UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

[Preliminary Report on Analytical Data of Plutonic Rocks of the Santa Rita Mountains, Southeast of Tucson, Arizona]

By

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Open-file report 74-260

1974

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Geological background

Plutonic masses and some related hypabyssal bodies were intruded into the rocks of the Santa Rita Mountains during Precambrian, Triassic, Jurassic, Cretaceous (2 episodes), Paleocene (3 episodes), and Oligocene times. The plutonic rocks range in composition from diorite to granite; most of them are granodiorite or quartz monzonite. The intrusive masses range in size from a small batholith to plugs and related dikes; most of them underlie areas of 1 to 10 square miles (2.6-26 km^2) in extent. Some of the intrusive masses are locally associated with contact metamorphic mineral deposits, and plugs of quartz latite porphyry of late Paleocene age are closely associated with hydrothermal deposits of base and noble metals in the Helvetia and Greaterville mining districts.

Drewes (in press) describes the geologic setting of these plutonic rocks, their petrography, major- and minor-element chemistry, radiometric ages, and selected features bearing on their genesis and ore association.

This preliminary report presents only the raw analytical data and specimen collection sites using manuscript maps and tables. References here to absent or unclear items require consultation with the final paper. Meanwhile, some support on the general geology of the area may be obtained from collateral reports on the Santa Rita Mountains that are already in print (Drewes, 1970, 1971a, 1971b, 1971c, 1972a, 1972b, and 1973). Figure 1 in this report serves as index to the other map illustrations. Analytical data and location maps are found on pages 2-33.

