Merced Peak Quadrangle, Central Sierra Nevada, California—Analytic Data

GEOLOGICAL SURVEY PROFESSIONAL PAPER 1170-D

Merced Peak Quadrangle, Central Sierra Nevada, California—Analytic Data

By DALLAS L. PECK *and* GERALD K. VAN KOOTEN

SHORTER CONTRIBUTIONS TO GENERAL GEOLOGY

GEOLOGICAL SURVEY PROFESSIONAL PAPER 1170-D

Chemical, semiquantitative spectrographic, and modal analyses and potassium-argon, uranium-lead, and rubidium-strontium age determinations on plutonic, metavolcanic, and volcanic rocks supplement U.S. Geological Survey Geologic Quadrangle Map GQ-1531

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MERCED PEAK QUADRANGLE, CENTRAL SIERRA NEVADA, CALIFORNIA—ANALYTIC DATA

By DALLAS L. PECK and GERALD K. VAN KOOTEN[1]

ABSTRACT

A variety of plutonic, metamorphic, and volcanic rocks and glacial deposits underlie the Merced Peak quadrangle, which spans the southeastern margin of Yosemite National Park. More than 800 rock samples were collected during geologic mapping of the area, of which 258 samples of plutonic rocks were analyzed modally and their specific gravities determined. The volume percentages of quartz, potassium feldspar, plagioclase, and mafic minerals and the bulk specific gravities are plotted on a simplified geologic base map and contoured where the data permit. Quartz, potassium feldspar, and plagioclase, calculated to 100 percent, are plotted on triangular diagrams. The modal analyses show that the compositions of individual plutons are predominantly granite and granodiorite but range from leucogranite to tonalite and quartz diorite. Chemical and spectrographic analyses of 41 plutonic rocks, 15 metavolcanic rocks, and 11 Pliocene volcanic rocks are tabulated, and normative quartz, orthoclase, and plagioclase of the plutonic and metavolcanic rocks are plotted on a triangular diagram. The metavolcanic rocks are primarily rhyodacite but range from rhyolite to andesite. The Pliocene volcanic rocks are predominantly trachybasalt but include several flows and volcanic necks of ultrapotassic mafic phonolite. Data on ages determined by the potassium-argon, uranium-lead, and rubidium-strontium methods on some plutonic, metavolcanic, and volcanic rocks are tabulated. A map of conspicuous, steeply dipping regional joints is included.

INTRODUCTION

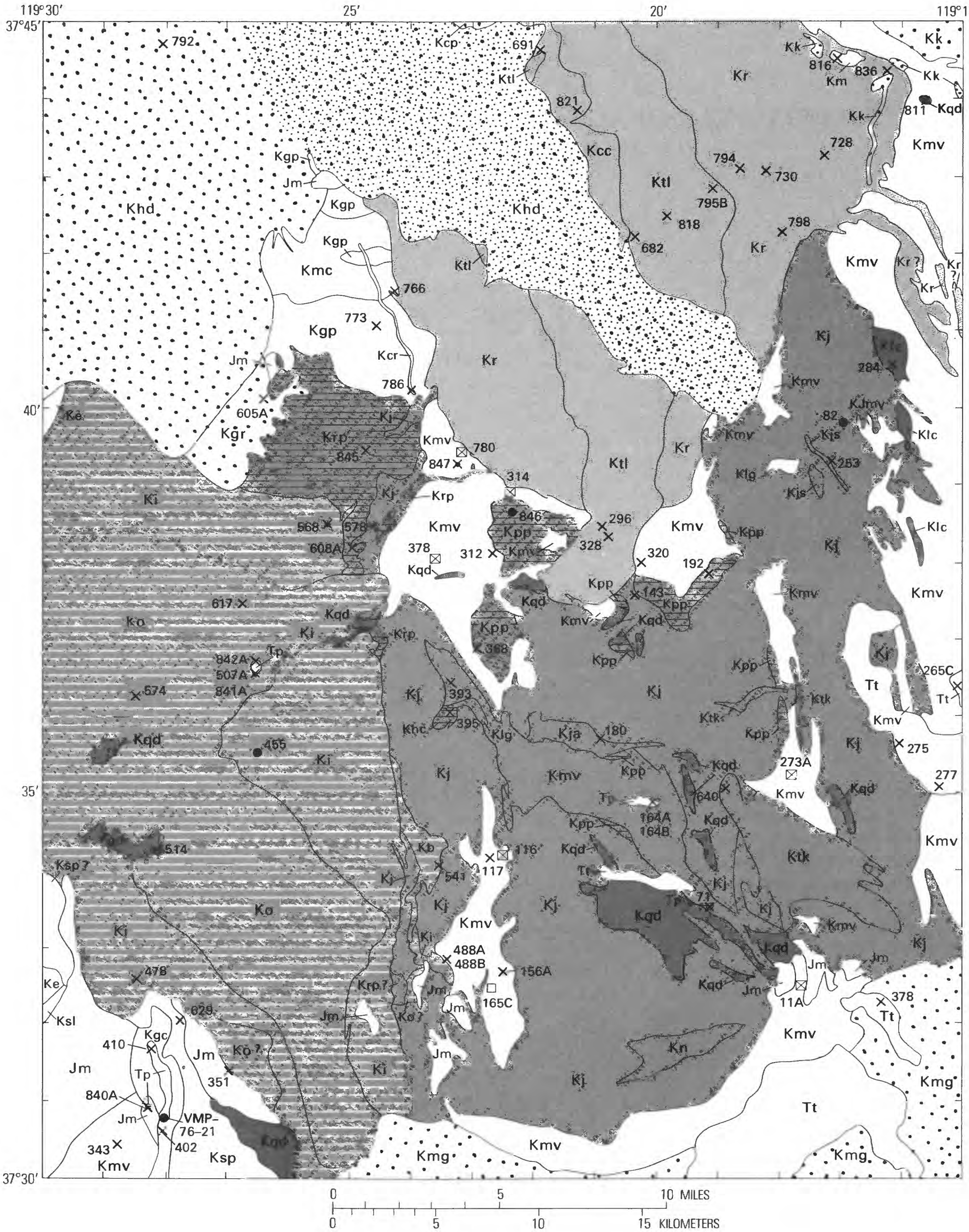
The Merced Peak quadrangle includes an area of about 620 km² of the Sierra Nevada batholith 10–40 km southeast and east of Yosemite Valley. The quadrangle is nearly bisected by the southeastern boundary of Yosemite National Park, which for the most part coincides in the area with the divide between the drainage basins of the Merced and San Joaquin Rivers. Altitudes range from 6,100 to 13,100 feet (about 2,000 to 4,000 m), and much of the area is at or near local timberline. Roads are limited to the southern margin, but a network of trails provides access to all parts of the area.

This paper supplements the "Geologic Map of the Merced Peak Quadrangle, Central Sierra Nevada, California" (Peck, 1980), by providing analytic data on the plutonic, metamorphic, and volcanic rocks of the quadrangle. It is part of a continuing study of the bedrock geology of the central Sierra Nevada batholith reported earlier by Bateman and others (1963), Bateman and Wahrhaftig (1966), and Bateman and Eaton (1967). A preliminary version of the geologic map of the Merced Peak quadrangle was published in uncolored form in 1964 (Peck, D. L., 1964). The bedrock geology of the northwestern part of the quadrangle was mapped and described by Calkins (1930), and the glacial deposits have been studied by Matthes (1930; 1960) and Birman (1964). Nokleberg (1970; 1981) mapped the Strawberry Mine area in detail as part of this project, and his mapping is incorporated in figure 1. Geologic maps of adjacent quadrangles have been published by Huber and Rinehart (1965), Kistler (1966a), Huber (1968), Bateman and others (1971), and Kistler (1973). Supplementary geologic and analytic reports include Kistler (1966b), Huber and Rinehart (1967), Bateman and Lockwood (1976), and Kistler (1974). Isotopic U-Pb ages of zircons from several of the plutonic units of the Merced Peak quadrangle, as well as from many other plutons of the central Sierra Nevada, have been reported recently by Stern and others (1981). Plutonic rocks in this report are classified according to the recommendations of the International Union of Geological Sciences (Streckeisen and others, 1973) as shown in figure 9*A*.

GENERAL GEOLOGY

The quadrangle is underlain chiefly by plutonic and metavolcanic rocks, as shown in the simplified bedrock geologic map (fig. 1) and described in the text of the geologic map of the Merced Peak quadrangle (Peck, 1980). Metasedimentary rocks are exposed only in a few localities. The rocks are predominantly metaquartzite but include less abundant quartz-biotite hornfels, quartz-plagioclase hornfels, tactite, and marble. A fossil from the Strawberry Mine area, identified by R.W. Imlay (oral commun., 1977) as *Inoceramus pseudomytiloides*(?) of Early Jurassic age, indicates that the beds are cor-

[1]Arco Oil and Gas, Geothermal Projects, P.O. Box 2819, Dallas, TX 75221.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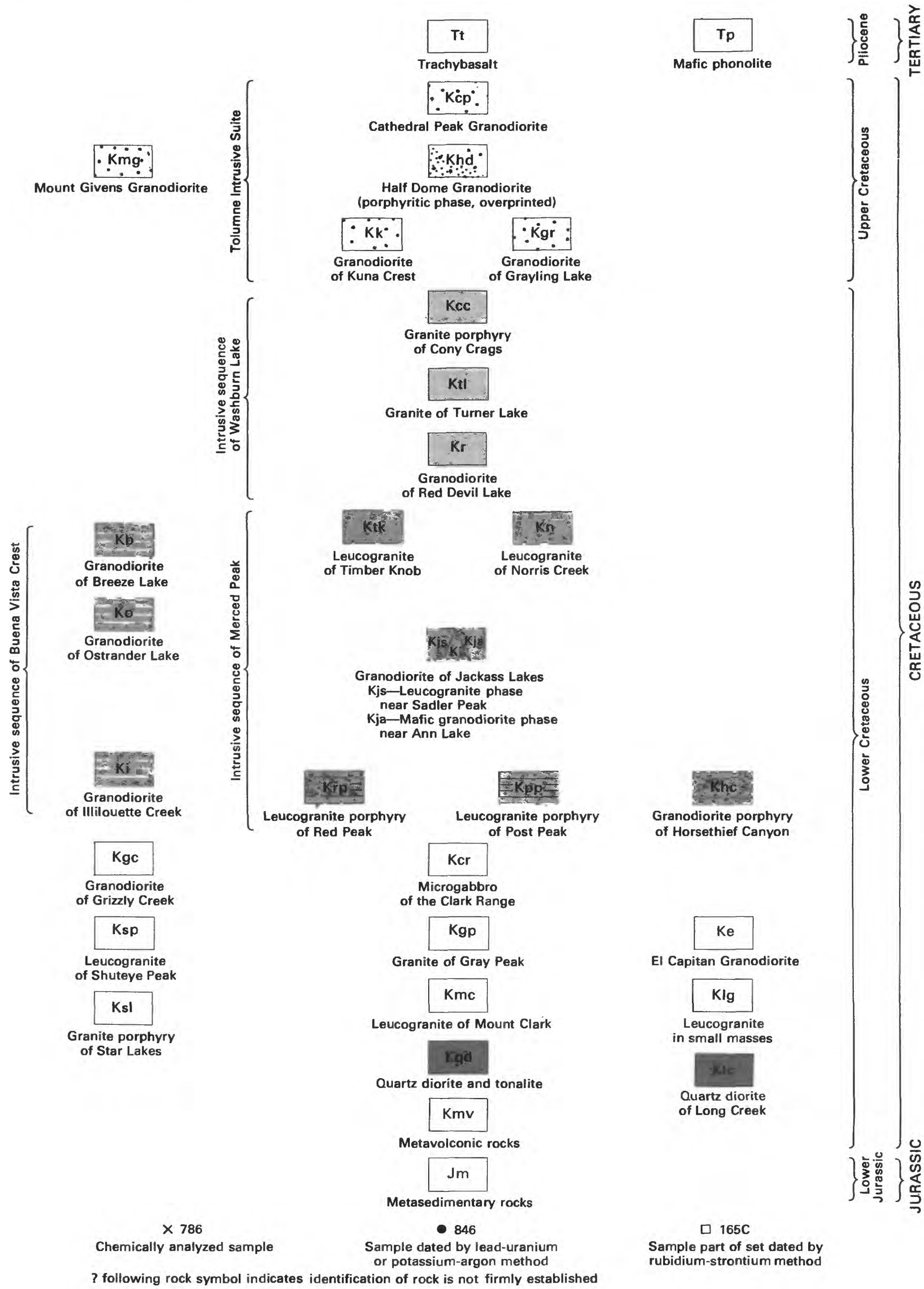


FIGURE 1.–Simplified bedrock geologic map of the Merced Peak quadrangle showing the locations of chemically analyzed and isotopically dated rock samples. Numbers refer to sample numbers in tables 1 through 5.

relative with the fossil-bearing metasedimentary rocks of the Boyden Cave pendant described by Jones and Moore (1973). Far more abundant are metavolcanic rocks, mostly blastoporphyritic, quartzo-feldspathic hornfels, epidote-amphibolite hornfels, and weakly foliated schist. They are predominantly derived from massive pyroclastic rocks of rhyodacitic composition but also include less abundant andesite, dacite, and rhyolite and sparse flows and shallow intrusions. The metavolcanic rocks along the eastern boundary of the quadrangle form the western margin of the Ritter Range pendant, described by Huber and Rinehart (1965). The metavolcanic rocks intrude metasedimentary rocks near the Strawberry Mine (Nokleberg, 1970; 1981) and are in turn intruded by many of the plutonic units, including quartz diorite and the intrusive sequence of Merced Peak. The rocks have yielded Early Cretaceous ages of 95 and 100 m.y. by rubidium-strontium and lead-uranium methods, respectively (tables 1 and 2), approximately the same ages as those obtained from the granodiorite of Jackass Lakes. The similarity in age of these units and their close spatial association and similar chemical compositions suggest that they may well be genetically related. The geographic distribution of the metavolcanic rocks (excluding those in the southwest corner of the quadrangle) and the plutonic rocks of the Merced Peak intrusive sequence indicates that they may represent the preserved lower part of a caldera.

Plutonic rocks ranging from quartz diorite to leucogranite underlie most of the quadrangle. The rocks constitute many different plutons (29 units are distinguished in fig. 1) that are in sharp contact with one another. Most of the plutonic rocks are medium-grained granodiorite and granite, but they range from quartz diorite to leucogranite and from very coarsely porphyritic granodiorite to fine-grained aplite and leucogranite porphyry. Most of the area is underlain by plutonic rocks that are part of areally extensive plutons or suites of closely related plutons covering 100 to 1,000 km². The intrusive sequences of Merced Peak and Washburn Lake are entirely or mostly confined to the quadrangle, but others extend for many kilometers beyond the boundaries, particularly the Shuteye Peak, Mount Givens, and El Capitan plutons, the intrusive sequence of Buena Vista Crest, and the Tuolumne Intrusive Suite. Individual plutonic suites and large plutons typically range from hornblende granodiorite (or quartz diorite) rich in discoid mafic inclusions at the margins to fine-grained biotite granite or leucogranite porphyry at the core.

The plutonic rocks range in age from Early to Late Cretaceous (105 to 85 m.y.) on the basis of radiometric ages from the Merced Peak quadrangle (listed in tables 2 and 3) and radiometric ages from adjacent areas. Most of the potassium-argon ages have been reduced by nearby younger intrusions, but the age of 95 m.y. for the hornblende from a sample of the granodiorite of Jackass Lakes (MP-82, table 3) is in good agreement with the age of 98 m.y. determined by lead-uranium methods on zircon from another sample of the unit (MP-520, table 2). That age and those determined on samples of the granodiorite of Red Devil Lake (MP-789, table 3) and of the metavolcanic rocks are consistent with the observed geologic relations and radiometric ages from adjacent areas, but the discordant age of 93 m.y. determined from a sample of the leucogranite porphyry of Post Peak appears to be too low by 6 m.y.

TABLE 1.—*Rubidium and strontium determinations on metavolcanic rocks*[1] [2]

[Rb and Sr determinations of MP-165B, MP-314, and MP-320 by isotope dilution, Carl Hedge analyst, U.S. Geological Survey, Denver, Colo.; all others by XRF, W. P. Doering analyst, U.S. Geological Survey, Denver, Colo. Strontium isotope analyses by R. Hildreth, U.S. Geological Survey, Denver, Colo., and R. Kistler, U.S. Geological Survey, Menlo Park, Calif. Rb/Sr about ±3.0 percent or ±2.0 percent on those specimens determined by XRF or isotope dilution, respectively. Strontium isotope ratios are from ±0.02 percent to ±0.10 percent, normalized to $^{86}Sr/^{88}Sr$=0.1194, and adjusted to E and A $SrCO_3$ $^{87}Sr/^{86}Sr$=0.7080. Isochron is regressed by the method of York (1966). Specimen MP-320 not used in isochron. $\lambda^{87}Rb = 1.42\times10^{-11}$/yr. Determinations GC-10 to -204 from Warren Nokelberg, 1981; samples from the Strawberry Mine area]

Sample no.	Rb (ppm)	Sr (ppm)	Rb/Sr	$^{87}Sr/^{86}Sr$
MP-11A	85.8	551	0.156	0.7082±.00014
MP-116	94.3	459	.205	.7075±.0007
MP-165B	274	39.1	7.001	.7341±.0002
MP-273A	137	60.4	2.266	.7161±.00014
MP-314	44.1	472	.093	.7072±.0002
MP-320	159	47.3	3.362	.7149±.0003
MP-378	130	233	.556	.7088±.00014
MP-780	114	388	.294	.7077±.00014
GC-10	59.0	504	.117	.7073±.00014
GC-41	122	387	.315	.7073±.00014
GC-50	115	366	.314	.7077±.00014
GC-62	189	96.9	1.947	.7142±.00014
GC-204	136	210	.646	.7096±.00014

[1] Age=94.7±4.6 m.y.
[2] Initial $^{87}Sr/^{86}Sr$=0.7068±.0002.

