.7 63.7	36.5	± 1.0
84AJm 695	Andesite (WR-HF)	55° 50' 00"	160° 43' 40"	.129	5.562 5.737	56.6 54.2	30.2	± 1.2
85AWs 310	Andesite (Plagioclase-HF)	55° 32' 37"	160° 52' 29"	.286	17.61 18.28	70.6 76.0	43.1	± 1.3
84AYb 675	Basalt (Plagioclase-HF)	55° 30' 46"	160° 58' 00"	.238	19.07 18.97	13.8 11.5	54.8	± 1.8
84AWs 274b	Leuco-basalt (Plagioclase-HF)	55° 28' 23"	161° 06' 16"	.052	3.852 3.955	17.2 17.1	51.7	± 5.5
83AJm 624	Diorite (Biotite)	55° 29' 45"	161° 28' 12"	6.26	425.7 418.6	82.4 78.4	46.3	± 1.0
84TKup 8	Andesite(?) (WR-HF)	55° 48' 00"	159° 31' 12"	.936	37.36 39.28	70.9 69.9	28.2	± 1.0
			Popof volcanic rocks (Tp)					
85AAi 98	Andesite (Plagioclase-HF)	55° 16' 08"	160° 22' 34"	0.092	4.160 4.182	46.6 56.3	31.2	± 1.4
85AWs 290	Andesite (Plagioclase-HF)	55° 21' 27"	160° 28' 26"	.066	3.206 3.356	38.4 59.0	34.5	± 1.3
85AWs 293	Leuco-basalt (Plagioclase-HF)	55° 19' 38"	160° 29' 50"	.114	5.311 5.317	62.4 47.1	32.2	± 1.5
85AWs 296a	Rhyolite (WR)	55° 11' 54"	160° 29' 25"	6.33	288.8 286.4	93.1 89.3	31.3	± .3
85AYb 743	Andesite(?) (Plagioclase-HF)	55° 22' 53"	160° 31' 22"	.181	9.182 9.678	78.8 79.0	35.9	± 1.4
82ACc 23	Dacite (Hornblende)	55° 12' 21"	160° 33' 21"	.393	19.71 19.07	59.2 58.8	34.0	± 1.1
82ACc 21	Dacite (Plagioclase-HF)	55° 12' 21"	160° 33' 57"	.369	18.63 18.04	74.4 85.4	34.2	± .9
85AWs 321	Andesite (Plagioclase-HF)	55° 16' 30"	160° 33' 55"	.329	16.67 16.14	71.1 83.8	34.3	± .9
82ASh 14	Dacite (Plagioclase-HF)	55° 19' 21"	160° 34' 10"	.229	12.23 12.50	60.1 71.4	37.1	± 1.2
82ASh 9	Dacite tuff (Biotite)	55° 19' 00"	160° 34' 32"	7.92	374.4 394.6	27.6 31.2	33.7	± 1.3
56968	Andesite (WR-HF)	55° 11' 20"	160° 36' 26"	0.252	11.52 11.11	27.2 25.8	30.9	± 1.1
88AWw 425	Andesite (Plagioclase-HF)	55° 18' 22"	160° 29' 48"	.156	7.845 7.722	59.9 60.4	34.4	± .5

Table 1. *K-Ar age determinations of rocks from the Port Moller and Stepovak Bay quadrangles* -- Continued

Sample number (sheet 1)	Rock type (mineral dated)	Latitude ° N.	Longitude ° W.	Mean K_2O (percent)	$^{40}Ar_{rad}$ $x10^{-12}$ (mol/gm)	Ar_{rad} (percent)	Mean age (Ma)	Error (m.y.)
Popof volcanic rocks (cont.)								
83ADt 167	Leuco-basalt (Plagioclase-HF)	55° 20' 35"	160° 05' 10"	0.044	1.638 1.568 1.438	14.7 12.2 11.8	24.6	±4.2
Stepovak Bay volcanos								
84AWs 176	Andesite (Plagioclase-HF)	55° 59' 05"	159° 39' 10"	0.594	1.796 1.790	11.8 9.0	2.10	±0.05
84AWs 177	Andesite (Plagioclase-HF)	55° 58' 30"	159° 39' 55"	.104	.08907 .08077	1.6 1.6	.57	± .06
84ADt 192	Andesite (Plagioclase-HF)	55° 59' 50"	159° 39' 42"	.415	1.789 1.849	25.5 24.7	3.04	± .08
83AWs 97	Leuco-basalt (Plagioclase-HF)	55° 53' 56"	159° 54' 07"	.094	1.495 2.535 2.017 1.950	2.4 4.4 3.3 3.8	1.48	± .36
84AYb 612	Andesite(?) (Plagioclase-HF)	55° 57' 50"	159° 44' 44"	.135	.09181 .08834	1.4 2.8	.464	± .017
82AWs 45	Andesite (Plagioclase-HF)	55° 50' 12"	160° 01' 47"	.356	.3216 .2249	7.1 5.0	.534	± .139
84AWs 204	Andesite (WR-HF)	55° 51' 26"	160° 08' 48"	.884	.4894 .5466	7.1 9.8	.407	± .034
84AYb 633	Andesite (Plagioclase-HF)	55° 49' 08"	160° 13' 40"	.416	2.781 2.786	45.1 39.1	4.65	± .07
85AYb 708	Andesite (Plagioclase-HF)	55° 57' 26"	160° 16' 50"	.906	2.198 2.245	47.2 53.3	1.70	± .03
84AWs 200	Andesite (WR-HF)	55° 53' 30"	160° 18' 51"	1.088	4.308 4.216	22.7 26.7	2.72	± .05
84AWs 199	Andesite (Plagioclase-HF)	55° 57' 00"	160° 27' 10"	.376	1.769 1.851	35.6 35.5	3.35	± .12
84AWs 197	Andesite (Plagioclase-HF)	55° 55' 14"	160° 28' 29"	1.562	8.689 8.736	75.9 56.5	3.87	± .06
Quaternary volcanic rocks								
84AWs 212	Andesite (Plagioclase-HF)	55° 44' 27"	160° 45' 14"	0.509	0.4940 .4855	10.2 7.4	0.668	±0.045
88ADg 20	Leuco-basalt (Plagioclase-HF)	55° 42' 04"	160° 45' 52"	.280	.3359 .3575	10.9 11.4	.862	± .056
85AYb 718	Dacite (WR-HF)	55° 39' 47"	160° 52' 55"	.742	.1483 .1738	3.3 4.0	.150	± .020
84AWs 246	Andesite (Plagioclase-HF)	55° 33' 39"	161° 57' 05"	.513	.7234 .7144	8.7 8.1	.974	± .052
Shumagin Islands batholith (Tg)								
PMF-892	Dacite (Biotite)	55° 07' 14"	159° 57' 32"	8.09	691.3 705.2	84.7 81.3	59.0	±0.9
405M	Granodiorite (Muscovite)	55° 03' 12"	160° 02' 30"	9.82	830.	84.	57.4	±2.9
75092	Granodiorite (Biotite)	55° 02' 25"	160° 02' 30"	8.248	733.4	91.8	60.7	±1.8
75088	Granodiorite (Biotite)	55° 09' 48"	159° 33' 30"	6.510	574.0	90.3	60.2	±1.8