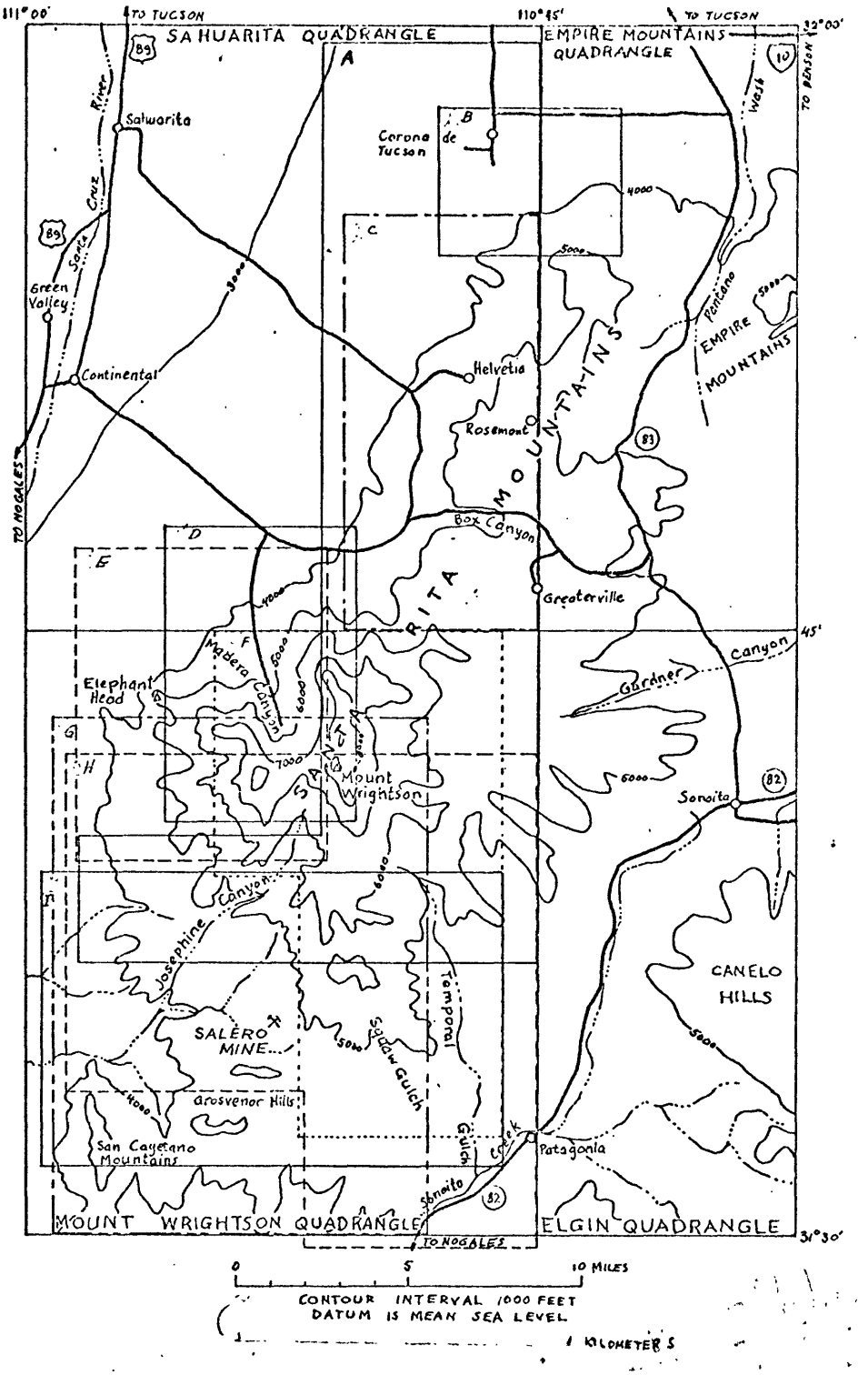


Figure 1.--The Santa Rita Mountains, showing areas covered by geologic maps in this report: A, figure 2; B, figure 5; C, figure 10; D, figure 7; E, figure 8; F, figure 3, G, figure 6; H, figure 4 ; I, figure 9.