TABLE 2.—*Uranium-lead age determinations on zircon from plutonic and metavolcanic rocks*

[Determinations by T. W. Stern, U.S. Geological Survey, Reston, Va. Constants used: $^{238}U/^{235}U$ 137.88; $238\lambda = 0.155\times10^{-9}$ yr^{-1}. Analytic uncertainties approximately ±3 percent. Age determined from $^{206}Pb/^{238}U$]

Sample no.	Rock unit	Pb (ppm)	U (ppm)	Th (ppm)	^{204}Pb (atomic percent)	^{206}Pb (atomic percent)	^{207}Pb (atomic percent)	^{208}Pb (atomic percent)	Age (m.y.)
MP-520	Granodiorite of Jackass Lakes	20.24	1140.4	951.8	0.03148	74.95	3.929	21.09	98
MP-568	Granodiorite of Illilouette Creek	19.64	1092.8	855.6	.04319	75.78	4.081	20.10	100
MP-789	Granodiorite of Red Devil Lake	20.15	807.5	1948.9	.02757	53.28	2.921	43.77	98
MP-846	Leucogranite porphyry of Post Peak	16.08	974.1	392.4	.2873	80.71	5.227	13.77	93
MP-847	Metavolcanic rocks	11.12	600.8	285.5	.1877	76.00	6.103	17.71	100

TABLE 3.–*Potassium-argon age determinations on minerals from granitic and volcanic rocks*

[Constants used ^{40}K: $\gamma\epsilon+\lambda\epsilon=0.581\times10^{-10}$ year^{-1}, $\gamma\beta=4.962\times10^{-10}$ year^{-1}; isotopic abundance 1.167×10^{-4} moles ^{40}K per mole K. Radiogenic argon=r^{40}Ar; total argon=t^{40}Ar. Analysts for MP-82, MP-455, and MP-789, R. W. Kistler and Lois Schlocker, U.S. Geological Survey, Menlo Park, Calif. Analyst for VMP-76-21 and MP-841A, Elliot Sims, under the direction of G. Brent Dalrymple, U.S. Geological Survey, Menlo Park, Calif.]

			Argon					
Sample	Rock unit	Mineral	K_2O (weight percent)		$^{40}Ar_{rad}$ (moles/g $\times10^{11}$)		$^{40}Ar_{rad}$ (percent)	Age (m.y.)
MP-82 ______	Granodiorite of Jackass Lakes	Biotite	9.21		115.83		81	85.5±2.1
		Hornblende	1.17		16.25		71	95.2±2.8
MP-455 _____	Granodiorite of Illilouette Creek	Biotite	9.30		121.50		65	88.7±2.2
		Hornblende	1.00		12.53		63	85.1±2.5
Mp-789 _____	Granodiorite of Red Devil Lake	Biotite	9.43		116.83		79	84.2±2.1
		Hornblende	.82		10.57		38	87.4±2.6
VMP-76-21 _	Mafic phonolite near Grizzly Creek	Phlogopite	9.83		5.105		25.2	3.60±0.06
MP-841A ___	Mafic phonolite near Merced Pass	Phlogopite	8.80		3.859		32.6	3.04±0.04
			$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$[1]	$^{36}Ar/^{39}Ar$	J[2]		
VMP-76-21 _	Mafic phonolite near Grizzly Creek	Phlogopite	1.949	0.02496	0.00541	0.005678	17.8	3.55±0.21
MP-841A ___	Mafic phonolite near Merced Pass	Phlogopite[3]	2.091	.03117	.00573	.005702	18.8	4.05±0.22
MP-841A ___	____________do____________	Phlogopite[4]	1.729	.03760	.00463	.005702	20.7	3.68±0.18
MP-841A ___	____________do____________	Sanidine	.8876	.1674	.00180	.005702	39.5	3.60±0.10

[1] Corrected for ^{37}Ar decay ($t_{1/2}$=35.1 days).
[2] J is a function of the age of the monitor mineral and of the integrated fast-neutron flux.
[3] Screened to 60-100 mesh.
[4] Screened to 100-200 mesh.

Volcanic rocks of Tertiary age occur near Jackass Meadow (near the southeast corner of the quadrangle), along Cora Creek (10 km farther north), and at several small isolated localities. Most are in flows and sparse cinder deposits of trachybasalt and less abundant trachyandesite similar to the Tertiary volcanic rocks of adjacent areas described by Hamilton and Neuerburg (1956). Small flows along Grizzly Creek and near Merced Pass and a flow and volcanic neck along the west fork of Granite Creek, however, represent a rare composition for volcanic rocks; they are phlogopite-bearing, ultrapotassic, mafic phonolite similar to the orendite and olivine orendite of the Leucite Hills, Wyoming (Carmichael, 1967), and the minette dikes of the Navajo region (Williams, 1936). The mineralogy, petrology, and geochemistry of these volcanic rocks have recently been described by Van Kooten (1980). Trachybasalt flows in adjacent quadrangles have yielded Pliocene potassium-argon ages of 2.9 to 3.6 m.y. (Dalrymple 1963, 1964). Similar ages of about 3.6 m.y. were determined by potassium-argon determination of phlogopite and sanidine from the Merced Pass and Grizzly Creek localities (as listed in table 3, samples MP-841A and VMP-76-21), indicating that the trachybasalt and phonolite are at least in part contemporaneous.

The Lower Cretaceous and older plutonic and metamorphic rocks, but not the Upper Cretaceous plutonic rocks, are cut by northwest-trending shears along several zones that cross the quadrangle. These shears are not indicated on the simplified geologic map (fig. 1) but are shown and discussed on the geologic map of the Merced Peak quadrangle (Peck, 1980). All the plutonic and metamorphic rocks are cut by steeply dipping regional joints, as shown in figure 2. This figure, which was prepared from aerial photographs of the quadrangle, shows a dominant north- to north-northeast-trending set of joint cracks crossed by a less prominent west- to northwest-trending set.

Glacial deposits, primarily of Wisconsinan Age, cover broad areas of the quadrangle, particularly along Granite, Illilouette, and Chiquito Creeks and the North and South Forks of the Merced River. These deposits are not shown on the simplified geologic map (fig. 1), but they are shown and described in the geologic map of the Merced Peak quadrangle (Peck, 1980).

ANALYTIC DATA

During the course of the geologic mapping, 845 rock samples were collected, including 520 of plutonic rocks. Of these, 258 were analyzed modally, and 41 were also analyzed chemically and spectrographically, as were 15 samples of metavolcanic rocks and 11 samples of Tertiary volcanic rocks. The locations of chemically and isotopically analyzed samples are plotted in figure 1 and listed in table 4 together with the chemical and spectrographic analyses, norms, and modes. Modes were determined by counting 1,000 to 2,000 regularly spaced points on rock slabs of not less than 40 cm^2, on which potassium feldspar had been selectively stained yellow and plagioclase red (Norman, 1974). Four constituents were counted–quartz, potassium feldspar, plagioclase, and mafic minerals. The locations of the modally analyzed samples are plotted in figure 3 and listed in table 5, along with modes and specific gravities. The percent-

TABLE 4.—*Chemical and spectrographic analyses, norms, and modes of representative igneous rocks*

[Chemical analyses: Standard rock analyses listed in columns 12, 15, 20, 22, 28, 35, 38, and 50 by Ellen S. Daniels, under the direction of L. C. Peck, U.S. Geological Survey, Denver, Colo., 1963; rapid rock analyses in columns 4, 6, 7, 8, 9, 10, 19, 23, 24, 25, 26, 29, 31, 32, 39, 41, 42, 44, 45, 47, 48, 49, 53, 55, 56, 58, 59, 61, 62, 64, and 66 prepared under the direction of Leonard Shapiro, U.S. Geological Survey, Reston, Va., 1963–64; all other analyses prepared by H. Smith and Z. A. Hamlin, U.S. Geological Survey, Reston, Va., using the method described by Shapiro (1975) under "single solution" in U.S. Geological Survey Bulletin 1401. Semiquantitative spectrographic analyses in columns 4, 6, 7, 8, 9, 10, 12, 15, 19, 20, 22, 23, 24, 25, 26, 28, 29, 31, 32, 35, 38, 39, 41, 42, 44, 45, 47, 48, 49, 50, 53, 55, 56, 58, 59, 61, 62, 64, and 66 by J. C. Hamilton, U.S. Geological Survey, Denver, Colo., and C. Heropoulos, U.S. Geological Survey, Menlo Park, Calif., in 1963; values reported to the nearest number in the series 1, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1, and so on, which represent midpoints on a geometric scale; the precision of a value is approximately plus or minus one bracket of 68 percent confidence or two brackets at 95 percent. N = not detected; detection limits (in ppm) are Ag, 0.5; B, 20; Ba, 1.5; Be, 1; Co, 3; Cr, 1; Cu, 1; Ga, 5; La, 30; Mo, 3; Nb, 10; Ni, 5; Pb, 10; Sc, 5; Sn, 10; Sr, 5; V, 7; Y, 10; Yb, 1; and Zr, 10. Semiquantitative spectrographic analyses in other columns prepared in 1977 under the direction of C. S. Annell, U.S. Geological Survey, Reston, Va., using automated techniques; the relative standard deviation for each reported concentration is plus 50 percent and minus 33 percent; detection limits (in ppm) are Ag, 0.1; B, 4.6; Ba, 2.2; Be, 1.0; Ce, 43; Co, 1.0; Cr, 1.0; Cu, 1.5; Ga, 1.5; La, 10; Mo, 1.0; Nb, 3.2; Ni, 1.5; Pb, 6.8; Sc, 1.0; Sn, 1.5; Sr, 1.0; V, 1.0; Y, 1.5; Yb, 0.15; Zn, 15; and Zr, 3.2. X-ray fluorescent analyses by G. Sellers, B. McCall, and J. Lindsay, U.S. Geological Survey, Reston, Va., 1978. Instrumental neutron activation analyses prepared by P. A. Baedecker and L. Schwartz, U.S. Geological Survey, Reston, Va., in 1978 and 1979; samples were irradiated for 2 hours in RT–3 at the National Bureau of Standards Reactor and counted after 1 week and 2 months decay on a low energy photon detector and on Ge (Li) spectrometers with subsequent computer processing. Modal analyses by Meade B. Norman II, U.S. Geological Survey, Menlo Park, Calif., Gerald K. Van Kooten, Arco Oil and Gas, Dallas, Tex., Dallas L. Peck, and Oleg Polovtzoff, U.S. Geological Survey, Menlo Park, Calif.: 1,000 to 2,000-point counts on a slab of at least 40 cm². Plagioclase compositions determined by Gerald K. Van Kooten by measuring extinction angles of albite twins on a universal stage. Biotite/hornblende ratios and modal composition of volcanic rocks determined by Gerald K. Van Kooten and Jeffrey W. Hedenquist (formerly U.S. Geological Survey) by counts of 1,000 to 2,000 points on standard thin sections]

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
														Granodiorite of Jackass Lakes					
	Quartz diorite and tonalite		Tonalite of Long Creek	Leuco-granite of Mount Clark	Leuco-Granite of Shuteye Peak	Granite of Gray Peak	Grano-diorite of Grizzly Creek	Grano-diorite porphyry of Horsethief Canyon	Micro-gabbro of the Clark Range	Leucogranite porphyry of Post Peak		Leucogranite porphyry of Red Peak		Granodiorite		Aplite	Grano-diorite near Ann Lake	Leuco-granite near Sadler Peak	Leuco-granite of Timber-lands
	quartz diorite																		
	MP–811	MP–514	MP–284	MP–766	MP–629	MP–773	MP–402	MP–395	MP–786	MP–368	MP–192	MP–608A	MP–845	MP–578	MP–520	MP–143	MP–180	MP–253	MP–640
Chemical analyses (weight percent)																			
SiO_2	50.8	60.1	61.7	75.6	74.6	70.1	65.1	67.6	54.4	73.0	77.2	74.05	77.9	64.9	68.57	76.1	66.6	72.0	74.7
Al_2O_3	17.1	17.3	17.9	13.0	13.4	14.6	16.3	15.9	17.1	13.8	11.9	13.57	12.8	16.2	15.60	13.7	16.4	15.3	13.2
Fe_2O_3	4.5	1.7	2.2	.66	.16	1.7	1.3	1.3	1.9	.87	.88	.75	.32	2.1	1.15	.29	1.6	.90	.40
FeO	6.9	4.0	2.4	.67	.56	2.2	3.2	2.3	6.2	1.3	.72	1.06	.16	2.5	1.89	.16	1.5	.92	.73
MgO	3.9	2.8	1.3	.16	.00	.51	2.0	.95	4.8	.44	.05	.32	.10	1.7	.99	.17	.62	.32	.08
CaO	6.4	6.9	6.1	.58	.67	2.3	4.3	3.1	7.9	1.7	.77	1.45	.54	4.1	3.02	.37	4.0	.98	1.0
Na_2O	2.4	3.5	4.7	3.8	4.3	3.9	3.8	4.4	3.7	3.8	3.2	3.51	3.8	3.8	4.02	4.6	4.2	4.6	3.3
K_2O	3.2	1.2	1.8	4.7	4.6	3.8	2.4	3.0	1.5	3.9	4.8	4.64	4.3	2.9	3.43	4.4	2.9	4.2	5.2
H_2O+	1.6	.61	.52	.40	.26	.25	.74	.51	.95	.50	.25	.19	.42	.69	.41	.28	.59	.43	.40
H_2O-	.03	.04	.01	.09	.03	.06	.03	.06	.13	.14	.01	.08	.19	.14	.05	.11	.04	.12	.04
TiO_2	1.0	.59	.59	.09	.00	.36	.59	.55	.20	.32	.02	.20	.14	.83	.47	.06	.37	.30	.12
P_2O_5	.69	.36	.47	.02	.09	.10	.16	.16	.23	.09	.12	.04	.06	.23	.13	.04	.27	.08	.02
MnO	.11	.00	.00	.07	.00	.08	.11	.13	.16	.16	.00	.04	.00	.07	.08	.11	.00	.04	.06
CO_2	.06	.03	.01	<.05	.02	<.05	<.05	<.05	<.05	<.05	.01	.01	.00	.01	.01	.01	.02	.01	<.05
Cl	–	–	–	–	–	–	–	–	–	–	–	.02	–	–	.01	–	–	–	–
F	–	–	–	–	–	–	–	–	–	–	–	.04	–	–	.05	–	–	–	–
Less O	–	–	–	–	–	–	–	–	–	–	–	.02	–	–	.02	–	–	–	–
Sum	99	99	100	100	99	100	100	100	99	100	100	99.92	101	100	99.86	100	99	100	99
Powder density	–	–	–	2.64	–	2.74	2.73	2.70	2.86	2.62	–	2.69	2.65	2.69	2.69	2.65	–	2.65	2.62
Semiquantitative spectrographic analyses (parts per million)																			
Ag	–	–	–	N	–	N	N	N	N	N	–	N	.1	N	N	N	–	N	N
B	–	–	–	5	–	3	7	10	N	10	–	N	N	8.9	N	N	–	N	7
Ba	–	–	–	1,000	–	2,000	7,000	1,000	700	700	–	700	520	830	1,500	11	–	1,900	500
Be	–	–	–	1.5	–	1.5	1	1	N	1.5	–	2	1.6	1.9	1.5	4.9	–	2.0	2
Ce	–	–	–	N	–	N	N	N	N	N	–	N	32	N	N	36	–	95	N
Co	–	–	–	N	–	3	7	5	30	2	–	N	1.9	69	5	1.9	–	2.2	N
Cr	–	–	–	50	–	7	15	30	70	50	–	2	2.0	5.6	2	2.4	–	4.8	30
Cu	–	–	–	5	–	3	10	7	15	3	–	5	4.5	9.9	5	3.3	–	3.5	2
Ga	–	–	–	20	–	30	20	20	20	15	–	20	18	23	20	28	–	21	15
La	–	–	–	N	–	50	30	N	N	30	–	50	11	26	50	15	–	51	N
Mo	–	–	–	N	–	N	N	N	N	N	–	N	N	N	N	N	–	N	N
Ni	–	–	–	15	–	1	7	20	30	15	–	N	N	2.5	N	N	–	7.0	15
Pb	–	–	–	30	–	30	20	20	N	30	–	15	120	26	15	34	–	29	30
Sc	–	–	–	5	–	5	15	15	30	7	–	N	2.4	14	10	16	–	7.7	3
Sn	–	–	–	N	–	N	N	N	N	N	–	N	29	N	N	9.1	–	N	N
Sr	–	–	–	100	–	100	700	700	1000	300	–	200	60	390	700	6.5	–	130	150
V	–	–	–	5	–	5	100	70	300	30	–	20	N	92	50	3.3	–	7.1	7
Y	–	–	–	30	–	30	20	30	20	20	–	20	5.7	25	20	81	–	19	20
Yb	–	–	–	3	–	3	3	3	2	2	–	3	.58	3.7	2	11	–	2.2	3
Zn	–	–	–	N	–	N	N	N	N	N	–	N	N	6.7	N	N	–	28	3