Table 1. *K-Ar age determinations of rocks from the Port Moller and Stepovak Bay quadrangles* -- Continued

Sample number (sheet 1)	Rock type (mineral dated)	Latitude ° N.	Longitude °W.	Mean K_2O (percent)	$^{40}Ar_{rad}$ x10^{-12} (mol/gm)	Ar_{rad} (percent)	Mean age (Ma)	Error (m.y.)
Shumagin Islands batholith (cont.)								
406	Granodiorite (Biotite)	55° 06' 48"	160° 01' 42"	7.94	682.5	86.	58.4	±2.9
	(Muscovite)	-- do --	-- do --	9.51	915.	82.	65.6	±3.3
62AGz 7	Granodiorite (Biotite)	54° 55' 00"	159° 13' 30"	6.60	578.4	72.	59.9	±3 0
Others (Altered rocks)								
Pyramid	Qtz diorite (Hydrothermal biotite)	55° 37' 00"	160° 41' 00"	8.47	78.54	46.	6.4	± .2
88AWs 28	Qtz-sericite (WR)	55° 16' 50"	160° 37' 50"	4.45	93.83 94.14	81.6 69.5	14.63	± .27
89AWw 130	Vein (Adularia)	55° 11' 23"	160° 34' 25"	15.30	761.2 750.1	74.4 87.1	34.0	± .5
82AWs 15	Qtz-sericite (WR)	55° 10' 08"	160° 46' 32"	3.60	167.5 164.8	91.5 92.6	31.8	± .6

Table 2. *Descriptions of dated rocks*

[All quadrangle locations specified are 1:63,360-scale quadrangles. All determinations of plagioclase anorthite content were made optically using Carlsbad-albite twin method. Samples are listed in numerical and alphabetical order. *, colors from Munsel Color Chart (1975)]

Sample No.	Rock Unit	Description
56228	Tiu	VABM "Fourth", Unga Island; Port Moller B-3 quad. Porphyritic andesite dome. Phenocrysts of large subhedral to euhedral, zoned, twinned hornblende and subhedral to euhedral, zoned and predominantly twinned, plagioclase (An_{33}) in a fine-grained groundmass of plagioclase laths, hornblende, anhedral opaque grains, and glass.
56953	Tv	Northwest-trending ridge southwest of VABM "Fourth", Unga Island; Port Moller B-3 quad. Intergranular-textured extrusive leuco-basalt. Phenocrysts of subophitic anhedral clinopyroxene and subhedral to euhedral, polysynthetically twinned, plagioclase (An_{65}). Chlorite aggregates with rounded grain boundaries, chlorite generally in radiating fans of microlites, may be replacing glass; abundant, anhedral sphene(?) commonly rimmed by chlorite.
56968	Tp	Apollo Mountain, Unga Island; Port Moller A-2 quad. Porphyritic andesite. Phenocrysts of subhedral to euhedral, zoned, and polysynthetically twinned, plagioclase (An_{56} or An_{70}), anhedral to subhedral orthopyroxene and clinopyroxene, and microporphyritic subhedral to euhedral epidote in a groundmass of anhedral to subhedral plagioclase, anhedral pyroxene, opaque grains, and epidote. Plagioclase phenocrysts are commonly altered to sericite(?) in cores or at rim. Some orthopyroxene phenocrysts have rims of clinopyroxene. Chlorite in forms that are pseudomorphs of pyroxene(?), minor sphene occurs with chlorite in pseudomorph.
77AWs 102	Tm	Clast from rubble flow from peak east of Ivanof River; Stepovak Bay D-5 quad. Porphyritic leuco-basalt flow. Dark-gray, fine-grained porphyritic flow containing anhedral to subhedral, commonly twinned, rarely zoned clinopyroxene phenocrysts and subhedral to euhedral generally polysynthetically twinned, zoned, plagioclase phenocrysts (An_{55-60}) in a groundmass of interstitial glass. Iddingsite, chlorite, and opaque grains are in forms that pseudomorph olivine(?). Chlorite usually at rim of iddingsite pseudomorph, opaque grains as inclusion; subhedral orthopyroxene phenocrysts; groundmass is fine-grained morass of plagioclase laths, anhedral clinopyroxene, minor chlorite, and anhedral to euhedral opaque grains.
82ACc 21	Tp	Unga Island, between Bloomer Peak and Delarof Harbor; Port Moller A-2 quad. Dark-olive-gray to dark-olive-black (5 Y 3/1) porphyritic dacite flow having yellowish-gray (5 Y 8/1) weathered surfaces. Slightly iron stained on some weathered surfaces. Phenocrysts of subhedral to euhedral, commonly zoned, polysynthetically twinned plagioclase and subhedral, rarely twinned, clinopyroxene in a groundmass of plagioclase microlites and laths, anhedral clinopyroxene, opaque grains, minor chlorite. Some plagioclase phenocrysts contain inclusions of abundant very fine grained anhedral clinopyroxene; others are partially altered to sericite.
82ACc 23	Tp	Unga Island, between Bloomer Peak and Delarof Harbor; Port Moller A-2 quad. Pinkish-gray (5 YR 8/1) amygdaloidal dacite porphyry; possibly a tuff. Megaphenocrysts of anhedral quartz, megaphenocrysts, subhedral to euhedral, commonly polysynthetically twinned, zoned plagioclase, subhedral to euhedral hornblende, minor clinopyroxene in a cryptocrystalline groundmass, containing opaque grains, very fine grained plagioclase, quartz, and hornblende. Groundmass is brown, predominantly spherulitic.
82AJm 507	Tvu	Unga Island, near Sombrero Point; Port Moller B-3 quad. Brownish-gray (5 YR 4/1) porphyritic leuco-basalt flow containing large yellowish-gray (5 Y 8/1) phenocrysts of plagioclase. Phenocrysts of subhedral, commonly twinned plagioclase (An_{70-80}) and anhedral to subhedral clinopyroxene in a groundmass of pilotaxitic plagioclase laths, abundant anhedral clinopyroxene, anhedral to euhedral opaque grains, chlorite, and fibrolite. Most plagioclase phenocrysts have rims that contain inclusions of clinopyroxene. Sparse chlorite(?) aggregates that are pseudomorphs of an unidentified mafic(?) mineral.
82ASh 9	Tp	Unga Island on Popof Strait; Port Moller B-2 quad. Very light gray (N 8) crystal dacitic tuff with angular, broken, or fractured crystals of quartz, plagioclase, biotite, and amphibole(?) in a weakly welded groundmass of glass shards.