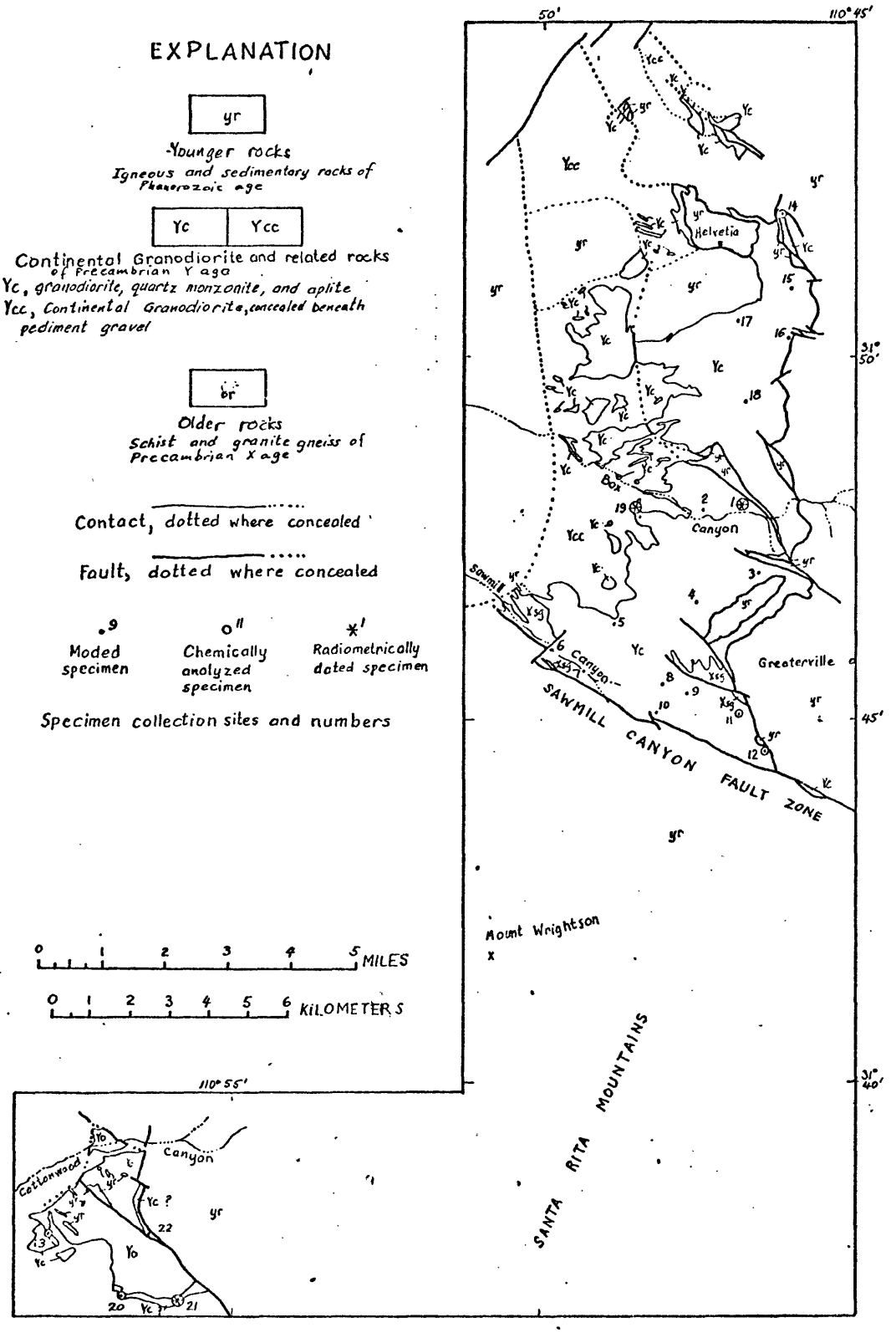


Figure 2.--Distribution of Precambrian rocks and specimen collection sites.

Table 1.-- Modes of Continental Granodiorite

[Field numbers are abbreviated; symbols showing year of collection and collector's initial omitted. Full field number of specimen 1 thus is 65D 914. Symbols σ, standard deviation; Tr., trace; and ....., not determined]

Specimen No.	1	2	3	4	5	6	7	8	9	10	11	12	13[1]	Mean 1-13	σ	14	15	16	17	18	19	Mean 14-19	σ	Mean 1-19	σ	20	21	22	23	24
Field No.	914	1034	1014	997	1022	913	994	6996	898	100	697	109	-627			1220	1191	1142	1151	1043	1046					620	616 688	614	1106	1109
Rock type	Granodiorite (includes quartz monzonite)															Slightly (regionally?) metamorphosed granodiorite and quartz monzonite										Strongly contact metamorphosed metagranodiorite			Fine-grained quartz monzonite and aplite phase	
Quartz	15.8	28.1	19.9	30.5	21.5	24.4	24.5	22.8	29.0	32.2	25.1	16.4	20.5	23.9	5.1	28.2	32.8	46.3	31.0	27.7	27.9	32.3	6.8	26.8	6.9	10.2	4.3	15.8	2.8	36.0
Plagioclase, total	32.8	35.1	52.6	43.4	46.9	41.0	45.8	42.2	39.6	39.4	42.8	26.7	56.5	41.9	7.9	35.4	32.9	27.6	42.8	41.5	31.0	35.2	7.8	39.9	7.6	26.2	55.4	42.6	46.4	19.8
(plagioclase perth.)	(8.4)	(1.0)	(0.2)	0	(1.2)	(0.8)	(0.8)	(3.5)	(2.6)	0	(1.5)	0	0	(1.5)	(2.3)	0	(5.1)	(2.0)	(1.2)	(Tr.)	(11.3)	(2.2)	(2.3)	(1.7)	(2.3)	(2.4)	0	(2.5)	(5.1)	(9.0)
Microcline	36.0	19.8	12.4	8.1	19.1	25.0	12.7	21.8	15.3	13.7	11.1	38.6	9.0	18.7	9.7	0	17.5	17.4	9.4	0	7.6	8.7	10.1	15.5	10.1	42.0	0	0	27.5	42.7
Orthoclase	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.....	15.2	0	0	0	18.0	18.0	8.5	6.4	2.7	6.4	0	.5	28.4	0	0