X-ray fluorescence analyses (parts in million)																			
Ba	–	–	733	–	–	–	–	–	556	721	564	650	557	909	935	–	857	2,011	–
Sr	–	–	693	–	–	–	–	–	541	204	86	144	94	430	358	–	484	158	–
Instrumental neutron activation analyses (parts per million)																			
Ba	–	–	838	–	–	–	–	–	536	830	664	800	641	1,010	1,013	–	1,037	2,060	–
Co	–	–	6.5	–	–	–	–	–	25.2	2.1	1.5	2.0	.2	9.6	5.4	–	4.3	.7	–
Cr	–	–	7.2	–	–	–	–	–	46.2	1.2	1.8	2.4	2.4	4.2	2.0	–	6.4	1.3	–
Cs	–	–	2.2	–	–	–	–	–	8.9	5.6	3.7	4.6	2.6	3.2	7.9	–	1.8	3.7	–
Hf	–	–	14.3	–	–	–	–	–	2.6	5.9	6.2	6.0	5.0	5.4	4.7	–	6.5	17.9	–
Rb	–	–	38	–	–	–	–	–	84	163	184	176	162	106	130	–	84	124	–
Sb	–	–	1.8	–	–	–	–	–	1.2	3.2	.7	.2	19.4	2.6	.6	–	.9	.8	–
Ta	–	–	.73	–	–	–	–	–	.38	1.28	1.24	1.20	1.36	.86	.86	–	1.04	.94	–
Th	–	–	12.7	–	–	–	–	–	3.3	19.9	29.0	26.4	19.3	11.8	18.6	–	13.0	17.2	–
U	–	–	4.2	–	–	–	–	–	1.0	7.2	7.2	7.0	6.9	4.6	5.3	–	3.5	2.8	–
Zn	–	–	87	–	–	–	–	–	124	64	34	50	20	89	65	–	63	65	–
Zr	–	–	675	–	–	–	–	–	–	303	218	192	175	341	284	–	275	322	–
Sc	–	–	11.37	–	–	–	–	–	20.54	4.78	2.50	3.61	2.47	11.16	6.23	–	8.10	6.58	–
La	–	–	33	–	–	–	–	–	16	36	46	54	14	31	34	–	28	56	–
Ce	–	–	66	–	–	–	–	–	32	65	84	80	30	55	59	–	60	94	–
Nd	–	–	33	–	–	–	–	–	19	32	33	36	11	26	23	–	30	42	–
Sm	–	–	7.2	–	–	–	–	–	4.6	5.9	6.2	6.7	1.4	5.4	4.3	–	6.1	7.0	–
Eu	–	–	1.92	–	–	–	–	–	1.08	.75	.46	.70	.36	1.18	.98	–	1.36	1.54	–
Gd	–	–	5.5	–	–	–	–	–	3.8	4.6	4.2	5.3	1.4	5.0	3.4	–	4.9	5.6	–
Tb	–	–	1.03	–	–	–	–	–	.60	.77	.67	.91	.22	.78	.56	–	.80	.81	–
Tm	–	–	.50	–	–	–	–	–	.25	.47	.36	.56	.15	.36	.32	–	.43	.37	–
Yb	–	–	3.2	–	–	–	–	–	1.8	2.8	2.4	3.3	.9	2.0	1.8	–	2.5	2.5	–
Lu	–	–	.49	–	–	–	–	–	.26	.41	.38	.47	.16	.34	.28	–	.38	.37	
CIPW norms (weight percent)																			
Q	3.903	15.973	14.140	33.836	30.854	26.480	20.226	21.788	1.871	31.266	38.630	32.172	37.927	20.327	23.847	31.401	22.352	26.554	33.228
C	–	–	–	.656	.396	.129	.016	.161	–	.452	.351	.383	1.049	–	.236	.813	–	1.616	.376
Or	19.161	7.153	10.669	27.813	27.543	22.464	14.178	17.728	8.938	23.042	28.384	27.427	25.226	17.108	20.293	25.897	17.291	24.769	30.960
Ab	20.578	29.876	39.890	32.206	36.868	33.014	32.145	37.232	31.570	32.148	27.096	29.562	31.922	32.100	33.983	38.769	35.858	38.846	28.135
An	26.786	28.195	22.496	2.751	2.644	10.761	20.281	14.334	25.835	7.844	2.975	6.604	2.270	18.550	13.805	1.505	17.487	4.267	14.867
Ne	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Wo	.181	1.575	1.968	–	–	–	–	–	5.081	–	–	–	–	.080	–	–	.262	–	–
En	9.842	7.035	3.247	.399	–	1.271	4.980	2.366	12.055	1.096	.125	.791	.247	4.227	2.469	.422	1.558	.795	.201
Fs	7.606	5.010	1.620	.668	.908	2.191	4.031	2.483	9.865	1.437	.562	1.071	–	1.613	1.895	.159	.829	.524	.930
Fo	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Fa	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Mt	6.611	2.486	3.199	.958	.235	2.466	1.884	1.835	2.773	1.261	1.277	1.088	.109	3.040	1.669	.419	2.341	1.302	.584
Hm	–	–	–	–	–	–	–	–	–	–	–	–	.242	–	–	–	–	–	–
Il	1.924	1.130	1.124	.171	–	.684	1.120	1.045	.383	.608	.038	.380	.264	1.574	.894	.113	.709	.569	.230
Ap	1.656	.860	1.117	.047	.216	.237	.379	.379	.549	.213	.284	.095	.141	.544	.308	.094	.645	.189	.048
Other	.138	.069	.023	–	.046	–	–	–	–	–	.023	.131	–	.023	.119	.023	.046	.023	–
Total	98.386	99.363	99.493	99.511	99.711	99.696	99.240	99.400	98.925	99.367	99.746	99.709	99.397	99.184	99.517	99.615	99.378	9.456	99.558
Modes (volume percent)																			
Quartz	5.4	10.8	11.4	37.2	32.5	27.9	25.8	19.6	5.3	30.0	34.1	28.6	24.1	19.7	23.5	–	22.2	26.7	29.3
K-feldspar	.1	.2	4.5	31.0	35.5	25.0	6.1	153	0	32.3	37.1	32.7	38.6	12.2	19.2	–	14.6	33.3	33.4
Plagioclase	57.2	55.3	68.0	29.8	30.8	38.4	53.6	54.4	47.0	32.8	25.5	34.3	37.1	52.9	47.3	–	51.7	36.5	35.0
Mafic minerals	37.3	33.7	16.1	2.0	1.2	8.7	14.5	10.7	47.7	4.9	3.3	4.4	.2	15.2	10.0	–	11.5	3.5	2.3
Plagioclase composition																			
An range	90–22	73–21	43–26	35–21	32–17	49–17	41–21	56–15	75–33	37–5	46–5	56–13	–	56–12	45–12	11–5	47–15	27–12	24–12
An average	45	40	35	30	20	25	30	30	60	20	20	20	–	30	25	10	30	20	20
Biotite/biotite + hornblende	.9	.6	.6	.3	1.0	.7	.7	.3	.4	1.0	1.0	1.0	1.0	.8	.9	1.0	.3	.9	1.0
Bulk specific gravity	2.86	2.812	2.751	nd	2.616	2.66	2.73	2.71	–	2.637	2.64	2.65	2.565	2.717	2.70	–	2.70	2.64	2.613
Location																			
Latitude	37°44′	37°34′	37°41′	37°42′	37°32′	37°41′	37°31′	37°36′	37°40′	37°37′	37°38′	37°38′	37°39′	37°38′	37°35′	37°38′	37°36′	37°39′	
Longitude	119°16′	119°28′	119°16′	119°24′	119°28′	119°25′	119°29′	119°23′	119°24′	119°23′	119°19′	119°25′	119°25′	119°25′	119°24′	119°20′	119°21′	119°17′	

TABLE 4.—*Chemical and spectrographic analyses, norms, and modes of representative igneous rock*—Continued

	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
			Granodiorite of Ostrander Lake																			
	Granodiorite of Illilouette Creek		Granite		Quartz Mountain body	Granodiorite of Breeze Lake	Granodiorite of Red Devil Lake						Granite of Turner Lake					Granite porphyry of Cony Crags		Granodiorite of Kuna Crest quartz monzodiorite	Granodiorite of Grayling Lake	Half Dome Granodiorite
							Granodiorite				Granite		Granite				Aplite					
	MP-568	MP-478	MP-617	MP-574	MP-351	MP-541	MP-728	MP-836	MP-789	MP-798	MP-730	MP-794	MP-682	MP-818	MP-795B	MP-328	MP-296	MP-821	MP-691	MP-816	MP-605A	MP-792
Chemical analyses (weight percent)																						
SiO_2	64.71	69.1	70.32	72.2	73.2	70.6	66.7	67.9	68.09	69.3	70.5	72.5	72.4	72.4	73.2	73.58	77.8	70.6	72.30	60.1	58.7	67.3
Al_2O_3	15.86	14.8	14.69	14.7	13.9	14.8	15.3	15.3	15.15	14.9	14.9	14.3	14.6	14.1	13.8	13.64	13.2	14.7	14.45	19.2	16.8	15.7
Fe_2O_3	1.46	1.2	.87	.37	.24	.90	1.6	2.0	1.50	1.1	1.4	.70	.70	1.4	1.4	.73	.15	1.2	.89	1.8	2.5	1.4
FeO	3.28	2.4	1.76	1.3	1.6	1.8	2.5	1.8	2.15	2.2	1.1	1.2	1.1	.92	.88	1.19	.40	.96	1.08	3.0	3.2	1.7
MgO	2.17	1.6	1.03	.52	.50	.65	2.3	1.3	1.33	1.1	.75	.57	.29	.40	.40	.65	.00	.52	.50	1.7	2.7	.66
CaO	4.84	4.7	2.83	2.0	1.8	2.4	3.2	3.3	3.27	2.8	2.4	1.9	1.8	2.2	2.1	2.21	.86	1.7	2.01	5.7	7.0	3.5
Na_2O	3.24	3.1	3.28	3.3	3.1	3.9	3.8	3.8	3.92	3.8	3.7	3.5	3.6	3.6	3.4	3.53	3.6	3.2	3.55	4.0	3.8	3.9
K_2O	2.71	2.4	4.01	4.0	4.5	3.2	3.0	3.2	3.12	3.3	3.9	4.2	4.7	3.8	4.0	3.57	5.0	4.9	4.27	2.4	2.4	3.6
H_2O+	.55	.46	.48	.90	.66	.85	.56	.56	.36	.60	.35	.45	.35	.38	.27	.31	.21	.56	.19	.80	.43	4.0
H_2O-	.06	.03	.05	.07	.05	.12	.06	.06	.06	.08	.07	.04	.02	.22	.13	.08	.04	.17	.06	.08	.03	0.3
TiO_2	.72	.33	.40	.30	.22	.43	.62	.58	.60	.48	.36	.25	.25	.32	.34	.30	.00	.32	.29	.75	.70	.44
P_2O_5	.15	.25	.09	.08	.06	.16	.16	.14	.15	.13	.08	.09	.06	.11	.10	.08	.08	.10	.09	.35	.49	.21
MnO	.08	.00	.05	.08	.04	.08	.12	.11	.09	.11	.05	.07	.08	.05	.04	.05	.00	.04	.04	.06	.00	.08
CO_2	.01	.02	.02	.08	<.05	.10	<.05	.02	.02	<.05	.02	.09	<.05	.05	.02	.06	.02	.03	.00	<.05	.02	.09
Cl	.03	–	.01	–	–	–	–	–	.01	–	–	–	–	–	–	.01	–	–	.00	–	–	–
F	.05	–	.05	–	–	–	–	–	.06	–	–	–	–	–	–	.04	–	–	.05	–	–	–
Less O	.03	–	.02	–	–	–	–	–	.03	–	–	–	–	–	–	.02	–	–	.02	–	–	–
Sum	99.89	100	99.92	100	100	100	100	100	99.85	100	100	100	100	100	100	100.01	101	99	99.75	100	99	99
Powder density	2.76	–	2.69	2.67	2.65	2.64	2.78	2.62	2.71	2.74	2.62	2.68	2.63	2.51	2.65	2.65	–	2.54	2.68	2.76	–	2.70
Semiquantitative spectrographic analyses (parts per million)																						
Ag	N	–	N	N	5	N	N	N	N	N	N	N	N	N	N	N	–	N	N	N	–	N
B	N	–	N	15	7	15	N	6.1	N	10	15	3	N	N	N	N	–	N	N	30	–	3
Ba	700	–	1,000	1,000	700	1,000	1,000	720	1,500	1,000	630	1,000	1,000	420	540	700	–	1,100	1,500	1,000	–	1,000
Be	2	–	1.5	1	2	1.5	1	2.2	N	1	2.3	1.5	1.5	1.9	1.6	2	–	2.0	2	1	–	N
Ce	N	–	N	N	N	N	N	110	N	N	55	N	N	69	48	–	–	110	–	–	–	–
Co	10	–	5	N	2	3	10	10	7	7	5.4	N	N	3.5	3.1	N	–	5.0	N	10	–	5
Cr	20	–	7	30	30	50	15	6.3	5	70	4.0	7	15	6.9	4.5	3	–	11	1.5	20	–	50
Cu	10	–	3	7	.7	1.5	7	4.1	5	5	3.6	3	5	3.7	4.1	7	–	4.2	3	15	–	10
Ga	20	–	20	20	20	20	20	21	20	20	21	20	20	15	15	15	–	21	20	20	–	20
La	30	–	50	N	50	30	30	54	30	N	27	30	N	26	28	30	–	55	70	N	–	30
Mo	N	–	N	N	N	N	N	N	N	3	N	N	20	N	N	N	–	N	N	N	–	N
Ni	7	–	5	10	10	15	7	7.6	5	30	4.9	2	7	N	N	N	–	9.0	N	10	–	15
Pb	10	–	20	20	30	20	10	22	15	15	24	20	30	27	21	15	–	42	15	10	–	15
Sc	15	–	7	N	N	5	10	11	10	10	6.9	N	N	1.6	4.0	N	–	4.6	N	10	–	5
Sn	N	–	N	N	N	N	N	N	N	N	N	N	N	N	N	N	–	N	N	N	–	N
Sr	700	–	500	700	300	700	700	330	700	700	240	500	500	180	180	500	–	290	700	1500	–	1000
V	100	–	70	30	30	70	150	74	70	100	36	50	30	26	23	30	–	28	30	150	–	100
Y	15	–	15	7	20	20	50	22	20	30	16	15	7	25	15	10	–	9.8	10	20	–	7
Yb	2	–	1.5	.7	2	2	5	2.7	2	3	27	1.5	1	3.7	2.1	1.5	–	1.4	1.5	2	–	1
Zn	N	–	N	N	N	N	N	72	N	N	N	N	N	N	N	N	–	N	N	N	–	N
X-ray fluorescence analyses (parts per million)																						
Ba	570	481	632	798	–	–	941	802	–	787	741	726	843	525	626	617	–	1132	1069	–	–	–
Sr	406	367	319	371	–	–	395	370	–	351	292	278	295	275	272	286	–	342	408	–	–	–

Instrumental neutron activation analyses (parts per million)																						
Ba	678	573	743	976	–	–	1,020	846	–	886	807	841	1,000	720	855	749	–	1,204	1,293	–	–	–
Co	11.6	8.1	5.5	2.6	–	–	8.5	8.0	–	6.2	4.0	2.4	2.2	2.7	2.6	3.9	–	3.1	2.5	–	–	–
Cr	17.0	15.4	7.3	2.0	–	–	6.1	5.4	–	5.8	3.1	2.4	3.0	5.3	5.1	3.8	–	8.0	2.2	–	–	–
Cs	3.7	2.2	8.3	6.2	–	–	6.1	8.6	–	5.8	11.8	8.2	4.6	5.6	7.4	6.0	–	6.0	4.5	–	–	–
Hf	4.2	6.2	4.9	4.2	–	–	5.9	5.6	–	5.2	4.2	5.1	3.4	7.3	7.4	4.2	–	6.1	5.2	–	–	–
Rb	88	72	162	144	–	–	113	132	–	130	165	184	214	163	166	152	–	239	191	–	–	–
Sb	.3	2.0	1.1	.4	–	–	1.6	1.7	–	1.6	3.0	2.0	.6	.6	1.0	.5	–	1.4	–	–	–	–
Ta	1.43	.99	1.22	1.32	–	–	1.06	.98	–	1.08	1.23	1.24	1.03	1.99	2.13	1.23	–	1.15	.84	–	–	–
Th	31.9	8.4	29.8	14.2	–	–	13.8	18.0	–	14.0	22.4	18.6	23.3	60.6	48.3	17.5	–	31.3	33.5	–	–	–
U	6.8	6.7	9.1	5.2	–	–	4.7	3.8	–	5.3	6.8	10.8	5.0	13.4	25.3	8.5	–	7.8	7.6	–	–	–
Zn	72	73	48	48	–	–	75	103	–	68	55	38	46	34	36	48	–	36	41	–	–	–
Zr	301	268	255	167	–	–	311	230	–	314	196	211	163	302	389	196	–	297	215	–	–	–
Sc	12.50	11.08	5.62	2.79	–	–	9.23	8.61	–	8.27	4.89	3.16	2.71	2.95	3.70	3.32	–	311	2.58	–	–	–
La	22	19	35	21	–	–	36	50	–	30	36	37	27	41	60	32	–	57	44	–	–	–
Ce	46	39	61	37	–	–	70	90	–	62	66	58	46	73	108	52	–	100	84	–	–	–
Nd	26	20	23	16	–	–	33	33	–	30	23	24	18	26	38	18	–	33	34	–	–	–
Sm	4.8	4.2	3.1	2.4	–	–	6.7	6.0	–	6.3	4.0	4.4	3.4	4.1	5.0	3.8	–	5.2	5.3	–	–	–
Eu	1.05	.94	.66	.73	–	–	1.29	1.19	–	1.10	.83	.72	.65	.83	.94	.62	–	.84	.80	–	–	–
Gd	4.9	3.6	3.1	2.4	–	–	5.3	4.2	–	5.0	3.5	2.9	2.8	5.6	5.0	2.8	–	1.4	3.3	–	–	–
Tb	.69	.60	.40	.33	–	–	.95	.80	–	.95	.54	.48	.34	.67	.83	.44	–	.48	.43	–	–	–
Tm	.31	.26	.19	.16	–	–	.45	.43	–	.40	.35	.29	.24	.38	.51	.24	–	.18	.16	–	–	–
Yb	2.1	2.0	1.4	.9	–	–	2.8	2.5	–	2.5	2.1	1.7	1.3	2.6	2.9	1.5	–	1.0	1.0	–	–	–
Lu	.34	.31	.25	.15	–	–	.38	.36	–	.38	.32	.29	.20	.43	.50	.27	–	.20	.17	–	–	–
CIPW norms (weight percent)																						
Q	21.304	29.236	27.919	32.323	32.440	29.374	22.176	24.584	24.251	26.163	28.026	31.079	28.832	32.026	33.330	33.678	35.403	29.330	30.330	12.578	10.845	22.944
C	–	–	.197	1.684	.802	1.172	.367	–	–	.298	0.468	.967	.462	.444	.345	.384	.533	1.364	.663	.497	–	–
Or	16.027	14.127	23.710	23.661	26.626	18.912	17.742	18.896	18.459	19.520	23.143	24.854	27.787	22.466	23.618	21.090	29.150	29.248	25.291	14.191	14.359	21.486
Ab	27.216	26.129	27.697	27.952	26.265	33.004	32.180	32.132	33.136	32.187	31.440	29.658	30.477	30.477	28.747	29.787	30.053	27.351	30.108	33.867	32.555	33.331
An	20.863	19.305	13.026	8.903	8.549	10.230	14.842	15.229	14.585	13.055	11.305	8.281	8.542	9.884	9.631	9.818	3.569	7.667	9.097	26.007	21.965	14.848
Ne	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Wo	.775	.905	–	–	–	–	–	.038	.087	–	–	–	–	–	–	–	–	–	–	–	4.102	.304
En	5.409	3.969	2.567	1.296	1.247	1.619	5.733	3.235	3.316	2.742	1.876	1.422	.723	.997	.995	1.618	–	1.308	1.248	4.236	6.808	1.660
Fs	3.780	2.860	1.947	1.737	2.454	2.001	2.470	.899	1.888	2.546	.363	1.345	1.178	.097	–	1.179	.602	.321	.845	2.897	2.688	1.401
Fo	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Fa	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Mt	2.119	1.733	1.262	.537	.348	1.305	2.322	2.898	2.177	1.596	2.038	1.016	1.015	2.031	1.980	1.058	.215	1.757	1.293	2.611	3.670	2.050
Hm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	.034	–	–	–	–	–	–	–
Il	1.369	.624	.760	.570	.418	.817	1.178	1.101	1.141	.913	.687	.475	.475	.608	.645	.57	–	.614	.552	1.425	1.346	.844
Ap	.356	.590	.213	.190	.142	.379	.379	.331	.356	.308	.190	.213	.142	.261	.237	.189	.187	.239	.214	.830	1.175	.502
Other	.147	.045	.148	.182	–	.227	–	.045	.159	–	.046	.205	–	.114	.045	.220	.045	.069	.086	–	.046	.207
Total	99.363	99.525	99.447	99.034	99.293	99.039	99.389	99.389	99.553	99.327	99.583	99.515	99.634	99.406	99.606	99.592	99.757	99.268	99.729	99.138	99.560	99.578
Modes (volume percent)																						
Quartz	23.4	26.5	29.1	30.5	30.6	28.7	23.0	26.3	21.0	26.5	29.6	30.0	31.3	27.5	27.9	30.0	–	32.0	29.7	12.0	13.4	20.6
K-feldspar	11.2	12.4	23.6	25.4	29.5	17.2	16.7	16.2	13.1	19.2	25.1	28.0	28.9	25.2	22.7	21.3	–	29.9	28.1	9.6	6.9	25.6
Plagioclase	48.4	42.6	39.2	38.9	34.8	48.4	48.4	45.1	51.5	43.6	39.3	34.4	35.2	41.8	43.9	42.7	–	33.0	37.5	63.4	53.9	46.2
Mafic mineral	17.0	18.5	8.1	5.2	5.1	5.7	11.9	12.4	14.4	10.7	6.0	7.6	4.6	5.5	5.5	6.0	–	5.1	4.7	15.0	25.8	7.6
Plagioclase composition																						
An range	56–20	50–30	47–18	48–17	47–15	53–10	41–13	–	33–14	33–17	–	30–14	–	–	–	34–10	29–15	–	43–21	60–21	53–28	39–21
An average	45	40	30	30	30	30	25	–	25	25	–	25	–	–	–	25	25	–	30	50	35	25
Biotite/biotite + hornblende	.6	.6	.8	1.0	1.0	1.0	.6	–	.8	.7	–	.9	1.0	1.0	–	1.0	1.0	1.0	1.0	.9	.5	.5
Bulk specific gravity	2.735	2.74	2.67	2.653	2.65	2.675	2.69	2.68	2.69	2.68	2.66	2.65	2.644	2.645	2.644	2.66	2.606	2.65	2.65	2.77	2.80	2.69
Location																						
Latitude	37°38′	37°33′	37°37′	37°36′	37°31′	37°34′	37°43′	37°44′	37°40′	37°42′	37°43′	37°43′	37°42′	37°42′	37°43′	37°38′	37°39′	37°44′	37°45′	37°45′	37°40′	37°45′
Longitude	119°25′	119°29′	119°27′	119°29′	119°27′	119°24′	119°17′	119°16′	119°23′	119°18′	119°18′	119°19′	119°20′	119°20′	119°19′	119°21′	119°21′	119°21′	119°22′	119°17′	119°26′	119°28′