Table 2. *Descriptions of dated rocks -- Continued*

Sample No.	Rock Unit	Description
82ASh 14	Tp	Unga Island on Popof Strait; Port Moller B-2 quad. Olive-gray (5 Y 3/2) porphyritic dacite with phenocrysts to 2 mm of plagioclase (An_{55-60}), orthopyroxene and clinopyroxene, and lithic fragments in a fine-grained groundmass of plagioclase microlites and glass. Groundmass plagioclase has a variable weak orientation or foliation.
82AWs 10	Tv	Volcanic flows capping Cape Aliaksin; Port Moller C-3 quad. Olive-gray (5 Y 4/1) andesite with large (2.5 mm) plagioclase phenocrysts (An_{60-65}) and clinopyroxene phenocrysts (2 mm) in a groundmass of plagioclase microlites and devitrified glass.
82AWs 15	Tp	"Lake" prospect, southwest end of Unga Island; Port Moller A-3 quad. Completely recrystallized, pinkish-white (7.5 YR 8/2)* quartz-sericite altered volcanic(?) rock. Quartz and sericite pseudomorphs after plagioclase(?) and pyroxene(?) with abundant pyrite. All primary minerals are replaced by secondary phases.
82AWs 32	Tv	Volcanic flows capping peninsula north of Swedania Point; Port Moller C-2 quad. Dark-olive-gray (5 Y 3/1) andesite with phenocrysts of hypersthene (1-1.5 mm) and plagioclase (2-3 mm, An_{64}) in a fine-grained groundmass of plagioclase, devitrified glass, and opaque oxides. Phenocrysts show weak parallel alignment or foliation.
82AWs 36	Tiu	Small hypabyssal plug on peninsula north of Swedania Point; Port Moller C-2 quad. Very light gray (N 8) dacite with phenocrysts (1-1.5 mm) of plagioclase (An_{64}) and clinopyroxene in a groundmass of quartz, plagioclase, and opaque oxides. Edges of pyroxene grains are altered to biotite and there is minor alteration of pyroxene to chlorite. Fracturing is pervasive throughout thin section.
82AWs 41b	Tvu	Dike intruding contact metamorphosed volcanic rocks at American Bay; Port Moller C-1 quad. Medium-gray (N 5) andesite with grayish-black (N 2) and very light gray (N 8) phenocrysts of hornblende and plagioclase (An_{45-55}) in a groundmass of plagioclase microlites and devitrified glass. Plagioclase phenocrysts show slight alteration in cores to clay minerals. Abundant chlorite veinlets cutting phenocrysts and groundmass, other chlorite disseminated though groundmass. Euhedral hornblende phenocrysts, some contain minor inclusions of plagioclase or opaque oxides.
82AWs 45	Qv	Flow from westernmost late Quaternary volcanic center in cluster south of Bear Lake; Port Moller D-1 quad. Medium-dark-gray (N 4) porphyritic andesite(?) with phenocrysts of clinopyroxene and plagioclase (An_{62-65}) in a very fine grained groundmass of glass, plagioclase, clinopyroxene, and opaque oxides. Phenocrysts are as large as 3 mm, glomeroporphyritic masses are as large as 5 mm.
82AWs 48a	Tv	Outer Iliasik Island; Port Moller A-6 quad. Medium-greenish-gray propylitically altered porphyritic andesite(?). Originally an amygdaloidal, porphyritic flow rock having phenocrysts of plagioclase and either pyroxene or hornblende in a fine-grained groundmass. Subhedral, flow-aligned plagioclase phenocrysts replaced by very fine grained quartz and calcite. Anhedral to euhedral mafic phenocrysts replaced by chlorite and calcite. Vugs and amygdules filled with calcite, subhedral to euhedral epidote, chlorite and anhedral to euhedral quartz. Groundmass now opaque grains, calcite, and chlorite.
83AAi 29	Ti	American Bay pluton; Port Moller C-1 quad. Porphyritic quartz diorite. Phenocrysts of subhedral to euhedral, zoned, twinned plagioclase (An_{55}) having a multimodal size distribution, anhedral to euhedral (most subhedral) hornblende, and anhedral quartz in a roughly 1- to 5-mm grain size groundmass of plagioclase laths, anhedral to subhedral biotite, hornblende, minor chlorite (usually associated with biotite), anhedral to euhedral opaque grains, anhedral quartz, and sericitically altered plagioclase.
83ACe 54	Tv	Near Island Bay on Kupreanof Peninsula; Stepovak Bay C-5 quad. Salt-and-pepper gray (N 7) porphyritic dacite having white (N 9) phenocrysts of plagioclase and grayish-black (N 2) hornblende phenocrysts. Phenocrysts of subhedral to euhedral, polysynthetically twinned, and zoned plagioclase, subhedral to euhedral hornblende, and minor subhedral opaque grains in a groundmass of subpolygonal plagioclase grains, subhedral hornblende, anhedral to euhedral opaque grains, and minor subhedral biotite. Minor sericitic alteration of plagioclase phenocrysts and groundmass.