Biotite	12.4	12.9	13.2	13.0	9.1	7.8	13.2	9.8	12.1	10.7	16.2	11.7	10.1	11.7	2.2	15.4	14.0	6.6	13.0	9.4	11.6	11.7	2.5	11.7	2.5	9.2	5.6	7.5	2.5	.7
Hornblende	0	0	0	0	0	0	0	0	0	0	0	0	.2	Tr.	.....	0	0	0	0	0	0	0	.....	Tr.	.....	.9	29.2	.1	0	0
Magnetite	1.5	2.0	1.7	3.9	1.4	.4	1.5	1.7	.9	3.0	2.9	2.9	2.2	2.0	.9	4.4	1.9	1.6	1.9	1.8	1.9	2.3	1.0	2.1	1.0	1.0	2.5	3.4	.4	.5
Apatite	.6	.4	Tr.	.6	.4	.4	.5	.4	.6	.8	1.0	1.0	.4	.5	.3	1.0	.9	.15	.9	.6	.9	.7	.3	.6	.2	Tr.	.7	.6	.2	Tr.
Sphene	.7	1.8	0	Tr.	1.6	.5	1.8	1.2	2.9	0	1.9	0	.9	.9	.8	.05	Tr.	.4	1.0	.9	1.1	.6	.7	.8	.7	.1	1.3	.2	.2	.1
Zircon	0	.05	.2	.05	.05	Tr.	Tr.	.05	.05	.1	.05	.2	.2	.1	.1	.1	Tr.	Tr.	.05	.1	.1	.1	.2	.1	.2	.1	0	Tr.	.05	Tr.
Allanite	0	0	0	0	0	.5	0	0	.05	0	0	0	0	Tr.	.....	0	0	0	0	0	Tr.	Tr.	Tr.	Tr.	.....	0	0	0	0	.15
Rutile	.05	0	0	0	0	0	0	0	0	0	0	0	0	Tr.	.....	0	0	0	0	0	0	0	.....	0	.....	0	0	0	0	0
Muscovite	0	0	0	.5	0	0	0	0	0	0	0	0	0	Tr.	.....	0	0	0	0	0	0	0	.....	0	.....	0	0	0	0	0
Pyrite	.1	0	0	0	0	0	0	0	0	0	0	0	0	Tr.	.....	0	0	0	0	0	0	0	.....	0	.....	0	0	0	0	0
Total	99.95	100.05	100.0	100.05	100.05	100.0	100.0	99.95	100.0	99.9	100.05	100.1	100.0	99.7	.....	100.05	100.0	100.05	100.05	100.0	100.0	100.1	.....	99.9	.....	99.9	100.0	100.0	100.05	99.95
Femic	15.4	17.0	15.1	17.7	12.5	9.6	17.0	13.2	16.1	14.7	21.0	18.3	14.0	15.5	2.9	21.2	16.6	8.7	16.8	12.8	17.6	15.3	4.2	15.4	3.2	11.4	39.8	12.4	4.3	1.5
Percent anorthite in plagioclase	5-10	0-10	5-10	5-10	0	0	0-5	0-5	0	0-5	5-10	3	27-30	0-10	.....	0?	0-5	.....	5-15	0-5	5-10	0-10	.....	0-10	.....	37-40	25-31	5-35	0-5	0
Quartz mixing index (see text)	.88	.79	.92	.86	.77	.89	.91	.93	.91	.92	.95	.....	.92	.88	.06	.89	.86	.77	.93	.92	.98	.80	.06	.88	.06	.67	.58	.25	.93	.84