TABLE 4.—*Chemical and spectrographic analyses, norms, and modes of representative igneous rock*—Continued

	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
	Metavolcanic rocks														
	Andesite		Dacite			Rhyodacite					Rhyolite				
	MP-488B	MP-343	MP-314	MP-11A	MP-312	MP-116	MP-780	MP-378	MP-393	MP-847	MP-117	MP-320	MP-156A	MP-273A	MP-488A
	Chemical analyses (weight percent)														
SiO_2	54.0	55.6	61.4	62.5	64.9	64.9	67.4	70.5	70.51	71.6	73.7	75.5	76.0	76.2	78.9
Al_2O_3	22.1	16.2	15.8	16.9	16.8	16.8	15.9	15.0	14.69	14.5	13.5	13.1	12.5	13.2	11.0
Fe_2O_3	3.0	1.9	.80	1.2	2.0	2.2	1.2	.38	1.12	.73	1.2	.72	.77	.05	.94
FeO	3.8	6.1	5.8	4.2	1.6	2.2	2.3	2.2	1.49	1.3	.52	.53	.32	.19	.51
MgO	1.9	5.8	3.0	1.6	.75	1.2	.85	.66	.67	.52	.17	.34	.06	.09	.17
CaO	5.2	7.8	8.1	4.6	2.8	3.9	3.1	1.7	2.10	2.0	.53	.40	.45	.28	.97
Na_2O	5.4	2.5	2.2	4.0	5.2	4.1	4.3	4.5	4.34	3.8	4.3	4.6	4.5	3.4	3.1
K_2O	2.2	1.6	.44	2.4	2.9	2.8	3.2	3.9	3.93	4.0	4.4	3.9	3.8	5.8	3.7
H_2O+	.90	1.0	.74	1.0	.44	.70	.80	.42	.31	.48	.29	.44	.18	.35	.28
H_2O-	.08	.01	.07	.13	.12	.09	.11	.06	.04	.14	.13	.04	.06	.05	.05
TiO_2	.90	.99	.97	.97	.74	.64	.54	.41	.40	.33	.21	.02	.13	.20	.18
P_2O_5	.24	.40	.32	.28	.20	.21	.15	.10	.10	.14	.02	.03	.01	.02	.03
MnO	.18	.09	.34	.14	.11	.14	.12	.16	.08	.06	.06	.07	.02	.08	.07
CO_2	<.05	.02	<.05	<.05	.07	<.05	<.05	<.05	.08	.21	.02	<.05	.02	<.05	<.05
Cl	–	–	–	–	–	–	–	–	.01	–	–	–	–	–	–
F	–	–	–	–	–	–	–	–	.06	–	–	–	–	–	–
Less O	–	–	–	–	–	–	–	–	.03	–	–	–	–	–	–
Sum	100	100	100	100	99	100	100	100	99.90	100	99	100	99	100	100
Powder density	2.90	–	2.85	2.79	2.72	2.70	2.68	2.62	2.68	2.64	2.62	2.65	2.64	2.58	2.73
	Semiquantitative spectrographic analyses (parts per million)														
Ag	N	–	N	N	N	N	N	N	N	N	N	N	N	N	N
B	N	–	3	N	N	10	N	5	N	5.6	N	5	N	N	15
Ba	1,000	–	1,000	2,000	1,600	2,000	2,000	1,500	1,000	1,600	850	700	590	2,000	1,500
Be	3	–	10	N	1.6	N	2	2	2	2.1	1.9	3	1.9	1	2
Ce	N	–	N	N	78	N	N	N	N	67	63	N	N	N	N
Co	20	–	50	15	4.4	10	5	5	N	4.5	1.7	N	1.7	N	N
Cr	7	–	100	5	3.3	10	3	5	1.5	3.5	2.6	5	2.8	50	3
Cu	50	–	15	15	4.0	7	10	7	3	5.8	2.6	5	2.4	3	7
Ga	30	–	30	20	22	20	20	20	20	20	17	20	15	20	15
La	30	–	N	N	32	30	30	50	50	41	35	50	21	50	30
Mo	N	–	N	N	N	N	N	N	N	N	N	N	N	N	N
Ni	2	–	50	2	5.0	1	N	N	N	6.6	N	N	N	N	N
Pb	50	–	20	0	28	15	30	30	15	48	24	30	13	20	20
Sc	30	–	50	20	14	20	10	15	10	7.2	7.2	5	4.7	N	N
Sn	10	–	N	N	7.9	N	N	N	N	N	N	N	N	N	N
Sr	1,500	–	1,500	2,000	390	1,500	1,000	500	500	210	34	70	31	150	200
V	300	–	500	300	300	100	100	50	30	26	3.5	10	N	N	10
Y	50	–	30	50	22	50	30	50	20	20	28	30	18	30	20
Yb	5	–	3	5	3.0	5	3	3	3	3.9	3.0	3	3.0	3	2
Zn	N	–	N	N	6.2	N	N	N	N	40	N	N	N	N	N
	X-ray fluorescence analyses (parts per million)														
Ba	–	–	–	900	1,669	1,258	1,194	1,110	983	–	1,109	–	633	897	–
Sr	–	–	–	537	493	464	406	243	227	–	59	–	44	70	–

Instrumental neutron activation analyses (parts per million)															
Ba	–	–	–	971	1,784	1,419	1,407	1,165	1,084	–	1,222	–	736	1,013	–
Co	–	–	–	8.9	3.0	6.8	4.6	3.2	3.1	–	.6	–	.5	.2	–
Cr	–	–	–	3.3	3.2	5.8	2.2	2.1	2.2	–	2.4	–	1.2	1.3	–
Cs	–	–	–	7.6	9.0	3.9	7.8	4.7	4.0	–	4.0	–	4.5	2.2	–
Hf	–	–	–	5.2	5.7	5.9	6.2	6.2	6.7	–	6.8	–	5.9	6.8	–
Rb	–	–	–	88	94	97	118	137	130	–	148	–	140	143	–
Sb	–	–	–	1.1	56	1.6	1.4	1.5	.8	–	2.8	–	1.4	1.4	–
Ta	–	–	–	.73	.87	.82	.93	1.04	1.15	–	1.25	–	1.24	1.31	–
Th	–	–	–	8.4	10.0	12.0	13.2	16.9	18.6	–	19.0	–	20.9	18.7	–
U	–	–	–	2.9	3.2	3.9	5.2	4.6	5.0	–	5.2	–	5.4	3.5	–
Zn	–	–	–	105	94	95	90	85	81	–	68	–	38	51	–
Zr	–	–	–	354	332	264	313	303	338	–	292	–	218	304	–
Sc	–	–	–	13.42	10.86	10.79	7.04	7.95	7.67	–	7.08	–	5.02	3.56	–
La	–	–	–	28	31	33	33	43	40	–	39	–	23	40	–
Ce	–	–	–	56	58	60	59	71	73	–	81	–	50	73	–
Nd	–	–	–	29	26	31	25	39	35	–	34	–	23	33	–
Sm	–	–	–	5.3	58	5.7	5.3	6.8	6.8	–	7.1	–	5.0	6.7	–
Eu	–	–	–	1.57	2.62	1.73	1.31	1.14	1.08	–	.97	–	.55	.77	–
Gd	–	–	–	4.9	4.5	4.2	3.5	5.6	58	–	5.7	–	4.2	5.0	–
Tb	–	–	–	.81	.81	.95	.68	1.05	.91	–	1.02	–	.81	.92	–
Tm	–	–	–	.39	.38	.38	.38	.46	.50	–	.48	–	.48	.46	–
Yb	–	–	–	2.3	2.2	2.4	2.4	2.9	3.1	–	3.4	–	3.0	3.1	–
Lu	–	–	–	.36	.34	.40	.35	.46	.46	–	.50	–	.43	.45	–
CIPW norms (weight percent)															
Q	–	8.703	23.220	16.160	17.308	20.158	21.495	23.534	24.866	29.538	30.865	32.423	34.722	33.522	44.506
C	1.958	–	–	.029	.666	.437	.085	.525	.055	1.107	.802	.658	.239	.869	.204
Or	13.013	9.454	2.601	14.194	17.375	16.566	18.915	23.048	23.240	23.682	26.250	23.118	22.723	34.305	21.886
Ab	45.739	21.152	18.619	33.874	44.612	34.735	36.396	38.082	36.676	32.216	36.734	39.045	38.532	28.796	26.258
An	24.253	28.253	31.943	21.008	12.310	17.997	14.403	7.781	8.891	7.694	2.395	1.794	2.065	1.260	4.621
Ne	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Wo	–	3.215	2.571	–	–	–	–	–	–	–	–	–	–	–	–
En	3.320	14.444	7.473	3.988	1.894	2.992	2.118	1.644	1.670	1.298	.427	.849	.151	.224	–
Fs	2.349	8.164	9.022	5.384	.272	1.428	2.564	3.347	1.300	1.353	–	.477	–	.126	.424
Fo	.992	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Fa	.774	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Mt	4.354	2.755	1.160	1.741	2.940	3.194	1.740	.551	1.625	1.060	1.275	1.047	.728	.073	1.352
Hm	–	–	–	–	–	–	–	–	–	–	.332	–	.277	–	.009
Il	1.711	1.880	1.843	1.844	1.425	1.217	1.026	.779	.760	.628	.403	.038	.250	.380	.342
Ap	.569	.947	.758	.664	.480	.498	.355	.237	.237	.332	.048	.071	.024	.047	.071
Other	–	.045	–	–	.161	–	–	–	.303	.479	.046	–	.046	–	–
Total	99.034	99.012	99.211	98.885	99.444	99.222	99.099	99.527	99.623	99.387	99.578	99.521	99.758	99.602	99.672
Modes (volume percent)															
Quartz	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
K-feldspar	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Plagioclase	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Mafic minerals	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Plagioclase composition	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
An range	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
An average	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Biotite/biotite + hornblende	–	–	–	–	–	–	–	–	–	–					
Bulk specific gravity	2.76	2.855	2.84	2.735	2.69	2.62	2.69	2.66	2.66	2.655	2.62	2.62	2.62	2.555	2.64
Location															
Latitude	37°33′	37°30′	37°39′	37°32′	37°38′	37°34′	37°39′	37°38′	37°37′	37°39′	37°34′	37°38′	37°33′	37°35′	37°33′
Longitude	119°23′	119°29′	119°22′	119°18′	119°23′	119°22′	119°23′	119°24′	119°23′	119°23′	119°23′	119°20′	119°22′	119°18′	119°23′

TABLE 4.—*Chemical and spectrographic analyses, norms, and modes of representative igneous rock*—Continued

	57	58	59	60	61	62	63	64	65	66	67
	Tertiary volcanic rocks										
	Trachybasalt				Trachyandesite	Mafic phonolite					
	MP-164B	MP-37B	MP-275	MP-277	MP-265C	MP-164A	MP-71	MP-410	MP-840A	MP-507A	MP-842A
	Chemical analyses (weight percent)										
SiO_2	50.8	50.6	51.6	51.2	61.0	43.7	47.3	51.7	53.1	51.0	49.6
Al_2O_3	14.2	15.6	14.4	14.9	16.5	10.8	12.2	12.7	13.0	11.6	12.4
Fe_2O_3	2.4	4.2	3.7	2.8	3.4	4.3	3.6	3.7	3.7	4.6	3.6
FeO	4.9	3.4	4.0	5.0	.98	5.3	5.7	2.8	2.8	2.8	4.0
MgO	11.4	8.9	10.1	10.1	4.0	15.0	12.0	5.7	5.6	9.2	12.4
CaO	8.0	7.2	6.8	7.5	3.5	10.2	9.3	6.4	5.8	7.4	7.2
Na_2O	2.9	3.5	3.3	3.0	4.2	2.8	2.8	2.0	1.7	2.0	2.2
K_2O	2.5	2.6	3.0	2.8	3.0	3.0	1.9	8.4	7.7	7.0	4.0
H_2O+	.72	.90	.60	.43	1.4	.82	2.5	1.8	1.4	.67	.50
H_2O-	.38	.26	.11	.17	.44	.45	.80	.89	.82	.24	.21
TiO_2	.89	1.7	1.2	1.3	.57	1.4	1.9	1.8	1.9	1.5	1.4
P_2O_5	.66	.09	.69	.60	.30	1.6	.67	1.5	1.5	1.6	.83
MnO	.10	.15	.16	.10	.12	.21	.12	.13	.08	.16	.10
CO_2	.01	<.05	<.05	.00	<.05	<.05	.08	<.05	.02	<.05	.00
Cl	–	–	–	–	–	–	–	–	–	–	–
F	–	–	–	–	–	–	–	–	–	–	–
Less O	–	–	–	–	–	–	–	–	–	–	–
Sum	100	99	100	100	99	100	101	100	99	100	99
Powder density	2.90	2.92	2.86	3.06	2.66	3.06	2.74	2.88	2.79	2.74	nd
	Semiquantitative spectrographic analyses (parts per million)										
Ag	N	N	N	N	N	N	N	N	N	N	–
B	N	N	N	7.3	N	N	6.0	N	N	N	–
Ba	1,700	1,000	1,000	1,800	1,000	2,000	960	3,000	3,200	3,000	–
Be	2.3	1	1	2.0	1	1	1.6	5	8.2	3	–
Ce	N	N	N	69	N	N	140	N	74	N	–
Co	39	30	30	40	15	30	47	20	22	30	–
Cr	800	150	200	510	100	500	700	100	190	200	–
Cu	77	30	30	27	20	50	75	50	77	50	–
Ga	25	10	10	29	10	10	27	15	30	10	–
La	38	30	N	N	20	50	52	20	55	20	–
Mo	N	N	N	N	N	N	3.4	N	N	N	–
Ni	310	150	200	300	100	150	320	70	120	150	–
Pb	110	N	10	40	15	15	110	15	42	20	–
Sc	20	15	15	18	7	20	20	10	17	15	–
Sn	7.4	N	N	N	N	N	7.4	N	N	N	–
Sr	700	1,500	1,000	760	1,000	1,500	700	2,000	1,900	2,000	–
V	180	150	150	130	50	200	180	150	160	150	–
Y	11	15	15	13	7	20	11	10	15	15	–
Yb	1.4	1.5	1.5	1.8	.7	2	1.4	1	1.6	1.5	–
Zn	84	N	N	70	N	N	84	N	110	N	–