Table 2. *Descriptions of dated rocks -- Continued*

Sample No.	Rock Unit	Description
83ADt 167	Tp	Andronica Island; Port Moller B-1 quad. Dark-gray (N 3) columnar-jointed porphyritic leuco-basalt plug. Phenocrysts of subhedral to euhedral, twinned, zoned plagioclase (An_{83-93}); anhedral to subhedral, commonly twinned, clinopyroxene, and serpentine minerals pseudomorphous after olivine(?) in a groundmass of plagioclase laths having weak preferential orientation, anhedral, very fine grained clinopyroxene, and anhedral to euhedral opaque grains.
83AJm 624	Tm	Settlement Point, Pavlof Bay; Port Moller B-5 quad. Mottled greenish-gray (5 GY 6/1) to dark-greenish-gray (5 GY 4/1) hypidiomorphic-granular fine- to medium-grained diorite. Contains subhedral to euhedral, twinned clinopyroxene, anhedral to euhedral, zoned, polysynthetically twinned plagioclase (An_{55}), anhedral olivine(?), anhedral chlorite, minor anhedral biotite, anhedral to euhedral opaque grains, and minor anhedral quartz.
83APk 10b	Tiu	Stepovak Bay D-5 quad. Porphyritic hypabyssal(?) quartz diorite. Phenocrysts of subhedral to euhedral, zoned, twinned plagioclase, minor, anhedral quartz exhibiting undulatory extinction, subhedral to euhedral, rarely twinned, hornblende, anhedral to subhedral opaque crystals in a groundmass of anhedral to subhedral biotite, fine-grained plagioclase laths, polygonal quartz, and opaque grains. Minor chlorite, usually associated with biotite, possibly replacing hornblende(?).
83APk 25a	Ti	Port Moller C-1 quad. Medium- to fine-grained porphyritic light-gray quartz diorite. Weathers medium-gray. Sparse dioritic zenoliths. Phenocrysts of subhedral to euhedral, zoned, twinned plagioclase (An_{33}), minor anhedral quartz, and moderately poikilitic, embayed, anhedral to euhedral hornblende in a groundmass of medium-grained subhedral biotite and chlorite, plagioclase, subhedral to euhedral hornblende, and intersertal quartz.
83APk 40d	Tiu	Southeast side of Pyramid Mountain; Port Moller C-3 quad. Porphyritic dacite(?) sill. Phenocrysts of subhedral to euhedral hornblende phenocrysts and subhedral to euhedral, zoned, predominantly polysynthetically twinned plagioclase phenocrysts in a groundmass of plagioclase laths, chlorite, hornblende, opaque grains, sericite, and minor epidote. Chlorite is pseudomorphous after hornblende(?) phenocrysts, there is common association of hornblende+chlorite+opaque grains. Common sericitic alteration of plagioclase phenocrysts.
83APk 50a	Tv	Northwest side of Dolgoi Island; Port Moller A-6 quad. Dark-greenish-gray porphyritic andesite in section of dark-brown to black flows and agglomerates. Phenocrysts of subhedral to euhedral, zoned, polysynthetically twinned plagioclase (An_{60}), subhedral to euhedral orthopyroxene, and subhedral to euhedral, twinned clinopyroxene in a groundmass of plagioclase laths, anhedral pyroxene, anhedral to subhedral opaque minerals, dark-brown chlorite(?), and sericite(?).
83AWs 65	Ti	Mitrofania Island; Stepovak Bay D-3 quad. Very light gray (N 8) hypidiomorphic-granular textured, fine- to medium-grained granodiorite containing black (N 1) hornblende and biotite. Hornblende and biotite rim clinopyroxene; plagioclase grains (An_{40-45}) and all occur in a matrix of interstitial quartz and potassium feldspar. Estimated mode: plagioclase 40 percent, K-feldspar 20 percent, quartz 20 percent, biotite 8 percent, clinopyroxene 5 percent, hornblende 5 percent, and opaque oxides 2 percent.
83AWs 97	Qv	North-northwest of Ramsey Bay; Stepovak Bay D-6 quad. Porphyritic leuco-basalt flow. Phenocrysts of subhedral to euhedral, zoned, polysynthetically twinned plagioclase (An_{80}); anhedral to euhedral olivine, and anhedral to subhedral, twinned, clinopyroxene phenocrysts in a nearly cryptocrystalline groundmass of subhedral to euhedral plagioclase laths, anhedral olivine(?), pyroxene(?), and opaque grains. Plagioclase phenocrysts commonly occur in aggregates.
83AWs 100	Tv	Ramsey Bay; Stepovak Bay D-6 quad. Light-olive-gray (5 Y 6/1)* andesite porphyry having olive-black (5 Y 2/1) hornblende and pinkish-white (5 YR 8/1)* plagioclase phenocrysts. Plagioclase phenocrysts (An_{55}) are partially resorbed and are weakly saussuritized(?); some hornblende phenocrysts are partially altered to calcite. Rare quartz and untwinned feldspar grains may be potassium feldspar. Plagioclase phenocrysts and the groundmass are pervasively fractured.
83AWs 116a	Tv	Between Lumber Bay and Swedania Point; Port Moller C-2 quad. Porphyritic dacite flow or sill intruding basalt or andesite. Phenocrysts of subhedral to euhedral,