[1] Mode of specimen 13 has affinity to metagranodiorite.

Table 2 .-- Chemical and spectrographic analyses and CIPW norms of Continental Granodiorite

[Chemical analyses by rapid rock method (Shapiro and Brannock, 1962), with analyses of specimens 1, 11, 14, and 19 supplemented by atomic absorption method and others supplemented by X-ray fluorescence method. Chemical analyses by: Lowell Artis, S. D. Botts, G. W. Chloe, P. L. D. Elmore, John Glenn, J. Kelsey, H. Smith, and Dwight Taylor. Spectrographic analyses by (semiquantitative method) by: W. B. Crandell, J. L. Finley, J. C. Hamilton, and A. L. Sutton. Elements looked for but not found: As, Au, B, Bi, Cd, Eu, Ge, Hf, Hg, In, La, Pd, Pr, Pt, Re, Sb, Sm, Sn, Ta, Te, Th, Tl, U, W, and Zn. Symbols ±, standard deviation; <, less than, ----, not determined; Tr., trace; N, not detected]

Specimen No.	1	11	12	13	14	Mean 1–14	±	19	Mean 1–19	±	20	21
Field No.	914	897	104	827	1220			1046			620	611
Rock type	Granodiorite and quartz monzonite							Slightly metamorphosed granodiorite	Granodiorite and quartz monzonite		Strongly contact-metamorphosed meta-granodiorite	
Chemical analyses (weight percent)												
SiO_2	59.0	67.4	69.4	64.6	67.8	65.6	4.1	67.4	65.9	3.7	64.3	59.7
Al_2O_3	17.4	14.4	12.4	17.6	14.0	15.2	2.3	14.3	15.0	2.1	17.9	17.4
Fe_2O_3	3.4	2.2	3.6	1.0	1.8	2.4	1.1	3.0	2.5	1.0	2.1	3.3
FeO	3.0	2.1	1.3	1.2	3.0	2.1	.9	2.0	2.1	.8	2.3	3.3
MgO	1.2	1.2	.61	1.2	1.3	1.1	.3	.91	1.1	.3	.90	2.0
CaO	2.9	2.7	1.7	5.2	2.0	2.9	1.4	3.3	3.0	1.2	4.5	4.9
Na_2O	3.7	2.8	3.8	4.2	2.3	3.4	.8	3.1	3.3	.7	4.6	3.8
K_2O	6.9	4.1	4.5	2.2	5.3	4.6	1.7	2.8	4.3	1.7	2.2	2.9
H_2O-	.08	.11	.13	.33	.08	.15	.11	.14	.15	.09	.08	.16
H_2O+	1.0	1.2	1.2	1.0	.42	1.0	.32	.82	.95	.29	.70	.76
TiO_2	.96	.18	.92	.74	.83	.63	.30	1.0	.69	.31	.52	1.0
P_2O_5	.42	.29	.34	.28	.27	.32	.06	.43	.34	.07	.22	.47
MnO	.12	.12	.12	.08	.13	.11	.02	.08	.11	.02	.12	.13
CO_2	<.05	.36	.34	.11	<.05	.16	.18	<.05	.14	.17	<.05	.08
Total	100	99	100	100	99	100		99	100		100	100
Spectrographic analyses (weight percent)												
Ag	0	0	0.0005	0	0	Tr.		0	Tr.		0	0
Ba	.2	.15	.2	.2	.1	.17	.04	.07	.15	.06	.2	.15
Be	.0001	.0002	0	.0002	.0003	.0002	.0001	0	.0001	.0007	.0002	0
Ce	.02	.02	.015	0	.05	.02	.02	N	N	N	0	.02
Co	.002	.001	.001	.0007	.001	.001	.0004	.007	.002	.002	.001	.0015
Cr	.0015	.002	.001	.0005	.01	.003	.004	.002	.003	.004	.0003	.001
Cu	.003	.02	.1	.00015	.005	.03	.04	.007	.02	.04	.0005	.002
Ga	.0015	.0015	.003	.002	.0015	.002	.001	N	N	N	.002	.001
La	.02	.01	.005	0	.01	.009	.007	.007	.009	.007	.01	.005
Mo	0	0	0	0	.0003	Tr.	N	0	Tr.	N	0	.0003
Nb	.0005	.0007	.0015	0	.002	.0009	.0008	0	.0008	.0008	0	0
Nd	.02	.015	.007	0	0	.008	.009	N	N	N	.005	0
Ni	<.003	<.003	.0007	.0015	.002	.002	.003	.003	.002	.001	.0005	<.003
Pb	.007	.007	.01	.0015	.002	.02	.03	.0015	.01	.03	.0015	.001
Sc	.002	.001	.001	.0015	.002	.0015	.0005	.007	.002	.002	.002	.002
Sn	.0005	.0007	0	0	0	.0001	.015	0	.0002	.0003	0	0
Sr	.03	.02	.03	.1	.02	.04	.03	.003	.03	.03	.01	.01
V	.007	.007	.007	.01	.007	.008	.001	.02	.01	.005	.007	.015
Y	.005	.005	.005	.002	.01	.005	.003	.0015	.005	.003	.003	.003
Yb	.0005	.0005	N	.0003	.001	.0005	.0003	N	N	N	.0007	.0003
Zr	.03	.05	.03	.015	.03	.03	.01	.007	.03	.01	.015	.03
CIPW norms												
Q	3.6	29.0	27.6	19.9	27.7			31.8			18.1	13.7
C	0	2.0	0	0	1.6			1.3			0	.4
or	40.9	24.4	26.6	13.0	31.5			16.7			13.0	17.1
ab	31.4	23.9	32.1	35.5	19.6			26.4			38.9	32.1
an	10.5	9.3	3.5	22.7	7.9			13.3			20.3	20.7
di wo	.35	0	.23	.24	0			0			.23	0
di en	.19	0	.20	.19	0			0			.12	0
di fs	.11	0	0	.02	0			0			.10	0
hy en	2.8	3.0	1.3	2.8	3.3			2.3			2.1	5.0
hy fs	2.0	2.0	0	.28	2.9			0			1.8	1.9
mt	4.9	3.2	1.9	1.5	2.6			3.8			3.0	4.8
hm	0	0	2.3	0	0			.38			0	0
il	.87	.39	1.7	1.4	1.6			1.9			1.0	1.9
ap	1.0	.69	.80	.66	.64			1.0			.52	1.1
cc	.11	.82	.77	.25	.11			.11			0	.18
Total	98.7	98.7	99.0	98.41	99.5			99.0			99.2	98.9
Femic	12.3	10.1	9.2	7.3	11.2			9.5			8.9	14.9