CIPW norms (weight percent)											
Q	–	–	–	–	12.548	–	–	–	.228	–	–
C	–	–	–	–	.702	–	–	–	–	–	–
Or	14.794	15.504	17.788	16.563	17.833	17.803	11.131	49.877	45.915	41.460	23.995
Ab	24.573	29.885	28.019	25.411	35.750	1.681	20.807	9.261	14.516	10.400	18.897
An	18.371	19.351	15.672	18.939	15.495	8.074	14.979	.872	5.147	2.006	12.330
Ne	–	–	–	–	–	11.979	1.453	4.195	–	3.555	–
Wo	7.095	6.722	5.701	6.005	–	13.463	10.823	8.845	5.792	10.152	7.693
En	8.630	6.268	9.695	9.072	10.021	10.707	8.377	7.645	14.074	8.774	8.284
Fs	1.742	.069	1.004	1.770	–	1.221	1.783	–	–	–	0.602
Fo	13.876	11.282	10.894	11.287	–	18.786	14.892	4.639	–	9.945	16.164
Fa	3.087	.138	1.243	2.427	–	2.360	2.514	–	–	–	1.295
Mt	3.485	6.145	5.383	4.064	1.909	6.261	5.175	4.252	3.813	5.211	5.299
Hm	–	–	–	–	2.103	–	–	.785	1.104	1.017	–
Il	1.693	3.258	2.287	2.471	1.089	2.670	3.577	3.435	3.641	2.855	2.699
Ap	1.565	.215	1.640	1.423	.715	3.806	1.573	3.570	3.585	3.798	1.996
Other	.023	–	–	–	–	–	.180	–	.046	–	–
Total	98.934	98.836	99.325	99.432	98.166	98.810	96.764	97.376	97.859	99.173	99.253
Modes (volume percent)											
Plenocrysts											
Olivine	–	12.0	11.3	12.0	–	15.8	0.7	–	nd	5.1	13.6
Orthopyroxene	–	–	–	–	6.2	–	–	–	–	–	1.4
Clinopyroxene	–	–	–	–	.9	.4	1.4	–	–	1.7	–
Biotite	–	–	–	–	.2	–	.6	9.4	–	6.3	1.4
Apatite	–	–	–	–	–	–	–	.5	–	–	–
Ilmenite	–	–	–	–	.2	–	–	–	–	–	–
Xenocrysts	–	–	–	–	–	–	3.4	–	–	–	.6
Groundmass	–	88.0	88.7	88.0	92.5	83.8	93.9	90.1	nd	86.9	83.0
Location											
Latitude	37°35′	37°32′	37°36′	37°35′	37°36′	37°35′	37°34′	37°32′	37°31′	37°31′	37°37′
Longitude	119°20′	119°16′	119°16′	119°15′	119°15′	119°20′	119°19′	119°28′	119°28′	119°27′	119°27′

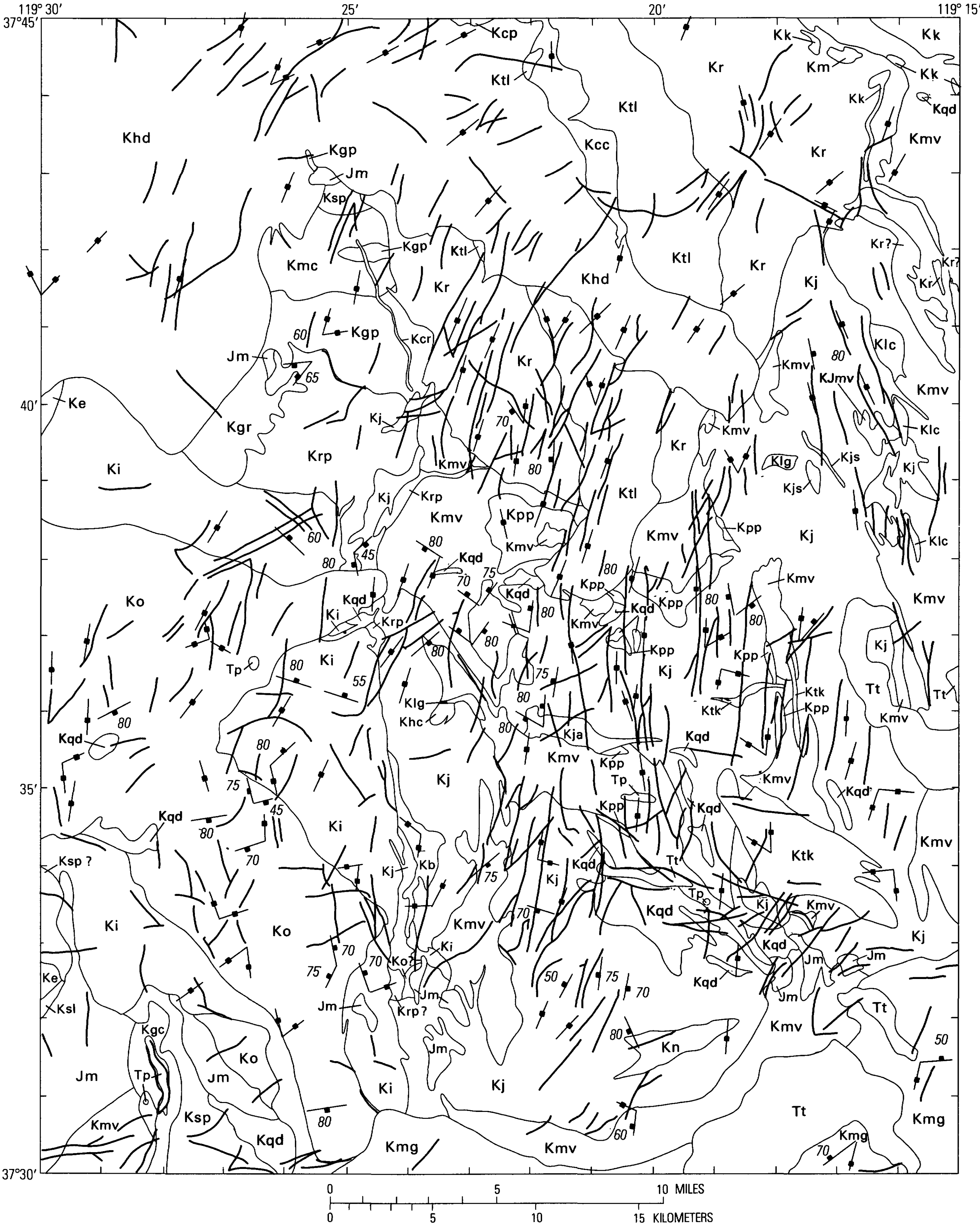


FIGURE 2.–Simplified bedrock geologic map of the Merced Peak quadrangle, showing steeply inclined regional joints (heavy lines) observed on aerial photographs and the attitude of joints as observed on the ground. See figure 1 for explanation. Figure prepared by J. W. Hedenquist.

TABLE 5.–*Modes, specific gravity, and location of plutonic rocks*

Sample no.	Map symbol for rock unit	Latitude 37°30′–45′	Longitude 119°15′–30′	Plagioclase (volume percent)	Alkali feldspar (volume percent)	Quartz (volume percent)	Mafic minerals (volume percent)	Specific gravity (g/cm³)
MP-1	Kmg	37°32′	119°16′	48.8	9.9	13.0	23.3	2.751
MP-4A	Kmg	37°32′	119°16′	51.5	16.4	20.4	11.7	2.688
MP-19	Kj	37°31′	119°19′	43.2	18.6	29.6	8.7	2.675
MP-39B	Kj	37°33′	119°17′	55.9	3.9	29.4	10.8	2.71
MP-56	Kj	37°34′	119°16′	61.8	4.6	18.6	14.9	2.715
MP-61	Kj	37°33′	119°19′	49.4	16.2	25.7	8.7	2.675
MP-65	Kj	37°32′	119°21′	50.1	20.4	21.9	7.6	2.64
MP-68E	Kmg	37°30′	119°21′	52.4	15.1	23.3	9.2	2.702
MP-77	Kj	37°40′	119°16′	44.9	20.7	24.3	10.1	2.68
MP-82	Kj	37°40′	119°17′	58.1	11.2	19.4	11.3	2.69
MP-89B	Kj	37°39′	119°16′	43.1	23.9	24.0	9.0	2.64
MP-93	Kj	37°38′	119°16′	51.7	19.4	19.5	9.4	2.68
MP-97	Ktk	37°34′	119°18′	40.5	23.0	31.3	5.2	2.63
MP-99B	Kj	37°35′	119°18′	43.2	24.8	22.5	9.5	2.67
MP-124B	Kqd	37°33′	119°21′	54.0	2.3	18.8	24.8	2.785
MP-133	Kpp	37°38′	119°20′	21.7	44.1	28.7	5.5	2.623
MP-134B	Ktl	37°38′	119°21′	40.3	22.5	29.6	7.6	2.66
MP-135B	Ktl	37°38′	119°22′	38.7	21.7	31.2	8.4	2.65
MP-138B	Kpp?	37°37′	119°23′	36.1	31.5	26.8	5.6	2.625
MP-143	Kj	37°38	119°20′					
MP-154A	Kj	37°34′	119°22′	50.6	14.8	21.4	13.1	2.71
MP-155	Kj	37°33′	119°22′	31.7	33.6	31.5	3.2	2.635
MP-158	Kj	37°34′	119°22′	46.8	17.4	25.5	10.2	2.682
MP-169C	Kj	37°36′	119°18′	52.0	17.9	22.6	7.5	2.662
MP-175	Kj	37°37′	119°21′	48.8	19.8	23.0	8.4	2.663
MP-180	Kja	37°36′	119°21′	51.7	14.6	22.2	11.5	2.70
MP-182	Kja	37°36′	119°22′	48.0	17.9	23.9	10.2	2.687
MP-183	Kja	37°36′	119°22′	47.1	13.8	31.9	7.2	2.67
MP-185A	Kja	37°36′	119°20′	54.9	13.9	19.3	11.9	2.712
MP-187	Kmg	37°30′	119°25′	44.3	23.5	20.6	11.6	2.677
MP-188	Kj	37°39′	119°18′	61.6	7.2	16.0	15.2	2.73
MP-192	Kpp	37°38′	119°19′	25.5	37.1	34.1	3.3	2.64
MP-195	Kj	37°37′	119°19′	45.4	22.0	23.8	8.8	2.665
MP-197	Kj	37°39′	119°18′	43.1	25.2	26.2	5.5	2.65
MP-198	Klg	37°39′	119°18′	31.0	30.3	34.6	4.1	2.626
MP-217	Kpp	37°38′	119°22′	36.4	27.9	28.2	7.5	2.655
MP-221	Kr	37°40′	119°22′	45.9	19.9	24.1	10.1	2.68
MP-253	Kjs	37°39′	119°17′	36.5	33.3	26.7	3.5	2.64
MP-254	Kjs	37°39′	119°17′	41.7	24.3	25.7	8.3	2.659
MP-257A	Kj	37°38′	119°17′	47.9	16.4	25.1	10.5	2.66
MP-262	Ktk	37°36′	119°18′	40.0	24.0	31.4	4.6	2.67
MP-263	Ktk	37°37′	119°18′	29.3	32.2	33.9	4.6	2.62
MP-271	Kj	37°35′	119°17′	52.2	15.3	15.8	16.7	2.73
MP-274B	Kpp	37°36′	119°18′	30.4	30.8	35.4	3.4	2.64
MP-284	Klc	37°41′	119°16′	68.0	4.5	11.4	16.1	2.751
MP-285	Kj	37°41′	119°17′	44.6	21.5	26.2	7.7	2.677
MP-289	Kr?	37°42′	119°16′	62.4	7.5	15.8	14.3	2.72
MP-290	Kr?	37°42′	119°15′	48.6	23.7	19.7	7.9	2.665
MP-293B	Kr?	37°41′	119°16′	54.7	15.4	22.4	7.5	2.69
MP-298	Ktl	37°38′	119°21′	34.9	24.5	33.0	7.6	2.65
MP-304	Kr	37°39′	119°22′	49.4	17.1	22.9	10.6	2.68
MP-305	Kr	37°39′	119°21′	45.8	20.0	25.8	8.4	2.665
MP-306	Kr	37°40′	119°21′	41.3	24.3	26.6	7.8	2.66
MP-307A	Ktl	37°41′	119°21′	38.5	24.1	31.7	5.7	2.67
MP-308	Khd	37°41′	119°20′	49.7	20.5	19.8	10.0	2.694
MP-309	Kpp	37°38′	119°22′	37.3	30.3	26.9	5.5	2.651
MP-311	Kpp	37°38′	119°22′	23.1	38.7	33.8	4.4	2.632
MP-322	Kr	37°39′	119°20′	44.4	16.4	29.0	10.2	2.68
MP-328	Ktl	37°38′	119°21′	42.7	21.3	30.0	6.0	2.66
MP-332B	Khd	37°40′	119°19′	47.9	22.2	19.8	10.1	nd.
MP-333	Kj	37°40′	119°18′	39.2	27.2	25.1	8.6	2.67
MP-334	Khd	37°41′	119°19′	35.5	27.1	28.1	9.2	2.662
MP-335	Kr	37°41′	119°18′	49.7	15.9	23.2	11.2	–
MP-337	Kj	37°41′	119°18′	47.0	20.2	22.7	10.1	2.675
MP-338	Kr	37°41′	119°18′	39.2	19.2	28.3	13.3	2.68
MP-340	Ktl	37°39′	119°21′	36.9	28.2	29.4	5.5	2.65
MP-341	Ktl	37°41′	119°21′	37.3	27.1	28.8	6.8	2.66

TABLE 5.—*Modes, specific gravity, and location of plutonic rocks*—Continued

Sample no.	Map symbol for rock unit	Latitude 37°30′-45′	Longitude 119°15′-30′	Plagioclase (volume percent)	Alkali feldspar (volume percent)	Quartz (volume percent)	Mafic minerals (volume percent)	Specific gravity (g/cm³)
MP-342	Khd	37°41′	119°21′	47.8	15.1	26.5	10.6	2.707
MP-348	Kqd	37°30′	119°26′	44.6	14.2	18.0	23.2	2.726
MP-351	Ko?	37°31′	119°27′	34.8	29.5	30.6	5.1	2.651
MP-353A	Ko	37°31′	119°25′	39.2	18.9	33.4	8.5	2.683
MP-354A	Ki	37°32′	119°25′	42.7	11.0	26.7	19.6	2.731
MP-361	Ksp	37°32′	119°28′	28.4	35.0	35.0	1.6	2.615
MP-364	Ki	37°32	119°26′	42.9	10.9	25.1	21.1	2.73
MP-365	Ko	37°32′	119°26′	43.1	18.9	31.0	7.0	2.67
MP-366	Ko	37°32′	119°25′	43.8	17.5	33.4	5.3	2.655
MP-368	Kpp?	37°37′	119°23′	32.8	32.3	30.0	4.9	2.637
MP-371	Kj	37°37′	119°22′	28.8	33.0	36.2	2.0	2.627
MP-381	Kj	37°37′	119°23′	43.4	21.5	25.7	9.4	2.675
MP-385	Klg	37°36′	119°23′	26.5	47.9	23.1	2.5	2.625
MP-386	Kj	37°36′	119°23′	49.4	16.4	24.5	9.7	2.675
MP-387	Khc	37°36′	119°23′	50.5	18.9	20.7	9.9	2.70
MP-388	Kj	37°36′	119°24′	51.4	17.3	22.6	8.7	2.675
MP-389B	Kqd	37°37′	119°25′	59.2	0.1	8.1	32.6	2.835
MP-391	Ko	37°37′	119°26′	39.5	17.4	27.3	15.8	2.717
MP-392	Ko	37°37′	119°26′	40.8	21.0	26.3	11.9	2.68
MP-395	Khc	37°36′	119°23′	54.4	15.3	19.6	10.7	2.71
MP-398	Kj	37°35′	119°23′	45.6	15.9	26.2	12.3	2.675
MP-402	Kgc	37°31′	119°28′	53.6	6.1	25.8	14.5	2.73
MP-420A	Kqd	37°38′	119°22′	58.0	4.3	19.0	18.7	2.76
MP-429	Kj	37°37′	119°24′	49.0	19.1	27.4	4.5	2.69
MP-430A	Ki	37°37′	119°25′	49.1	3.8	19.5	27.6	2.78
MP-434A	Krp	37°37′	119°24′	43.6	23.2	28.9	4.3	2.656
MP-437A	Ko	37°38′	119°25′	52.0	10.4	21.5	16.1	2.723
MP-439A	Kb	37°35′	119°24′	49.6	15.6	28.0	6.8	2.68
MP-440A	Kb	37°35′	119°24′	44.7	21.3	31.2	2.8	2.657
MP-441	Ki	37°35′	119°25′	45.0	14.4	24.8	15.8	2.72
MP-443	Ko	37°35′	119°27′	42.7	19.8	30.3	7.2	2.654
MP-447A	Ko	37°36′	119°29′	40.3	23.1	31.6	5.0	2.645
MP-448	Ko	37°36′	119°30′	40.5	21.9	33.8	3.8	2.659
MP-450	Ko	37°35′	119°29′	41.7	22.4	29.8	6.1	2.662
MP-453	Ko	37°35′	119°26′	42.1	21.9	28.0	8.0	2.636
MP-455	Ki	37°35′	119°26′	41.7	16.7	27.0	14.6	2.707
MP-460A	Kj	37°34′	119°23′	50.5	17.9	21.3	10.3	2.68
MP-465	Kb	37°34′	119°24′	45.7	18.4	31.3	4.6	2.667
MP-470A	Ko	37°34′	119°25′	41.9	23.0	27.7	7.4	2.655
MP-472	Ki	37°33′	119°24′	35.0	27.0	27.2	10.8	2.673
MP-473	Ko	37°33′	119°25′	39.2	23.9	31.6	5.2	2.64
MP-475	Ko	37°33′	119°27′	37.0	27.1	30.3	5.6	2.64
MP-478	Ki	37°33′	119°29′	42.6	12.4	26.5	18.5	2.74
MP-484	Kj	37°33′	119°24′	54.3	13.9	16.4	15.4	2.70
MP-486	Krp	37°32′	119°24′	35.8	27.2	33.2	3.8	2.637
MP-497	Krp	37°40′	119°25′	34.7	31.7	30.2	3.4	2.64
MP-498	Kgr	37°40′	119°26′	50.6	7.9	18.9	22.6	2.77
MP-499A	Kgr	37°40′	119°26′	58.2	4.6	14.8	22.4	2.787
MP-502	Ko	37°35′	119°28′	40.2	20.2	27.5	12.1	2.683
MP-505	Ko	37°36′	119°27′	38.0	23.6	30.0	8.4	2.677
MP-506	Ko	37°37′	119°27′	36.4	25.9	30.5	7.2	2.64
MP-510	Kqd	37°36′	119°29′	50.3	2.4	24.0	23.4	2.172
MP-511B	Ko	37°35′	119°29′	39.3	23.9	31.0	5.8	2.64
MP-512	Ko	37°35′	119°29′	42.9	21.1	30.2	5.8	2.67
MP-514	Kqd	37°34′	119°28′	55.3	0.2	10.8	33.7	2.812
MP-520	Kj	37°35′	119°24′	47.3	19.2	23.5	10.0	2.68
MP-521	Ki	37°34′	119°24′	45.9	12.2	25.6	16.3	2.717
MP-525	Ki	37°34′	119°24′	40.6	8.6	30.8	20.0	2.727
MP-529	Ki	37°34′	119°25′	44.8	10.2	28.2	16.8	2.714
MP-531	Ko	37°34′	119°26′	40.8	21.0	30.6	7.5	2.638
MP-532	Ko	37°34′	119°27′	40.1	23.6	30.0	6.3	2.631
MP-533	Ko	37°33′	119°27′	39.0	24.5	30.4	6.1	2.658
MP-534	Ko	37°34′	119°27′	41.6	25.0	28.3	5.1	2.658
MP-536	Ki	37°34′	119°25′	45.9	9.3	29.3	15.4	2.71
MP-539	Ko	37°34′	119°28′	37.3	24.4	32.0	6.3	2.66
MP-540	Ki	37°33′	119°29′	49.8	8.5	23.1	18.6	2.75
MP-541	Kb	37°34′	119°24′	48.4	17.2	28.7	5.7	2.675