Table 2. *Descriptions of dated rocks -- Continued*

Sample No.	Rock Unit	Description
		polysynthetically twinned, zoned plagioclase and subhedral to euhedral, brown pleochroic hornblende, commonly glomeroporphyritic in short subparallel folia, in a groundmass part cryptocrystalline and part plagioclase laths, opaque grains, and hornblende. Plagioclase phenocrysts commonly fragmented or fractured.
83AWs 118a	Tv	South end of Guillemot Island; Port Moller C-2 quad. Porphyritic leuco-basalt flow. Glomeroporphyritic phenocrysts of anhedral to subhedral olivine and anhedral to subhedral, twinned clinopyroxene in a groundmass of predominantly subhedral to euhedral, polysynthetically twinned plagioclase (An_{63}). Phenocryst aggregates as large as about 7 mm in diameter. Minor alteration of olivine to chlorite.
83AWs 125	Tv	Columnar-jointed plug on Ukolnoi Island; Port Moller A-5 quad. Dark-olive-gray (5 Y 3/1), fine-grained andesite. Clinopyroxene and plagioclase phenocrysts in a groundmass of devitrified glass and minor orthopyroxene. Larger plagioclase laths (An_{75-80}) are unaltered and larger clinopyroxene grains are altered to bastite.
83AWs 126	Ti	Moss Cape pluton; Port Moller A-6 quad. Clinopyroxene-biotite quartz monzodiorite. Light-yellowish-gray (10 YR 6/1) containing dusky-green (5 G 3/2) pyroxene and black (N 1) biotite crystals. In thin section, subhedral plagioclase laths (An_{50-60}), clinopyroxene, and amphibole crystals with inclusions of irregular blebs of quartz. Groundmass of biotite, and anhedral potassium feldspar and quartz. Abundant opaque oxides, particularly as inclusions in amphibole. Quartz is also present as fracture fillings. Estimated mode: 60 percent plagioclase, 15 percent potassium feldspar, 10 percent clinopyroxene, 10 percent quartz, 3 percent biotite, and 2 percent opaque oxides.
83AWs 129a	Tiu	Small plug on southeast Wosnesenski Island; Port Moller A-5 quad. Medium-light-gray (N 6), fine- to very-fine-grained, two-pyroxene, plagioclase diorite. Clinopyroxene is dominant over orthopyroxene. Plagioclase and pyroxene laths have strong parallel alignment. Plagioclase composition indeterminate due to fine grain size.
83AWs 131	Tv	Columnar-jointed flows surrounding plug on Wosnesenski Island; Port Moller A-5 quad. Black (N 2), fine-grained, porphyritic, flow-banded andesite. Plagioclase phenocrysts (An_{80-85}?) are partially resorbed into groundmass composed of abundant opaque oxides and fine-grained clinopyroxene with very fine glass. Altered mafic phenocrysts that may have been olivine. Flows surround plug described above (sample 83AWs 129a).
83AYb 515b	Tm	South end of Jacob Island; Stepovak Bay C-5 quad. Porphyritic hornblende andesite clast in volcanic breccia. Phenocrysts of subhedral to euhedral, commonly twinned, pleochroic green-brown hornblende and subhedral to euhedral, zoned, twinned, and moderately to strongly sericitically altered plagioclase in a groundmass that is partially cryptocrystalline and partially composed of plagioclase laths, hornblende, opaque minerals, and sericite.
83AYb 526	Tv	Sill at Dent Point; Stepovak Bay D-6 quad. Porphyritic light-gray (N 7) dacite having moderate-olive-brown (5 Y 4/3) hornblende and yellowish-white (5 Y 8/1) plagioclase phenocrysts. Fractured subhedral, strongly-zoned, plagioclase phenocrysts (to 3 mm, average An_{48}) and euhedral, though very slightly resorbed, hornblende phenocrysts (2 mm) in a very fine grained groundmass of devitrified glass and plagioclase(?) microlites. Very minor alteration of some plagioclase to sericite.
83AYb 573	Tv	North coast Wosnesenski Island; Port Moller A-5. Porphyritic andesite. Phenocrysts of subhedral to euhedral, twinned, zoned plagioclase (An_{70-90}) and subhedral to euhedral, twinned clinopyroxene in a groundmass of mostly cryptocrystalline glass, containing opaque grains, clinopyroxene, and plagioclase. Some alteration of pyroxene to chlorite and inclusions of chlorite in some plagioclase phenocrysts.
84AAi 86	Tbe	North of head of Dolgoi Harbor on Dolgoi Island; Port Moller A-6 quad. Columnar-jointed microporphyritic andesite flow. Phenocrysts of subhedral to euhedral, zoned, polysynthetically twinned plagioclase, subhedral, commonly twinned, clinopyroxene, and subhedral orthopyroxene in a groundmass composed of subhedral to euhedral plagioclase laths, anhedral to subhedral clinopyroxene and orthopyroxene, and anhedral to euhedral opaque grains. Chlorite aggregates that are pseudomorphs after olivine(?) or pyroxene(?) and are rimmed by orthopyroxene.

Table 2. *Descriptions of dated rocks -- Continued*

Sample No.	Rock Unit	Description
84ACe 113c	Tm	Shapka Island; Stepovak Bay D-4 quad. Hypabyssal(?), dark-greenish-gray (5 GY 4/1), porphyritic leuco-basalt containing abundant phenocrysts of greenish-black (5 G 2/1) hornblende. Phenocrysts of subhedral to euhedral, commonly twinned, hornblende and subhedral to euhedral, twinned plagioclase in a pilotaxitic groundmass of plagioclase laths, chlorite(?), and opaque minerals. Hornblende shows minor alteration to chlorite, plagioclase is sericitically altered.
84ACe 177	Tm	Southwest of Hot Spring; Port Moller D-2 quad. Massive-appearing, dark-gray (N 3) porphyritic leuco-basalt flow 5 to 6 m thick, interbedded with oyster fossil-bearing volcaniclastic sedimentary rocks. Phenocrysts of subhedral to euhedral, zoned, polysynthetically twinned plagioclase and yellow-brown chlorite pseudomorphs after pyroxene(?) in a groundmass of tabular plagioclase, anhedral, very fine grained clinopyroxene, anhedral to euhedral opaque minerals, anhedral chlorite, and fibrolite (plagioclase?).
84ADt 192	Qv	North of Stepanof Flats; Stepovak Bay D-5 quad. Columnar-jointed light-olive-gray (5 Y 5/2) vesicular porphyritic andesite flow capping ridge underlain by the Bear Lake Formation. Phenocrysts of subhedral to euhedral, zoned, polysynthetically twinned plagioclase (An_{70}), and anhedral to subhedral, commonly twinned clinopyroxene phenocrysts in a groundmass of plagioclase laths, anhedral clinopyroxene laths, opaque grains, and iddingsite. Plagioclase in groundmass shows weak preferential orientation.
84ADt 206	Tm	West coast of Mud Bay, south of Hot Spring; Port Moller D-2 quad. Fine-grained microporphyritic dacite dike intruding volcanic rocks of the Meshik Volcanics. Minor subhedral to euhedral, zoned, polysynthetically twinned plagioclase phenocrysts in a groundmass of oriented plagioclase laths, anhedral very fine grained pyroxene, and anhedral to euhedral opaque minerals. Clinopyroxene rims some opaque grains. Dark-brown, very fine grained chlorite(?) throughout sample.
84ADt 253	Tv	South of Bluff Point on Dolgoi Island; Port Moller A-6 quad. Columnar-jointed olive-gray to olive-black (5 Y 3/1) porphyritic andesite flow. Phenocrysts of subhedral to euhedral, zoned, polysynthetically twinned plagioclase, and anhedral to euhedral orthopyroxene and clinopyroxene in a groundmass composed of plagioclase laths, anhedral pyroxene, anhedral to euhedral opaque grains, epidote(?), fibrolites, and chlorite. Clinopyroxene commonly twinned, plagioclase phenocrysts commonly occur in aggregates. Some plagioclase phenocrysts sericitically altered.
84ADt 262	Tv	Easternmost point of Ukolnoi Island; Port Moller B-5 quad. Porphyritic leuco-basalt flow. Phenocrysts of subhedral to euhedral, zoned, polysynthetically twinned plagioclase phenocrysts (An_{75}) and clinopyroxene. Aggregates of chlorite and very fine grained quartz(?) are pseudomorphs after clinopyroxene, the few remaining anhedral clinopyroxene phenocrysts generally have chlorite rims. Groundmass is pilotaxitic plagioclase microlites, very fine grained, anhedral clinopyroxene, and subhedral to euhedral cubic opaque grains (pyrite?).
84AJm 695	Tm	East of Eagle Rock on Herendeen Bay; Port Moller D-3 quad. Brownish-black (5 YR 2/1) porphyritic andesite containing dark-reddish-brown (10 R 3/4) phenocrysts. Weathered surfaces are slightly iron stained. Possible pillow structures in outcrop. Phenocrysts of subhedral to euhedral, polysynthetically twinned, commonly zoned plagioclase and anhedral to euhedral, commonly twinned, clinopyroxene in a pilotaxitic groundmass of plagioclase fibrolites, clinopyroxene, and opaque grains. Minor propylitic alteration.
84AJm 719a	Tv	North peak on Poperechnoi Island; Port Moller A-5 quad. Olive-gray (5 Y 4/1), hypabyssal, porphyritic andesite intruding the Belkofski(?) Formation. Phenocrysts of subhedral to euhedral, commonly zoned, polysynthetically twinned plagioclase phenocrysts (An_{83}) and anhedral to subhedral, twinned, glomeroporphyritic clinopyroxene phenocrysts in a groundmass composed of fine-grained plagioclase laths, anhedral pyroxene crystals, anhedral to euhedral opaque grains, and chlorite. Chlorite generally in radiating fans of microlites. A few plagioclase phenocrysts contain abundant fine-grained, anhedral clinopyroxene inclusions.
84AWs 176	QTv	North of Stepanof Flats; Stepovak Bay D-5 quad. Columnar-jointed porphyritic andesite flow. Phenocrysts of subhedral, zoned, polysynthetically twinned plagioclase and anhedral to subhedral, twinned, clinopyroxene phenocrysts in a groundmass of chlorite, sericite(?), fibrolite, plagioclase laths opaque grains,