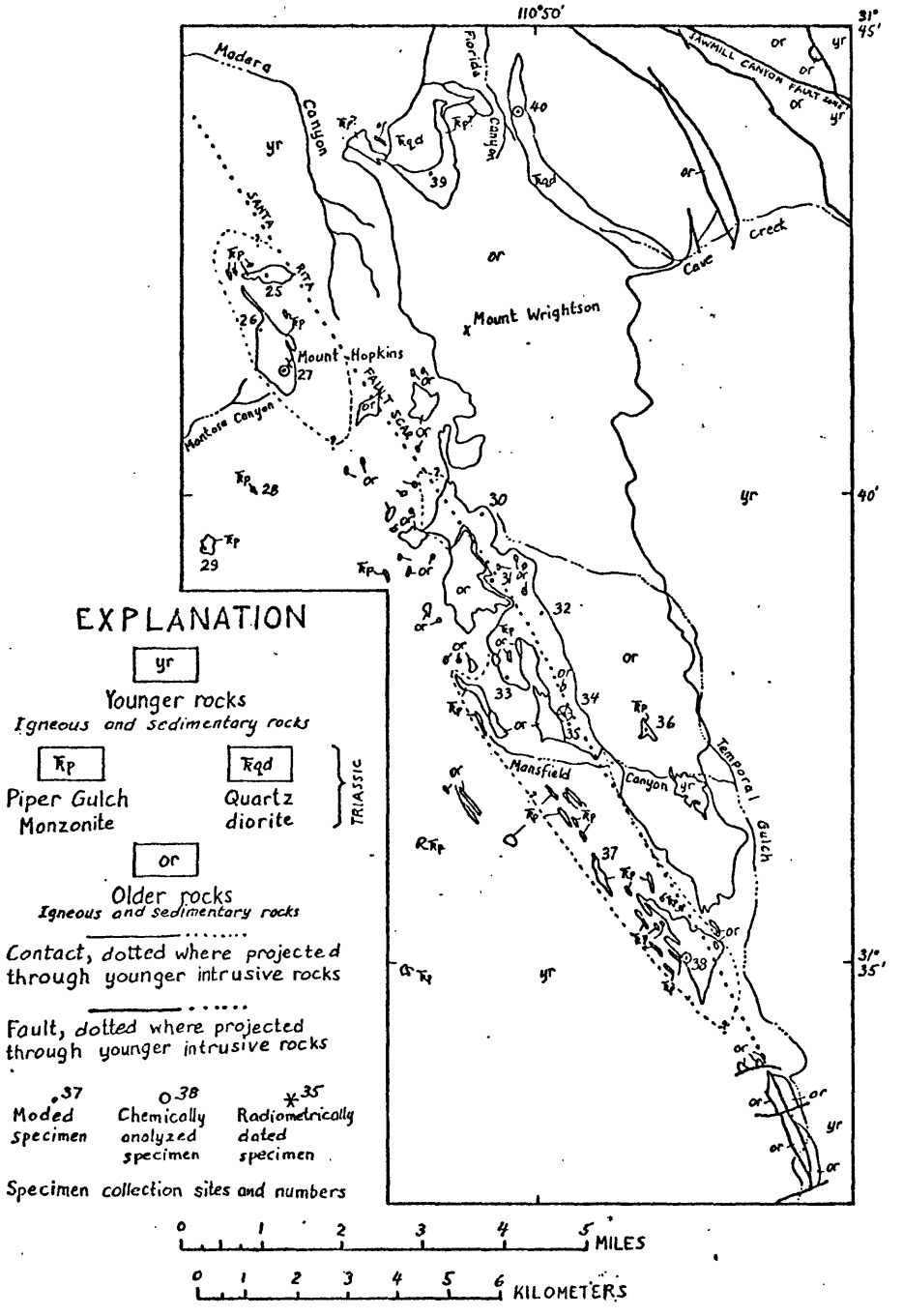


Figure 3.--Distribution of Triassic rocks and specimen collection sites.