TABLE 5.–*Modes, specific gravity, and location of plutonic rocks*–Continued

Sample no.	Map symbol for rock unit	Latitude 37°30′-45′	Longitude 119°15′-30′	Plagioclase (volume percent)	Alkali feldspar (volume percent)	Quartz (volume percent)	Mafic minerals (volume percent)	Specific gravity (g/cm³)
MP-543	Ki	37°32′	119°25′	39.8	15.9	25.9	18.3	2.715
MP-546	Ki	37°31′	119°24′	36.1	23.5	22.1	18.2	2.715
MP-547	Ko	37°32′	119°26′	39.5	21.7	32.0	6.8	2.64
MP-549	Krp	37°39′	119°25′	34.8	29.1	30.7	5.4	2.651
MP-557A	Krp	37°39′	119°24′	28.7	32.3	36.3	2.7	2.636
MP-559	Kj	37°40′	119°24′	44.6	19.8	25.3	10.3	2.70
MP-560	Ki	37°38′	119°26′	44.4	6.8	25.4	23.4	2.75
MP-562A	Ki	37°39′	119°28′	46.6	4.9	26.5	21.9	2.74
MP-563	Ki	37°38′	119°26′	43.7	9.9	26.6	19.8	2.74
MP-565	Ki	37°38′	119°28′	43.9	12.6	25.8	17.6	2.715
MP-567	Ko	37°38′	119°27′	40.6	22.7	27.2	9.5	2.65
MP-568	Ki	37°38′	119°25′	48.4	11.2	23.4	17.0	2.735
MP-569A	Kmc	37°41′	119°25′	29.0	34.0	35.2	1.8	2.63
MP-572	Ko	37°36′	119°28′	39.6	26.3	24.6	8.5	2.66
MP-573	Ko	37°36′	119°28′	37.0	27.0	28.8	7.2	2.653
MP-574	Ko	37°36′	119°29′	38.9	25.4	30.5	5.2	2.653
MP-575	Ko	37°36′	119°29′	37.5	25.1	31.6	5.8	2.66
MP-576	Ko	37°37′	119°28′	36.0	24.5	30.9	8.6	2.65
MP-577	Krp	37°38′	119°25′	32.9	35.6	28.6	2.9	2.645
MP-578	Kj	37°38′	119°25′	52.9	12.2	19.7	15.2	2.717
MP-585	Ki	37°39′	119°29′	49.9	3.9	27.0	19.2	2.75
MP-586A	Ko	37°38′	119°29′	44.8	11.7	29.7	13.7	2.71
MP-591	Ki	37°34′	119°29′	49.1	8.2	26.3	16.4	2.73
MP-602A	Kgp	37°40′	119°25′	35.4	30.0	29.9	4.7	2.647
MP-603B	Kgp	37°41′	119°26′	45.0	14.6	26.5	13.9	2.70
MP-605A	Kgr	37°40′	119°26′	53.9	6.9	13.4	25.8	2.80
MP-608A	Krp	37°38′	119°25′	34.3	32.7	28.6	4.4	2.65
MP-615A	Krp	37°39′	119°25′	30.9	35.1	29.8	4.2	2.625
MP-617	Ko	37°37′	119°27′	39.2	23.6	29.1	8.1	nd
MP-619	Ko?	37°31′	119°26′	30.0	30.0	34.6	5.4	2.635
MP-622	Ksp	37°33′	119°30′	30.0	30.1	31.4	8.6	2.66
MP-623	Ke	37°33′	119°30′	37.3	24.6	30.3	7.8	2.658
MP-629	Ksp	37°32′	119°28′	30.8	35.5	32.5	1.2	2.616
MP-632	Kj	37°31′	119°23′	42.2	26.6	23.7	7.5	2.67
MP-640	Ktk	37°35′	119°19′	35.0	33.4	29.3	2.3	2.613
MP-643A	Kn	37°31′	119°20′	30.5	36.7	32.5	0.3	2.62
MP-644	Kn	37°32′	119°19′	24.7	43.9	29.1	2.2	2.604
MP-675	Khd	37°41′	119°28′	43.8	14.2	25.4	16.6	2.71
MP-676	Khd	37°42′	119°28′	36.0	26.2	30.9	6.8	2.66
MP-677	Khd	37°42′	119°29′	43.9	25.7	20.8	9.6	2.675
MP-678	Khd	37°44′	119°23′	47.7	20.1	24.7	7.5	2.66
MP-680	Khd	37°43′	119°22′	49.1	19.9	24.7	6.3	2.68
MP-682	Ktl	37°42′	119°20′	35.2	28.9	31.3	4.6	2.64
MP-684	Khd	37°45′	119°23′	46.4	20.4	26.5	6.7	2.67
MP-685	Khd	37°45′	119°22′	45.0	20.3	25.7	9.0	2.67
MP-688	Khd	37°45′	119°23′	47.4	19.6	26.2	6.8	2.675
MP-690	Khd	37°45′	119°29′	44.4	25.8	21.5	8.2	2.67
MP-691	Kcc	37°45′	119°22′	37.5	28.1	29.7	4.7	2.65
MP-692	Kcc	37°45′	119°22′	41.7	26.1	26.4	5.8	2.66+
MP-693	Ktl	37°45′	119°21′	40.0	19.3	35.5	5.2	2.65
MP-694	Kr	37°45′	119°20′	35.8	28.1	29.8	6.3	2.65−
MP-695	Kr	37°45′	119°20′	32.9	26.2	34.7	6.2	2.64
MP-698	Khd	37°43′	119°24′	37.4	27.5	25.1	10.0	2.675
MP-702	Khd	37°44′	119°25′	48.7	20.0	22.1	9.2	2.68
MP-703	Khd	37°44′	119°27′	49.2	13.2	25.3	12.4	2.69
MP-708	Khd	37°42′	119°24′	49.4	19.0	21.9	9.7	2.70+
MP-712	Kmc	37°42′	119°25′	28.7	32.9	36.6	1.8	2.61
MP-713	Kr	37°42′	119°24′	49.1	16.4	23.3	11.2	2.67−
MP-714	Kr	37°40′	119°23′	47.8	11.0	29.0	12.2	2.69+
MP-715	Kr	37°41′	119°22′	40.0	23.6	28.9	7.5	2.66
MP-716	Kr	37°41′	119°23′	39.1	24.5	28.8	7.6	2.65–2.66
MP-717	Kr	37°41′	119°23′	48.8	16.8	24.6	9.8	2.67
MP-718	Kr	37°44′	119°19′	33.4	30.2	31.2	5.2	2.64
MP-723	Kr	37°43′	119°16′	50.6	15.7	21.8	11.9	2.68+
MP-724	Kr	37°43′	119°16′	49.3	14.6	26.2	9.9	2.69−
MP-728	Kr	37°43′	119°17′	48.4	16.7	23.0	11.9	2.69
MP-729	Kr	37°43′	119°17′	51.4	10.9	26.4	11.3	2.69
MP-730	Kr	37°43′	119°18′	39.3	25.1	29.6	6.0	2.66

TABLE 5.—*Modes, specific gravity, and location of plutonic rocks*—Continued

Sample no.	Map symbol for rock unit	Latitude 37°30′-45′	Longitude 119°15′-30′	Plagioclase (volume percent)	Alkali feldspar (volume percent)	Quartz (volume percent)	Mafic minerals (volume percent)	Specific gravity (g/cm³)
MP-732	Kr	37°44′	119°18′	42.5	23.2	27.0	7.3	2.67 –
MP-735	Kr	37°45′	119°18′	41.0	25.3	26.3	7.4	2.66
MP-737	Kr	37°44′	119°19′	35.6	27.5	30.5	6.4	2.65
MP-738	Kr	37°43′	119°19′	36.1	29.1	29.1	5.7	2.65 –
MP-739	Ktl	37°44′	119°20′	38.7	25.7	29.7	5.9	2.634
MP-741	Kk	37°45′	119°15′	51.4	15.7	13.1	19.8	2.73
MP-753	Kmc	37°42′	119°26′	22.9	33.1	40.6	3.4	2.62
MP-755	Kmc	37°42′	119°26′	23.3	35.1	39.1	2.5	2.62
MP-759	Khd	37°43′	119°27′	49.6	17.0	22.6	10.8	2.69
MP-760	Khd	37°43′	119°26′	46.5	16.3	22.0	15.2	2.72
MP-761	Kgp	37°43′	119°25′	37.9	27.4	28.8	5.9	2.64
MP-762	Kr	37°40′	119°23′	45.7	15.8	25.0	13.5	2.67 +
MP-763	Kr	37°40′	119°23′	47.5	17.1	24.8	10.6	2.68–2.67
MP-764	Kr	37°41′	119°23′	43.8	19.2	27.6	9.4	2.66
MP-765	Kr	37°41′	119°24′	47.2	19.5	23.0	10.3	2.69
MP-766	Kmc	37°41′	119°25′	29.8	31.0	37.2	2.0	nd.
MP-770	Kgp	37°42′	119°25′	38.9	23.2	30.2	7.8	2.66
MP-772	Kgp	37°41′	119°24′	28.2	25.8	38.3	7.7	2.65
MP-773	Kgp	37°41′	119°25′	38.4	25.0	27.9	8.7	2.66
MP-775	Kr	37°41′	119°24′	42.8	19.0	28.4	9.8	2.69
MP-776	Kgp	37°40′	119°24′	37.2	22.5	32.0	8.3	2.65
MP-779	Kgp	37°41′	119°25′	33.9	26.2	33.3	6.6	2.66
MP-786	Kcr	37°40′	119°24′	47.0	0	5.3	47.7	–
MP-788	Kr	37°40′	119°23′	49.1	17.3	25.0	8.6	2.67
MP-789	Kr	37°40′	119°23′	51.5	13.1	21.0	14.4	2.69
MP-790A	Ktl	37°42′	119°23′	37.6	21.4	33.0	8.0	2.67
MP-792	Khd	37°45′	119°28′	46.2	25.6	20.6	7.6	2.69
MP-793	Khd	37°44′	119°29′	46.9	19.2	22.8	11.1	2.693
MP-794	Kr	37°43′	119°19′	34.4	28.0	30.0	7.6	2.65
MP-795B	Ktl	37°43′	119°19′	43.9	22.7	27.9	5.5	2.644
MP-796	Ktl	37°42′	119°19′	38.2	22.8	32.1	6.9	2.64
MP-797	Kr	37°42′	119°19′	41.1	22.1	29.8	7.0	2.65 –
MP-798	Kr	37°42′	119°18′	43.6	19.2	26.5	10.7	2.68 –
MP-799	Kr	37°42′	119°18′	47.2	15.4	27.2	10.2	2.67
MP-801	Kj	37°42′	119°17′	66.6	7.4	12.4	13.6	2.70
MP-806	Kr	37°43′	119°16′	52.7	17.4	18.2	11.7	2.68–2.69
MP-808	Kr	37°43′	119°17′	50.2	15.4	22.1	12.3	2.68
MP-811	Kqd	37°44′	119°16′	57.2	0.1	5.4	37.3	2.86
MP-814	Kr	37°44′	119°18′	40.4	20.6	31.1	7.9	2.65 +
MP-815	Kr	37°44′	119°17′	43.0	22.4	25.5	9.1	2.67
MP-816	Kk	37°45′	119°17′	63.4	9.6	12.0	15.0	2.77
MP-817	Kr	37°44′	119°17′	41.2	20.9	26.8	11.1	2.70 –
MP-818	Ktl	37°42′	119°20′	41.8	25.2	27.5	5.5	2.645
MP-819	Khd	37°44′	119°22′	43.7	24.0	25.2	7.1	2.66 +
MP-820	Ktl	37°43′	119°19′	37.2	23.9	33.1	5.8	2.65
MP-821	Kcc	37°44′	119°21′	33.0	29.9	32.0	5.1	2.65 –
MP-822	Ktl	37°44′	119°21′	41.6	18.0	33.5	6.9	2.66
MP-823	Ko	37°36′	119°30′	39.2	24.1	28.9	7.8	2.65
MP-825	Kk	37°45′	119°15′	52.6	10.7	11.3	25.4	2.76
MP-825-2	Ko	37°35′	119°30′	39.5	27.2	25.8	7.5	2.648
MP-831	Kk	37°44′	119°15′	62.8	9.3	11.5	16.4	2.73
MP-833	Kk	37°45′	119°15′	46.6	14.7	13.4	25.3	2.765
MP-835	Kk	37°44′	119°16′	65.0	1.3	5.9	27.8	2.79
MP-836	Kr	37°44′	119°16′	45.1	16.2	26.3	12.4	2.68 +
MP-843	Krp	37°39′	119°25′	30.7	35.6	31.3	2.4	2.625
MP-844	Krp	37°39′	119°25′	29.6	38.3	30.5	1.6	2.63
MP-845	Krp	37°39′	119°25′	37.1	38.6	24.1	0.2	2.565
MP-846	Kpp	37°39′	119°22′	40.1	29.3	26.8	5.2	2.66

ages of the modal constituents are plotted on the simplified geologic maps of figures 4 through 7. Isopleths have been drawn where the data permit, but no attempt was made to contour all the data systematically. Several of the intrusive sequences, notably those of Washburn Lake and Buena Vista Crest and Tuolumne Intrusive Suite, show systematic variations inward from the margin. The observed trends are an inward decrease in plagioclase and mafic minerals and an inward increase in quartz and potassium feldspar. Similar variations were noted during mapping of the granodiorites of Mount Givens and Jackass Lakes,

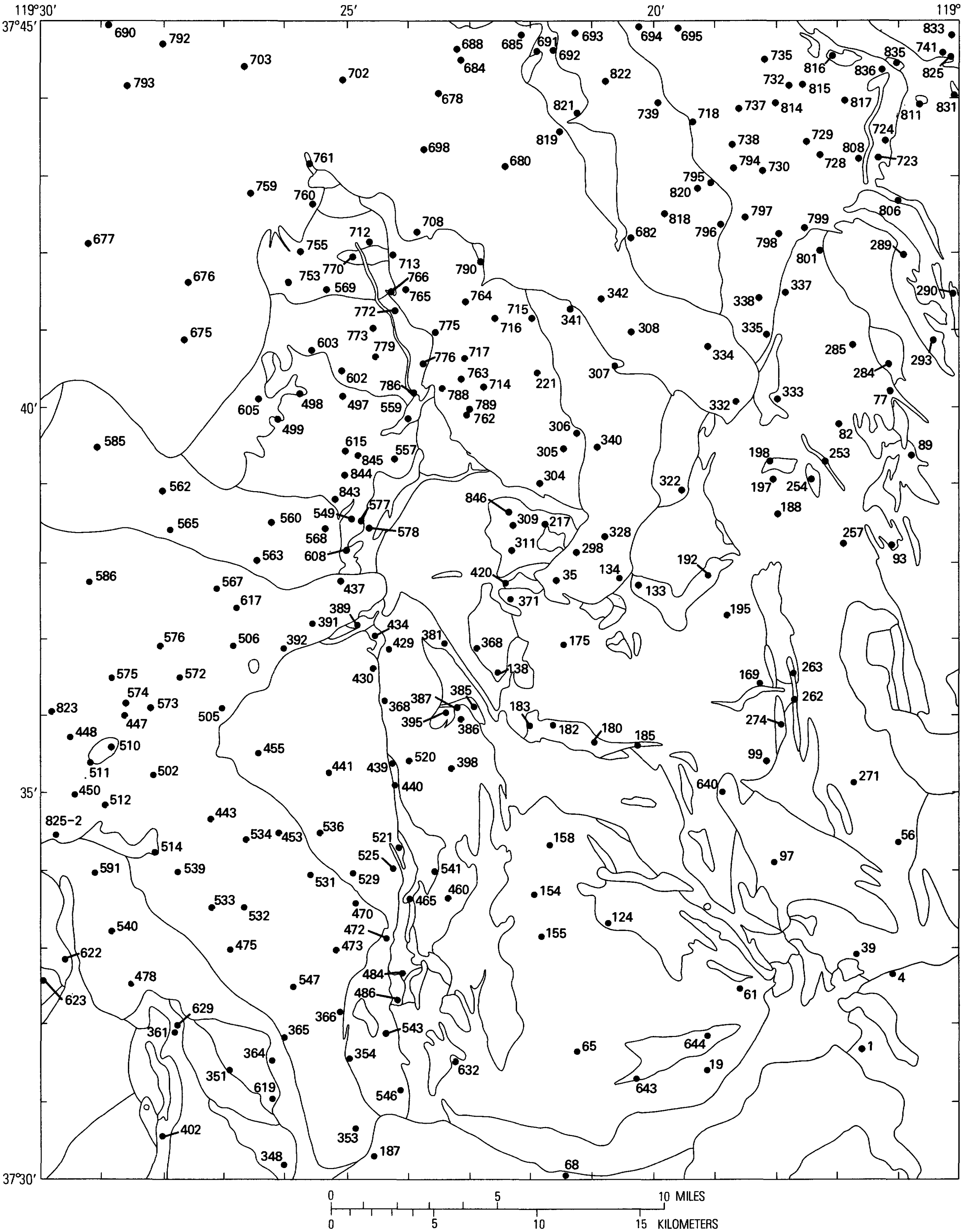


FIGURE 3.–Simplified bedrock geologic map of the Merced Peak quadrangle, showing locations of modally analyzed plutonic rock samples. Explanation in figure 1.