Table 2. *Descriptions of dated rocks -- Continued*

Sample No.	Rock Unit	Description
		anhedral clinopyroxene, and minor calcite. Aggregates of very fine grained quartz, sericite(?), and chlorite.
84AWs 177	Qv	North of Stepanof Flats; Stepovak Bay D-5 quad. Porphyritic andesite flow. Phenocrysts of locally glomeroporphyritic, subhedral to euhedral, zoned, polysynthetically twinned plagioclase and anhedral to subhedral orthopyroxene and clinopyroxene (some twinned) in a groundmass of plagioclase laths, opaque grains, and anhedral pyroxene. Rarely, orthopyroxene is rimmed in clinopyroxene. Subrounded aggregates (xenoliths?) of very fine grained anhedral quartz and pyroxene.
84AWs 187	Tm	Southwest of peak 1480, north of Stepanof Flats; Stepovak Bay D-6 quad. Porphyritic basaltic agglomerate. Phenocrysts of large, euhedral to subhedral, clinopyroxene, subhedral, polysynthetically twinned, zoned plagioclase (An_{80}), and large, subhedral orthopyroxene in a groundmass composed of subhedral to euhedral, randomly oriented plagioclase laths, very fine grained, anhedral clinopyroxene, and opaque grains. Chlorite commonly rims or occurs within fractures of pyroxene grains.
84AWs 197	QTv	East of Harbor Point on coast of Port Moller; Port Moller D-2 quad. Massive, columnar-jointed, porphyritic andesite flow. Phenocrysts of subhedral to euhedral, typically zoned, polysynthetically twinned plagioclase and anhedral to subhedral clinopyroxene, rarely twinned in a groundmass of anhedral to subhedral plagioclase, anhedral clinopyroxene, anhedral to euhedral opaque grains, anhedral yellow-brown chlorite(?), and fibrolite. Quartz occurs in subrounded aggregates, possibly filling vesicles. Some plagioclase phenocrysts contain abundant very fine grained, anhedral pyroxene and chlorite(?) inclusions.
84AWs 199	QTv	Southeast of Port Moller cannery at elevation of 2,100 feet; Port Moller D-2 quad. Porphyritic andesite flow. Phenocrysts of subhedral, zoned, polysynthetically twinned plagioclase phenocrysts (An_{72}), and anhedral to subhedral, commonly twinned, clinopyroxene in a groundmass of plagioclase laths, anhedral clinopyroxene, chlorite, and anhedral to euhedral opaque grains.
84AWs 200	QTv	North of Left Head of Port Moller; Port Moller D-1 quad. Dark-gray porphyritic andesite dike intruding the Bear Lake Formation. Phenocrysts of subhedral, commonly zoned, polysynthetically twinned plagioclase, anhedral to subhedral, generally twinned, clinopyroxene, and minor subhedral orthopyroxene phenocrysts commonly rimmed with clinopyroxene in a groundmass of plagioclase laths, iddingsite, opaque grains, anhedral pyroxene, epidote(?), and aggregates of calcite.
84AWs 204	Qv	East of Left Head of Port Moller; Port Moller D-1 quad. Porphyritic andesite flow overlying the Bear Lake(?) Formation. Glaciated flow originates from southwesternmost of the volcanoes of Stepovak Bay (Wilson, 1989). Phenocrysts of subhedral, commonly zoned, polysynthetically twinned plagioclase (An_{81}) and anhedral to subhedral clinopyroxene in a cryptocrystalline groundmass. Clinopyroxene is rarely twinned and may occur in glomeroporphyritic aggregates.
84AWs 205b	Tm	Head of Mud Bay; Port Moller D-2 quad. Porphyritic andesite dike cutting basaltic(?) plug. Phenocrysts of anhedral to euhedral, zoned, generally polysynthetically twinned plagioclase, anhedral to subhedral clinopyroxene, and commonly twinned orthopyroxene in a groundmass of tabular plagioclase, very fine grained, anhedral clinopyroxene, opaque minerals, dark-brown chlorite(?), and subhedral epidote(?).
84AWs 212	Qv	Late Quaternary flows capping Pinnacle Peak; Port Moller C-3 quad. Reddish-gray (10 R 5/1)* porphyritic andesite containing phenocrysts of olivine, clinopyroxene, orthopyroxene, and plagioclase (An_{85-90}) in a fine-grained groundmass of clinopyroxene, plagioclase, and glass. Partial alteration of olivine to iddingsite. Fine-grained opaque oxides are common in groundmass.
84AWs 246	Qi	West peak of Trader Mountain; Port Moller C-6 quad. Porphyritic andesite dome. Phenocrysts of large altered, subhedral to euhedral, red-brown hornblende, subhedral, commonly zoned, polysynthetically twinned plagioclase, and microphenocrysts of rarely twinned, anhedral clinopyroxene in a groundmass of plagioclase laths, showing weak to moderate preferred orientation, anhedral clinopyroxene, opaque grains, hornblende, and fibrolite. Hornblende partially