Table 3.-- Modes of Piper Gulch Monzonite and related rocks

[Field numbers are abbreviated; symbols showing year of collection and collector's initial omitted. Full field number of specimen 25 thus is C5D 840, etc. (except R21, which was collected independently by R. Rohrbacher). Symbols: $\bar{x}$, standard deviation; Tr., trace; and ----, not determined]

Specimen No.	25	26	27	28	29	30	31	32	33	34	35	36	37	38	Mean 25-38	$\bar{x}$	39	40
Field No.	840	725	779	578	470	144	151	148	R21	280	160	156	185	212			USGS 854	
Rock type	Monzonite and syenodiorite																Quartz diorite and diorite	
Quartz	2.8	1.9	3.3	[2]10.9	5.6	.8	2.7	3.1	4.8	8.6	4.2	6.1	1.3	7.3	3.8	2.4	0.7	3.5
Plagioclase, total	62.8	55.8	43.2	52.9	38.7	51.0	57.4	55.9	29.5	57.8	42.4	40.5	46.7	49.3	48.9	9.2	54.9	71.2
(plagioclase in perthite)	0	(2.0)	(4.5)	0	(4.1)	(0.6)	0	(2.0)	0	0	0	0	0	0	(0.9)	(1.6)	(1.9)	0
Orthoclase	13.1	26.3	31.7	29.2	26.4	35.0	22.2	21.4	39.7	14.5	31.4	27.6	34.6	24.4	27.0	7.6	27.0	9.2
Hornblende	[3]10.3	7.6	3.8	11.4	17.6	7.8	12.9	7.8	21.5	14.4	11.0	11.6	2.8	9.8	10.7	5.0	8.7	11.6
Pyroxene	0	0	5.7	0	0	0	0	0	0	0	4.8	3.9	6.7	4.8	1.9	2.6	0	0
Biotite	[3]6.3	.8	4.4	.5	6.2	.5	.6	8.2	0	Tr.	1.1	2.7	2.2	0	2.4	2.8	.5	0
Magnetite	2.7	3.9	5.9	3.8	4.6	3.9	3.3	2.5	3.3	4.0	3.8	6.3	3.9	3.7	4.0	1.1	6.9	3.7
Apatite	1.0	1.1	1.2	1.0	.5	.6	.4	.8	1.2	.7	1.1	.8	.9	.4	.8	.3	1.0	.5
Sphene	.9	.8	.6	.3	.4	.3	.4	.3	0	0	Tr.	.05	0	.05	.3	.3	.3	.3
Rutile	0	0	0	0	0	0	0	0	0	0	.1	.3	.1	0	Tr.	.08	0	0
Tourmaline	.1	.8	.2	0	0	.05	0	.05	0	Tr.	.05	.2	.8	.1	.2	.5	Tr.	0
Zircon	.05	0	0	0	0	0	0	0	0	Tr.	0	0	Tr.	0	Tr.	----	0	Tr.
Total	100.05	100.0	100.0	100.0	100.0	99.35	100.0	100.05	100.0	100.0	99.35	100.05	100.0	100.05	100.0	----	100.0	100.0
Femic	21.3	16.0	21.9	17.0	29.3	13.2	17.7	19.6	15.9	19.0	22.0	25.8	17.4	13.0	19.7	4.2	17.4	16.1
Percent plagioclase in anorthite	47-55	45-56	50-55	50-55	0-5	45-50	45-50	0	38-60	60	38-39	47-55	29-56	45-50	Common range 35-55		37-41	0-5
Quartz mixing index (see text)	.85	.90	.97	.80	.93	1.00	.50	.79	.62	.85	.45	.53	.55	.36	.72	.21	.30	.87

[1] Rock is metamorphosed.
[2] Quartz content may be as much as 0.5 percent higher, owing to presence of uncounted micrographyre.
[3] Modal sum of hornblende and biotite, 16.6 percent is more reliable than these reported values.