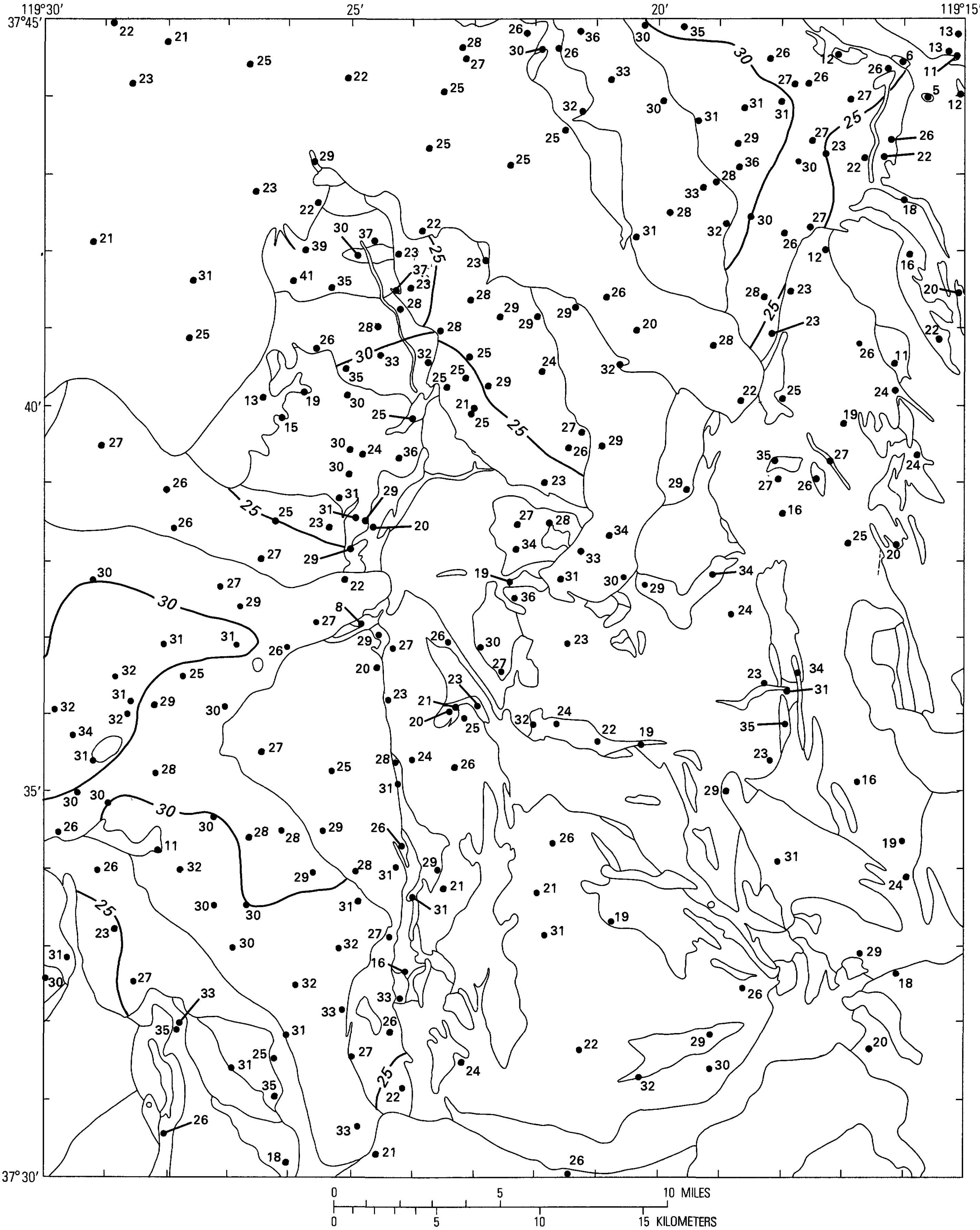


FIGURE 4. – Simplified bedrock geologic map of the Merced Peak quadrangle, showing localities of samples analyzed for quartz in volume percent. Generalized isopleths show equal volume percent. Contour interval 5 percent. Explanation in figure 1.

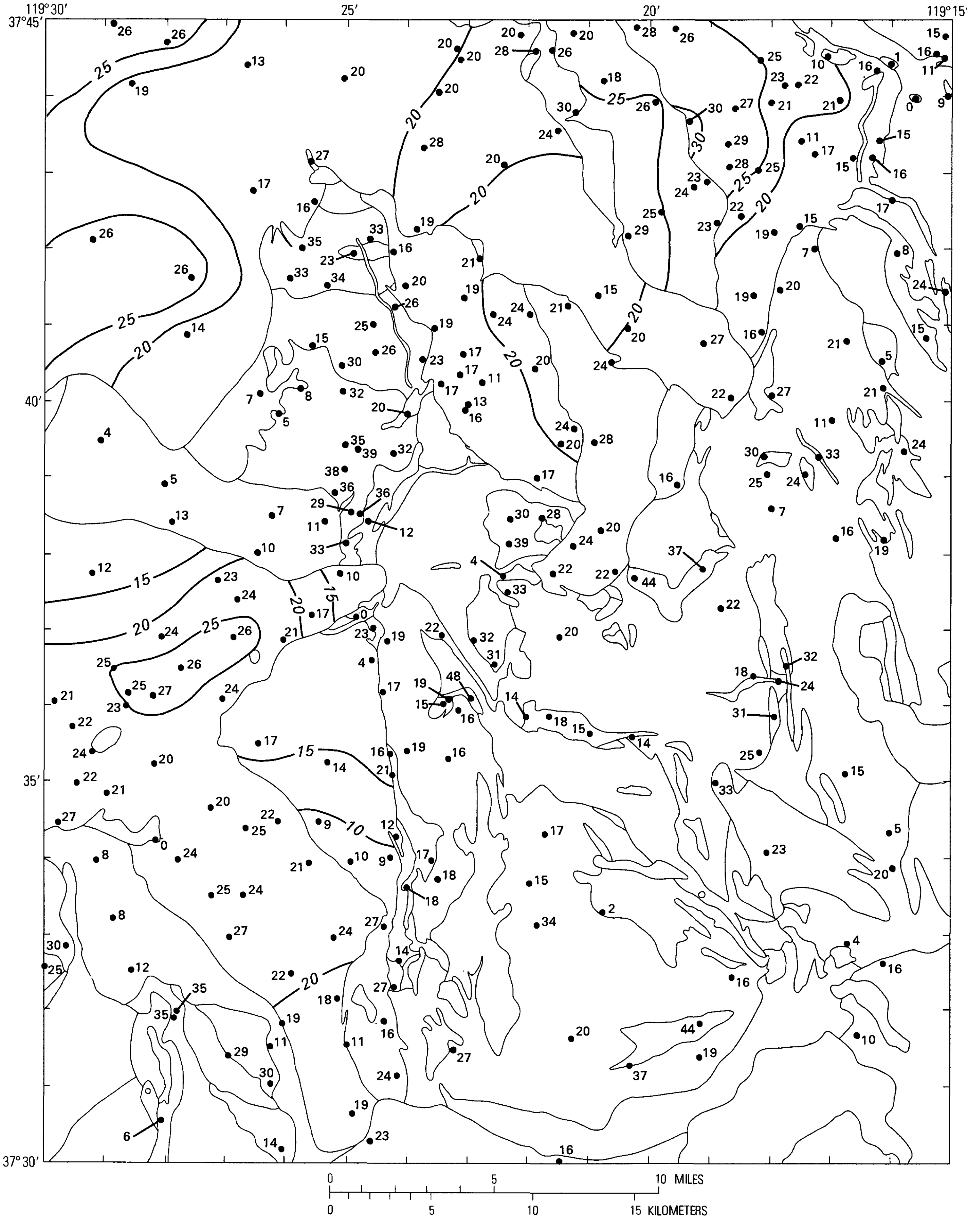


FIGURE 5.–Simplified bedrock geologic map of the Merced Peak quadrangle, showing localities of samples analyzed for potassium feldspar in volume percent. Generalized isopleths show equal volume percent. Contour interval 5 percent. Explanation in figure 1.

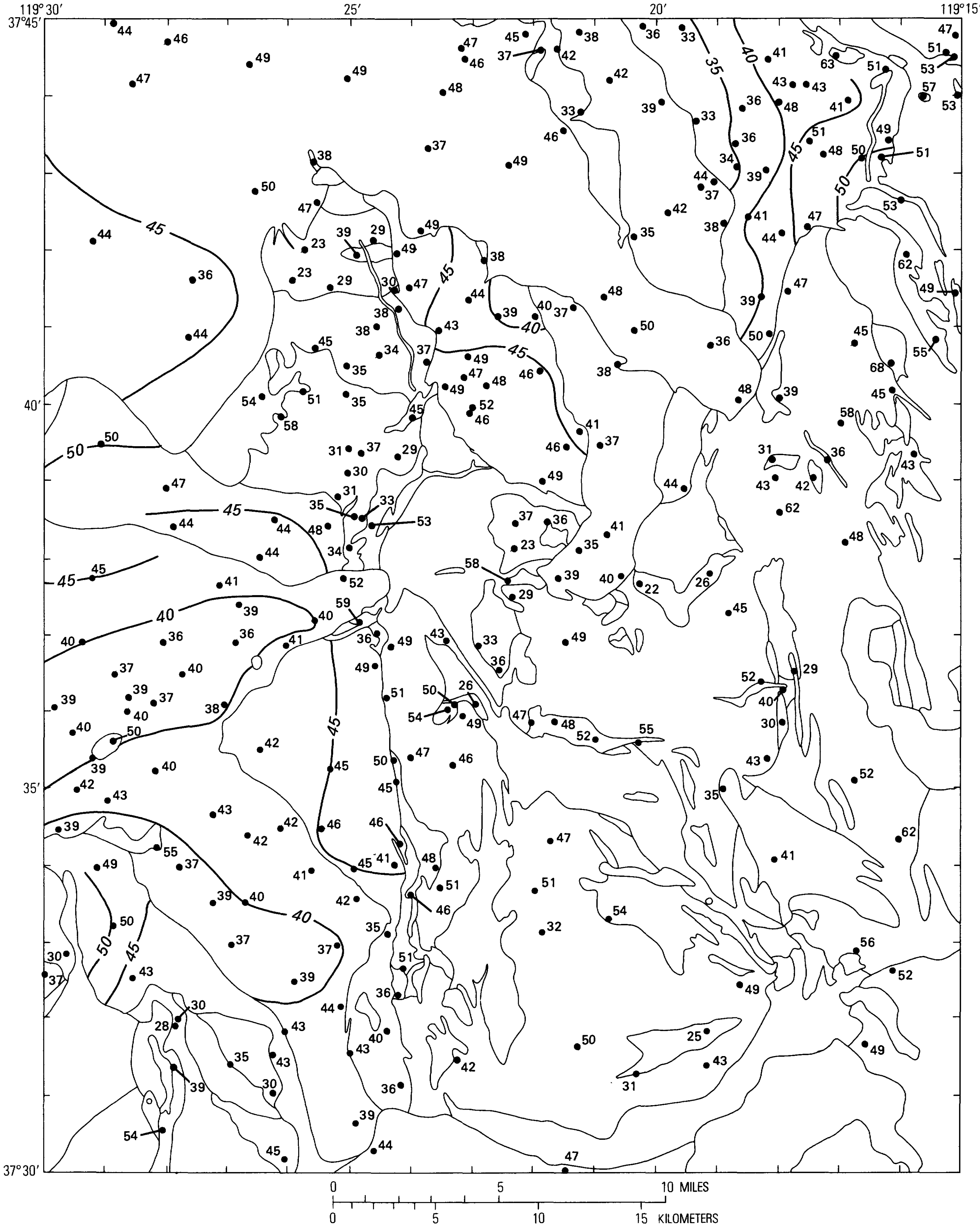


FIGURE 6.–Simplified bedrock geologic map of the Merced Peak quadrangle, showing localities of samples analyzed for plagioclase in volume percent. Generalized isopleths show equal volume percent. Contour interval 5 percent. Explanation in figure 1.

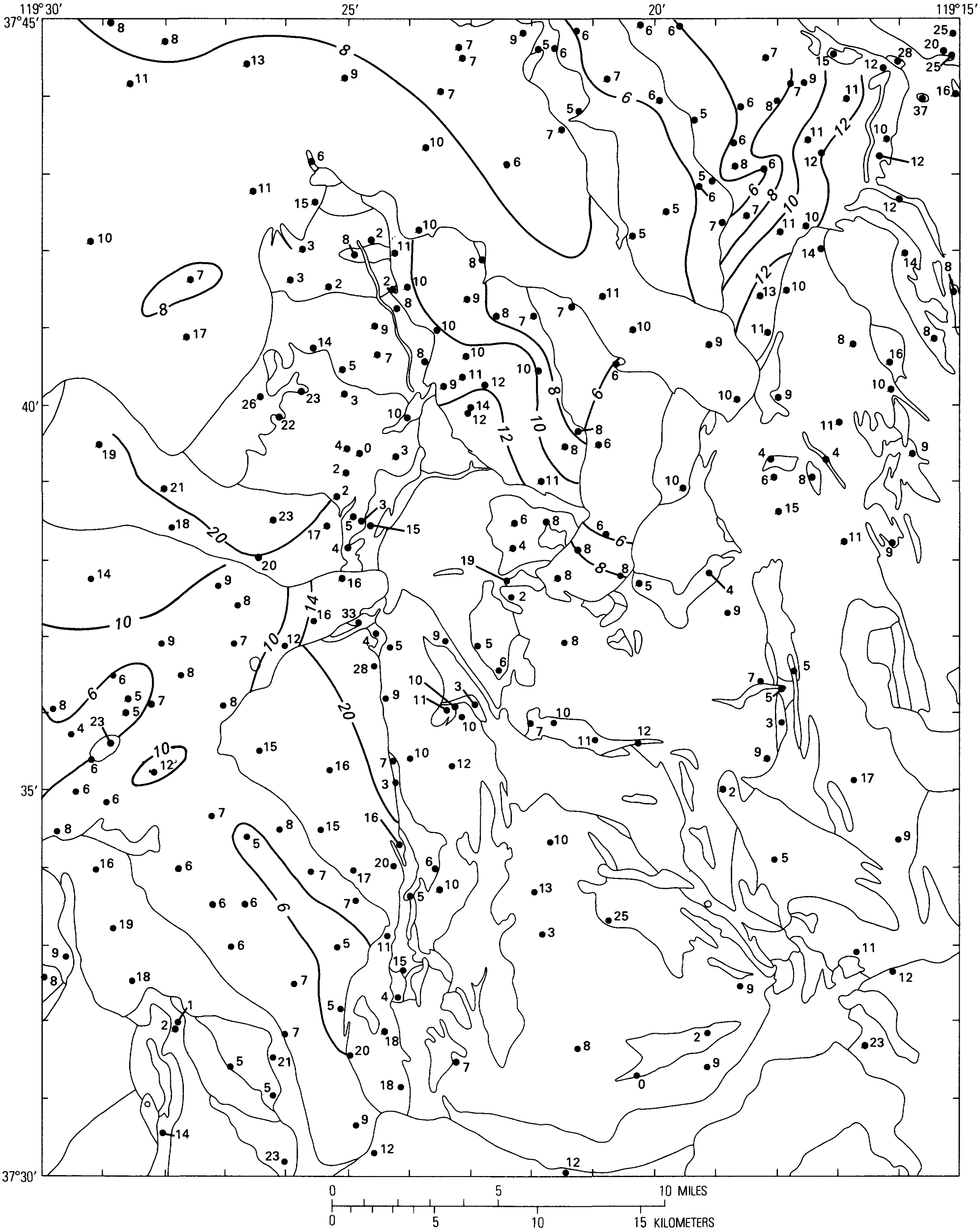


FIGURE 7.–Simplified bedrock geologic map of the Merced Peak quadrangle, showing localities of samples analyzed for mafic minerals in volume percent. Generalized isopleths show equal volume percent. Contour interval 5 percent. Explanation in figure 1.

but too few samples were collected to document the variations. Several of the plutons, however, do not show systematic modal variations with respect to their margins; this applies particularly to the bodies of quartz diorite and tonalite and to those of leucogranite and leucogranite porphyry.

Biotite, hornblende, and accessory minerals cannot be distinguished consistently on stained slabs, so their separate amounts were not determined with the modes. The relative abundance of biotite and hornblende was determined for many of the chemically analyzed samples by counts of 1,000 to 2,000 points in thin sections, and the results are given in table 4. In general, biotite and hornblende are in nearly equal abundance in quartz diorite and tonalite, biotite predominates in granodiorite, and biotite occurs to the near exclusion of hornblende in granite.

The composition of plagioclase in most of the chemically analyzed samples was determined by measuring extinction angles of albite twins on the universal stage. The ranges and average compositions so determined are listed in table 4. In general, the average plagioclase composition of quartz diorite and tonalite ranges from An_{35} to An_{45}, that of granodiorite from An_{25} to An_{35}, and that of granite from An_{20} to An_{30}.

The bulk specific gravities of 412 samples of plutonic and metavolcanic rocks were measured on a direct-reading balance and are plotted in figure 8. Those of modally analyzed plutonic rocks are listed in table 5. Table 4 gives the powder densities of chemically analyzed plutonic and metavolcanic rocks. The intrusive sequences of Washburn Lake and Buena Vista Crest show a systematic decrease in specific gravity inward from the margins, ranging from 2.68 g/cc at the margins to 2.64 g/cc or less in the cores. In general, quartz diorite and tonalite have a specific gravity of 2.83 to 2.73 g/cc, granodiorite ranges from 2.73 to 2.66 g/cc, and granite ranges from 2.66 to 2.63 g/cc. Plotted specific-gravity values of metavolcanic rocks range from 2.56 to 2.95 g/cc. The values for metavolcanic rocks along the eastern border of the quadrangle show the largest variation and a high average value of 2.76 g/cc, reflecting the varied composition of the metavolcanic rocks along the western margin of the Ritter Range pendant and their andesitic average composition. The specific-gravity values of the metavolcanic rocks farther west in the quadrangle (excluding those in the southwest corner) show a more limited range; almost all are between 2.60 and 2.72 and average 2.66, reflecting the rhyodacitic composition of these metatuffs.