Table 2. *Descriptions of dated rocks -- Continued*

Sample No.	Rock Unit	Description
		altered to very fine grained clinopyroxene, quartz, opaque grains, plagioclase, and cryptocrystalline material.
84AWs 274b	Tm	Southeast of Wolverine Gulch, between Canoe Bay and McGinty Point; Port Moller B-4 quad. Massive porphyritic leuco-basalt flow. Phenocrysts of subhedral to euhedral, commonly zoned, polysynthetically twinned plagioclase (An_{65}) and anhedral to subhedral, some twinned, clinopyroxene in a groundmass of plagioclase laths, anhedral pyroxene, and abundant opaque grains. Minor aggregates composed predominantly of very fine grained quartz(?), calcite, and chlorite.
84AYb 601	Tvu	Northern Mitrofania Island; Stepovak Bay D-3 quad. Greenish porphyritic andesite flow. Phenocrysts of subhedral to euhedral, zoned, polysynthetically twinned plagioclase (An_{71}), sparse twinned, anhedral clinopyroxene phenocrysts generally having chlorite rims in a groundmass of pilotaxitic plagioclase microlites, very fine grained anhedral clinopyroxene, and subhedral to euhedral cubic opaque grains (pyrite). Aggregates of chlorite and very fine-grained quartz(?) are in forms that pseudomorph clinopyroxene(?) phenocrysts.
84AYb 612	Qv	North of Stepanof Flats on tributary of Big River; Stepovak Bay D-6 quad. Light-brownish-gray to brownish-gray (5 YR 5/1) porphyritic andesite(?) flow. Phenocrysts of subhedral, zoned, polysynthetically twinned plagioclase (An_{72}) and anhedral to subhedral, twinned, clinopyroxene phenocrysts in a groundmass of plagioclase laths, abundant anhedral clinopyroxene, opaque grains, minor epidote, and quartz. Plagioclase phenocrysts commonly contain abundant pyroxene(?) inclusions in their cores.
84AYb 633	QTv	South of Left Head of Port Moller; Port Moller D-1 quad. Porphyritic andesite flow. Phenocrysts of subhedral to euhedral, zoned, polysynthetically twinned plagioclase (An_{63}), anhedral to subhedral, commonly twinned, clinopyroxene, and anhedral to subhedral orthopyroxene in a pilotaxitic groundmass of plagioclase laths, anhedral pyroxene, and opaque grains. Some plagioclase phenocrysts partially altered to sericite.
84AYb 675	Tm	West of Beaver Bay; Port Moller C-3 quad. Fine- to medium-grained, mottled dark-greenish-gray (5 G 4/1) and light-gray (N 7), basalt dike. Iron stained on weathered surfaces. Intrudes black shale of the Stepovak(?) Formation. Anhedral, fractured, olivine crystals; anhedral to subhedral, twinned plagioclase (An_{70}); radiating fans and aggregations of very fine grained white mica; apple-green, very fine grained chlorite; minor anhedral, red-brown biotite; late, anhedral clinopyroxene containing olivine and plagioclase inclusions.
84TKup 8	Tm	Uppermost bluff above cliff-forming sequence of flows at edge of water, east side of Kupreanof Peninsula; Stepovak Bay C-5 quad. Tuffaceous porphyritic andesite(?). Contains about 40 percent subhedral, zoned, polysynthetically twinned plagioclase phenocrysts and 5 to 10 percent chloritized mafic phenocrysts in dark-brown, cryptocrystalline, groundmass (description based on 2 photomicrographs and written commun., Gordon Thrupp, Univ. of California-Santa Cruz). Plagioclase phenocrysts commonly altered to sericite(?).
85AAi 88	Tvu	Frying Pan at Right Head of Port Moller; Port Moller D-1 quad. Porphyritic andesite flow. Phenocrysts of twinned, zoned, subhedral plagioclase (An_{70}) and twinned, anhedral to subhedral clinopyroxene in a pilotaxitic groundmass of plagioclase opaque minerals, and pyroxene. Clinopyroxene fresh to strongly altered to chlorite and opaque minerals. Rare glomeroporphyritic aggregates of plagioclase and clinopyroxene. Minor calcite and very fine grained quartz(?) aggregates.
85AAi 98	Tp	South of Simeon Bight on Popof Island; Port Moller B-2 quad. Porphyritic andesite flow. Phenocrysts of subhedral to euhedral, twinned and strongly zoned plagioclase (An_{82}), twinned clinopyroxene, orthopyroxene, and opaque minerals in a groundmass of microcrystalline plagioclase and pyroxene laths. Clinopyroxene and orthopyroxene phenocrysts commonly occur in aggregates. Rare alteration of pyroxene rims to chlorite.
85ADt 341	Tv	West of Albatross Anchorage, Balboa Bay; Port Moller C-2 quad. Dark-gray (N 3) porphyritic andesite sill or possible flow. Slight iron staining on fractured surfaces. Phenocrysts of subhedral to euhedral, twinned and zoned plagioclase (An_{64}), anhedral to subhedral twinned clinopyroxene, and euhedral to subhedral

Table 2. *Descriptions of dated rocks -- Continued*

Sample No.	Rock Unit	Description
		orthopyroxene in a groundmass of microcrystalline plagioclase laths, pyroxene, and opaque minerals. Minor propylitic alteration of pyroxene.
85AJm 781	Tv	Bay Point, Unga Island; Port Moller B-3 quad. Porphyritic andesite plug. Phenocrysts of anhedral to subhedral olivine and clinopyroxene(?) in a groundmass of flow-aligned plagioclase microlites, very fine grained anhedral olivine, opaque grains, and anhedral to subhedral clinopyroxene. Clinopyroxene phenocrysts almost completely altered to chlorite and pumpellyite(?).
85AWs 290	Tp	VABM "Green" at East Head, Popof Island; Port Moller B-2 quad. Massive porphyritic andesite flow or sill associated with agglomerate and fossil-bearing volcaniclastic sandstone of the Stepovak Formation. Phenocrysts of subhedral to euhedral, albite-twinned, zoned plagioclase (An_{91}), subhedral hornblende, and twinned, subhedral clinopyroxene in a groundmass of pilotaxitic plagioclase, opaque grains, and pyroxene. Plagioclase phenocrysts and glomeroporphyritic aggregates as much as 5 mm in diameter. Some plagioclase phenocrysts contain abundant opaque inclusions.
85AWs 293	Tp	Plug near Sand Point city dump, Popof Island; Port Moller B-2 quad. Porphyritic leuco-basalt plug. Phenocrysts of subhedral to euhedral, twinned and zoned plagioclase (An_{83}) and minor, twinned clinopyroxene and 7-10 percent devitrified glass in a groundmass of randomly oriented plagioclase laths, fine anhedral pyroxene crystals, opaque grains, and minor calcite and glass.
85AWs 296a	Tp	East of Bloomer Peak on coast, Unga Island; Port Moller A-2 quad. Pink microcrystalline to cryptocrystalline, spherulitic rhyolite dike or dome. Rare anhedral phenocrysts (about 1 mm) of quartz and 1 percent 1-mm opaque grains, and less than 1 percent calcite aggregates in a cryptocrystalline groundmass containing about 1 to 3 percent 1-mm spherules.
85AWs 300	Tiu	Peak south of VABM "Fourth", Unga Island; Port Moller B-3 quad. Porphyritic hornblende andesite dome. Phenocrysts of subhedral to euhedral, zoned, and albite-twinned plagioclase (An_{58}) and anhedral to euhedral hornblende in a groundmass of plagioclase laths, hornblende fibrolite and laths, and opaque minerals. Much of the hornblende is strongly altered to chlorite and opaque minerals.
85AWs 302	Tv	Ridge northwest of VABM "Fourth", Unga Island; Port Moller B-3 quad. Fine- to medium-grained, hypidiomorphic-granular, leuco-basalt flow(?). Subhedral to euhedral, twinned plagioclase (An_{88-90}), anhedral to subhedral clinopyroxene and olivine(?) and minor opaque minerals. Parts of sample exhibit ophitic to subophitic clinopyroxene and plagioclase. Minor alteration of clinopyroxene and olivine(?) to chlorite. Spherical aggregates of calcite rim chlorite(?); some chlorite(?) occurs in radiating fans.
85AWs 310	Tm	North of Beaver Bay; Port Moller C-3 quad. Glomeroporphyritic andesite flow. Phenocrysts of subhedral to euhedral zoned and albite-twinned plagioclase phenocrysts (An_{64}) in a groundmass of pilotaxitic plagioclase laths and anhedral, fine-grained clinopyroxene, orthopyroxene(?), chlorite, and opaque minerals. Phenocryst aggregates as much as 5 mm in maximum dimension. Minor chlorite aggregates are in forms that pseudomorph(?) pyroxene.
85AWs 321	Tp	East coast of Unga Island, along Popof Strait; Port Moller B-2 quad. Massive, columnar-jointed, porphyritic andesite. Phenocrysts of subhedral to euhedral, twinned, zoned plagioclase (An_{64-72}), subhedral orthopyroxene, twinned clinopyroxene phenocrysts, and anhedral to euhedral opaque grains in a groundmass of pilotaxitic plagioclase laths, very fine grained anhedral to euhedral pyroxene, and brown glass. Chlorite(?) pseudomorphs after pyroxene(?) phenocrysts.
85AYb 708	QTv	Southwest of Bear Lake; Port Moller D-1 quad. Light-gray porphyritic andesite. Phenocrysts of large, euhedral, zoned, twinned plagioclase (An_{66}), anhedral to euhedral twinned clinopyroxene, and anhedral orthopyroxene having clinopyroxene rims in a microcrystalline groundmass of anhedral to subhedral plagioclase, clinopyroxene, and orthopyroxene. Minor plagioclase phenocrysts include very fine grained anhedral pyroxene.

Table 2. *Descriptions of dated rocks -- Continued*

Sample No.	Rock Unit	Description
85AYb 718	Qv	Saddle between Beaver River valley and Buck Valley; Port Moller C-3 quad. Light-gray (N 7) porphyritic dacite dome containing white (N 9) and very light gray (N 8) phenocrysts of plagioclase. Phenocrysts of subhedral to euhedral, zoned, albite-twinned plagioclase (An_{88}), subhedral to euhedral clinopyroxene and olivine, and opaque minerals in a groundmass of plagioclase, pyroxene, and opaque laths exhibiting preferential orientation. Groundmass folia bend around some phenocrysts.
85AYb 743	Tp	West Head beach, Unga Island; Port Moller B-2 quad. Massive, 12-m-thick, porphyritic andesite(?) flow interlayered with agglomerate. Phenocrysts of subhedral to euhedral, twinned and zoned plagioclase (An_{78}), subhedral twinned clinopyroxene, minor euhedral orthopyroxene, and opaque minerals in a cryptocrystalline groundmass. Some clinopyroxene phenocrysts exhibit rims of clinopyroxene of a different optical orientation. Minor alteration of pyroxene at rims and in fractures to chlorite.
88ADg 20	Qv	Ridge southwest of Pinnacle Peak; Port Moller C-3 quad. Brownish-gray (5 YR 4/1), fine-grained, porphyritic leuco-basalt containing large, dark-greenish-gray (5 GY 4/1) phenocrysts of clinopyroxene. Phenocrysts of subhedral to euhedral, commonly zoned, polysynthetically twinned plagioclase, large, anhedral to subhedral clinopyroxene, and anhedral olivine in a groundmass of subhedral to anhedral plagioclase, anhedral clinopyroxene and olivine, and opaque grains.
88AWs 28	Tp	Zachary Bay prospect, Unga Island; Port Moller B-2 quad. Pinkish-gray (5 YR 8/1), iron-stained quartz-sericite altered dioritic dike or sill. Primary minerals completely replaced by anhedral quartz in aggregates within sericite aggregates and white mica microlites. Anhedral to subhedral opaque grains (pyrite) gives rock a spotty appearance. Hydrothermal alteration date.
88AWw 425	Tp	Southwest of Sand Point airport, Popof Island; Port Moller B-2 quad. Porphyritic andesite plug. Phenocrysts of subhedral, polysynthetically twinned, zoned plagioclase, anhedral to euhedral, commonly twinned, clinopyroxene, and subhedral orthopyroxene in a microcrystalline groundmass of plagioclase laths, anhedral to euhedral opaque grains, anhedral pyroxene, and chlorite(?). Some plagioclase phenocrysts are altered to sericite, others contain clinopyroxene and chlorite inclusions. Orthopyroxene phenocrysts are partially altered to pumpellyite(?) or chlorite(?).
PMF 892	Tg	Head of Sanborn Harbor, Nagai Island; Stepovak Bay A-6 quad. Porphyritic dacite dike. Phenocrysts of large, subhedral to euhedral, zoned, polysynthetically twinned plagioclase, anhedral to subhedral biotite (often intergrown with chlorite), rounded quartz having undulatory extinction, and chlorite in a partly cryptocrystalline groundmass composed of anhedral to subhedral plagioclase, quartz, biotite, chlorite, and minor epidote. Chlorite phenocrysts (probably altered biotite) often have fibrolite fans grown within grain. Minor quartz and white mica aggregates. Some plagioclase phenocrysts partially altered to sericite. Many biotite phenocrysts have bent cleavages.