The percentage contents of quartz, potassium feldspar, and plagioclase were recalculated to 100 and plotted on ternary diagrams (figs. 9*B* through 9*G*.). Ternary compositions mostly lie within the granodiorite and granite fields (fig. 9*A*) along a band extending from 20 percent quartz, 70 percent plagioclase, and 10 percent orthoclase to 35 percent quartz, 30 percent plagioclase, and 35 percent orthoclase. The intrusive sequence of Buena Vista Crest, however, as well as the granite of Gray Peak, the granodiorite of Grizzly Creek, and El Capitan Granite (as shown by modal analysis of samples from the adjacent Yosemite quadrangle) range along a band of more constant quartz content, from approximately 30 percent quartz, 65 percent plagioclase, and 5 percent orthoclase to 35 percent quartz, 30 percent plagioclase, and 35 percent orthoclase.

The 67 chemical analyses listed in table 4 include 55 prepared by the rapid method of Shapiro and Brannock (1962) and 8 prepared in the U.S. Geological Survey laboratories in Denver using standard methods described by L. C. Peck (1964). The percentage contents of the computer-calculated normative quartz, orthoclase, and plagioclase (ab + an) of the plutonic and metavolcanic rocks are plotted in figure 10. Faint lines on the triangular plot connect the normative composition of some of the analyzed samples to the modal composition of the same samples in terms of quartz, alkali feldspar, and plagioclase. Modal compositions of most quartz diorite, tonalite, and granodiorite lie closer to the quartz-plagioclase side of the diagram than does the normative plot because the K_2O content of modal hornblende and biotite is calculated as orthoclase in the norm. Modal compositions of most granites, in contrast, lie farther from the quartz-plagioclase side because albite in the modal perthitic feldspars is counted with potassium feldspar as the alkali feldspar component. Compositions near the granite-granodiorite boundary differ little between normative and modal plots because of the compensating effect of the two factors.

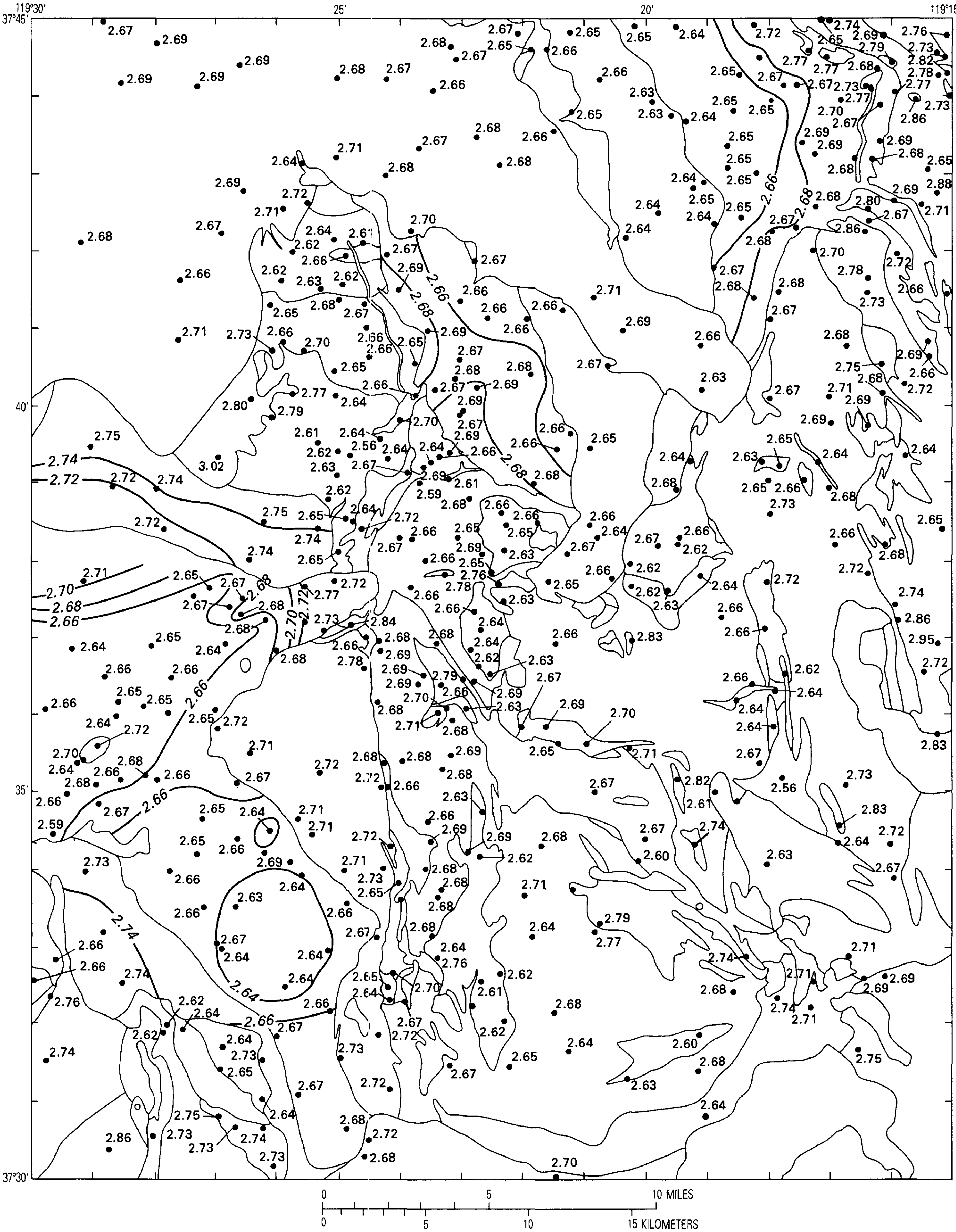
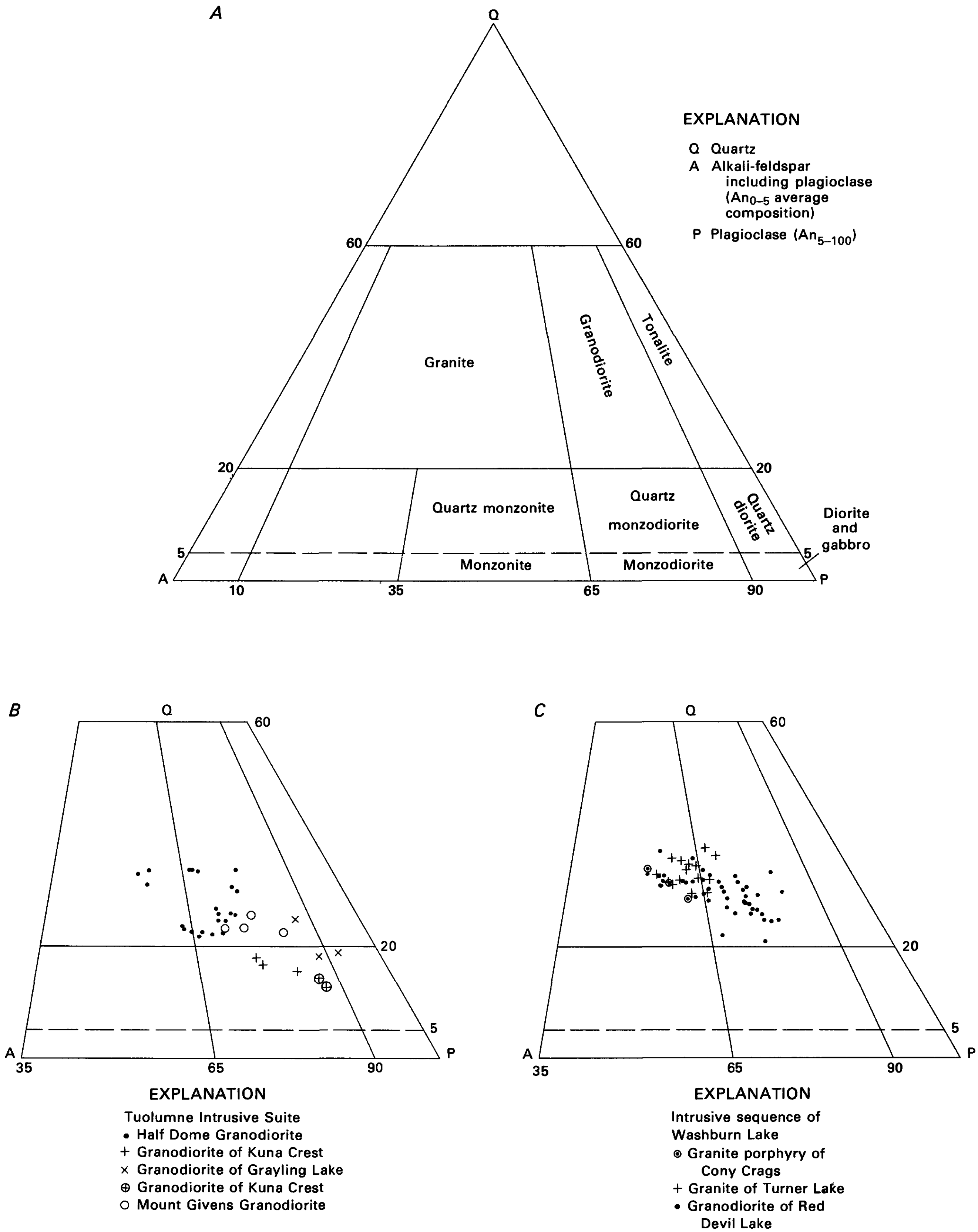


FIGURE 8.–Simplified bedrock geologic map of the Merced Peak quadrangle, showing localities of samples analyzed for specific gravity. Generalized isopleths show equal specific gravity. Contour interval 0.02 percent. Explanation in figure 1.


A
Q
EXPLANATION
Q Quartz
A Alkali-feldspar including plagioclase (An_{0-5} average composition)
P Plagioclase (An_{5-100})
60
60
Granite
Granodiorite
Tonalite
20
20
Quartz monzonite
Quartz monzodiorite
Quartz diorite
Diorite and gabbro
5
5
Monzonite
Monzodiorite
A
P
10
35
65
90
B
Q
60
20
5
A
P
35
65
90
EXPLANATION
Tuolumne Intrusive Suite
• Half Dome Granodiorite
+ Granodiorite of Kuna Crest
× Granodiorite of Grayling Lake
⊕ Granodiorite of Kuna Crest
○ Mount Givens Granodiorite
C
Q
60
20
5
A
P
35
65
90
EXPLANATION
Intrusive sequence of Washburn Lake
⊚ Granite porphyry of Cony Crags
+ Granite of Turner Lake
• Granodiorite of Red Devil Lake

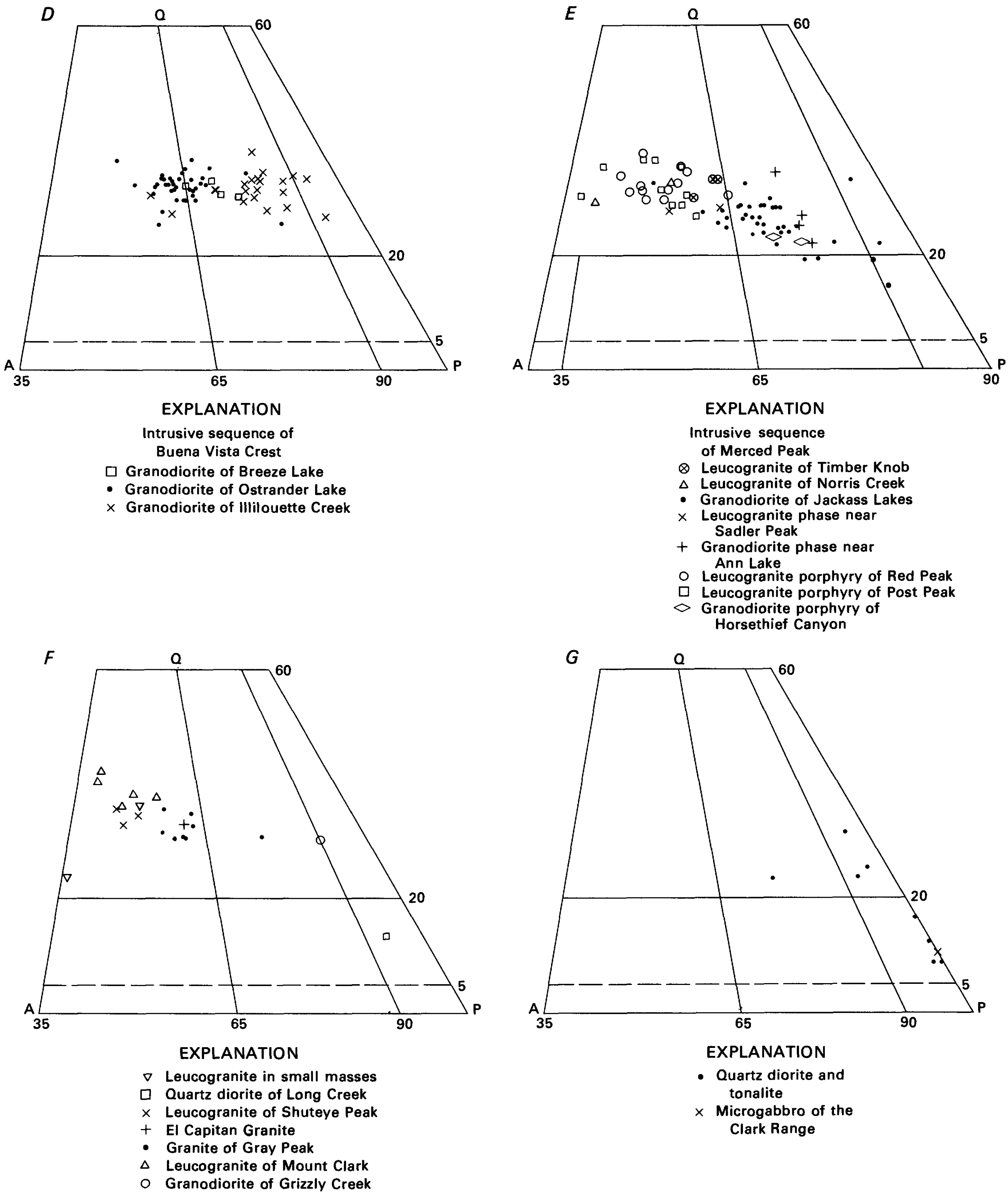


FIGURE 9.–Plots of modes of granitic rocks. Classification plan by Streckeisen and others (1973). *A*, Ternary compositions; *B*, Tuolumne Intrusive Suite; *C*, intrusive sequence of Washburn Lake; *D*, intrusive sequence of Buena Vista Crest; *E*, intrusive sequence of Merced Peak; *F*, other granitic rocks; *G*, quartz diorite, tonalite, and microgabbro.

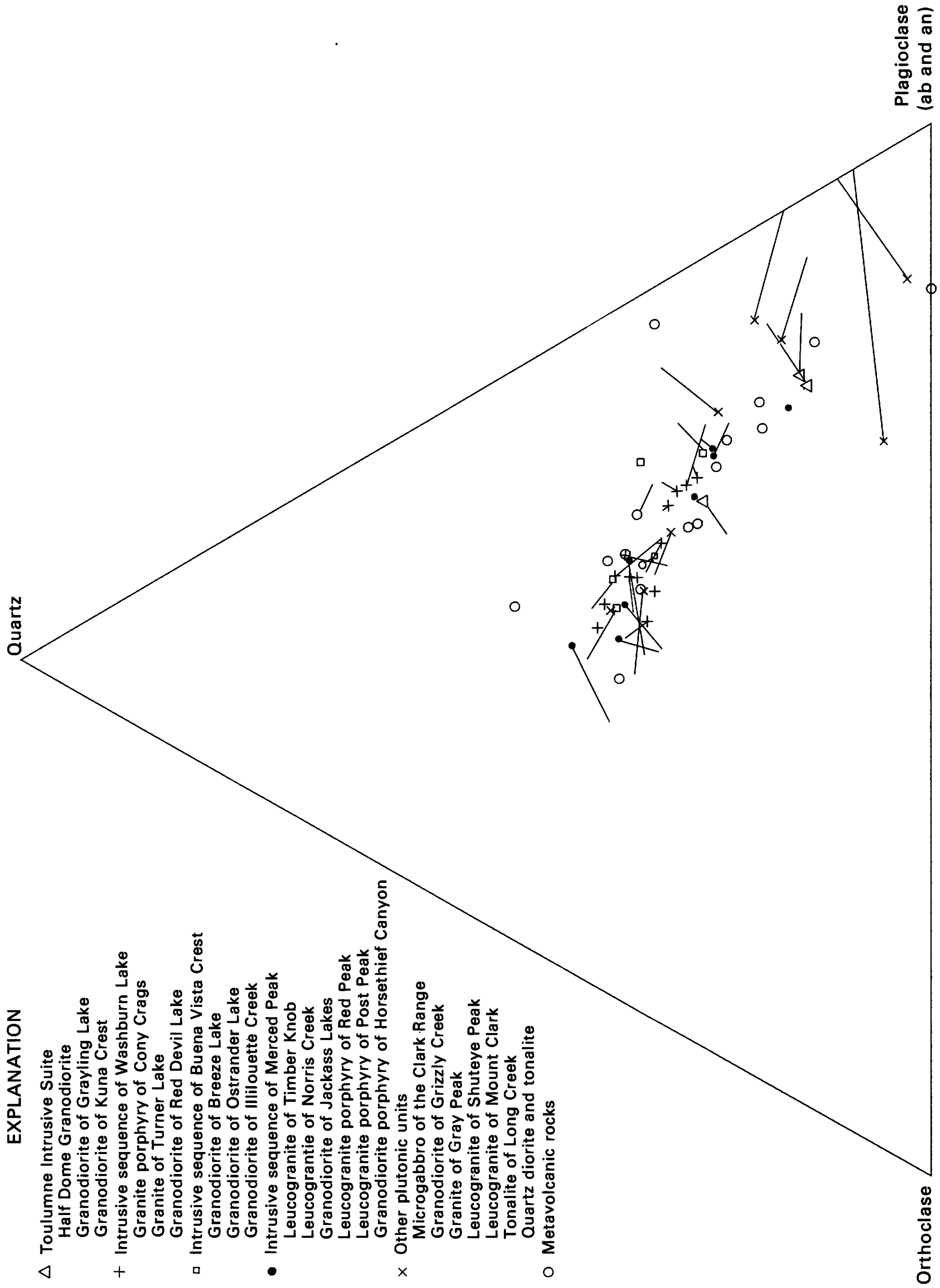


FIGURE 10.—Plots of norms of plutonic and metavolcanic rocks. Lines extend from several normative plots to the modal composition of the analyzed sample in a quartz-alkali feldspar-plagioclase plot.

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