Table 4.--Chemical and spectrographic analyses and CIPW norms of Piper Gulch Monzonite and related rocks

[Chemical analyses by rapid rock method (Shapiro and Brannock, 1962), with sample 40 supplemented by atomic absorption method and other specimens supplemented by x-ray fluorescence method. Chemical analysts: Isabell Artis, S.D. Botts, G.W. Chloe, P.L.D. Elmore, John Glenn, H. Smith, and Dwight Taylor. Spectrographic analyses by semiquantitative method. Spectrographic analysts: W.B. Crandell, J.L. Finley, and J.C. Hamilton. Elements looked for but not found: Ag, As, Au, Bi, Cd, Eu, Ge, Hf, Hg, In, La, Pd, Pr, Pt, Re, Sb, Sm, Ta, Te, Th, Tl, U, W, and Zn. Symbols: ±, standard deviation; <, less than; N, not detected; and ----, not determined]

Specimen No.	27	34	38	Mean 27-38	±	40
Field No.	779	280	212			854
Rock type	Monzonite and syenodiorite					Quartz diorite

Chemical analyses (weight percent)

SiO_2	56.4	56.0	66.0	55.8	.3	64.1
Al_2O_3	18.2	16.8	17.2	17.1	1.2	16.8
Fe_2O_3	4.2	5.0	4.5	4.6	.4	2.8
FeO	3.0	3.8	3.3	3.4	.4	2.1
MgO	3.1	2.7	3.0	2.9	.2	1.1
CaO	5.0	5.3	5.0	5.1	.2	4.3
Na_2O	3.8	3.0	3.4	3.4	.4	4.0
K_2O	4.3	4.2	4.5	4.3	.2	2.0
H_2O-	.30	.19	.19	.23	.06	.15
H_2O+	.80	1.4	1.1	1.1	.3	1.3
TiO_2	.97	1.2	1.2	1.12	.1	.78
P_2O_5	.57	.53	.42	.51	.08	.29
MnO	.14	.33	.18	.22	.1	.13
CO_2	.11	.16	<.05	.09	.08	<.05
Total	100	100	100	100		100

Spectrographic analyses (weight percent)

B	0.007	0.005	0.003	0.005	0.002	0
Ba	.1	.15	.01	.09	.07	.1
Be	.0001	.0002	.0003	.0002	.0001	0
Ce	.01	0	N	.005	.007	.01
Co	.002	.002	.003	.003	.0006	.0005
Cr	.001	.002	.0007	.001	.0007	0
Cu	.03	.015	.03	.03	.009	.0005
Ga	.001	.003	N	.002	.001	.0015
La	.007	.005	.005	.006	.001	.007
Mo	.0005	0	0	.0002	.0002	0
Nb	0	.0015	0	.0005	.0008	0
Nd	0	.007	N	.004	.005	.01
Ni	<.003	.0015	.003	.002	.0008	0
Pb	.0015	.0015	.001	.001	.0003	.0007
Sc	.005	.002	.007	.004	.003	.0005
Sn	.0003	0	0	.0001	.0002	
Sr	.1	.1	.015	.07	.05	.07
V	.02	.015	.015	.02	.003	.002
Y	.003	.003	.015	.007	.007	.002
Yb	.0003	N	N	.0003		.0002
Zr	.03	.02	.005	.02	.01	.02

CIPW norms

q	3.2	9.4	5.5			23.1
c	0	0	0			1.0
or	25.4	24.8	26.6			11.8
ab	32.1	25.4	28.8			33.9
an	19.9	17.2	18.4			19.1
di wo	.20	.19	.15			0
di en	.16	.14	.12			0
di fs	.01	.31	.12			0
hy en	7.6	5.3	6.2			2.7
hy fs	.68	1.2	.58			.50
mt	6.1	7.3	6.5			4.1
hm	0	0	0			0
il	1.8	2.3	2.3			1.5
ap	1.4	1.3	1.0			.69
cc	.25	.36	0			.11
Total	99.8	98.2	98.7			98.5
Femic	18.2	21.4	19.4			9.6

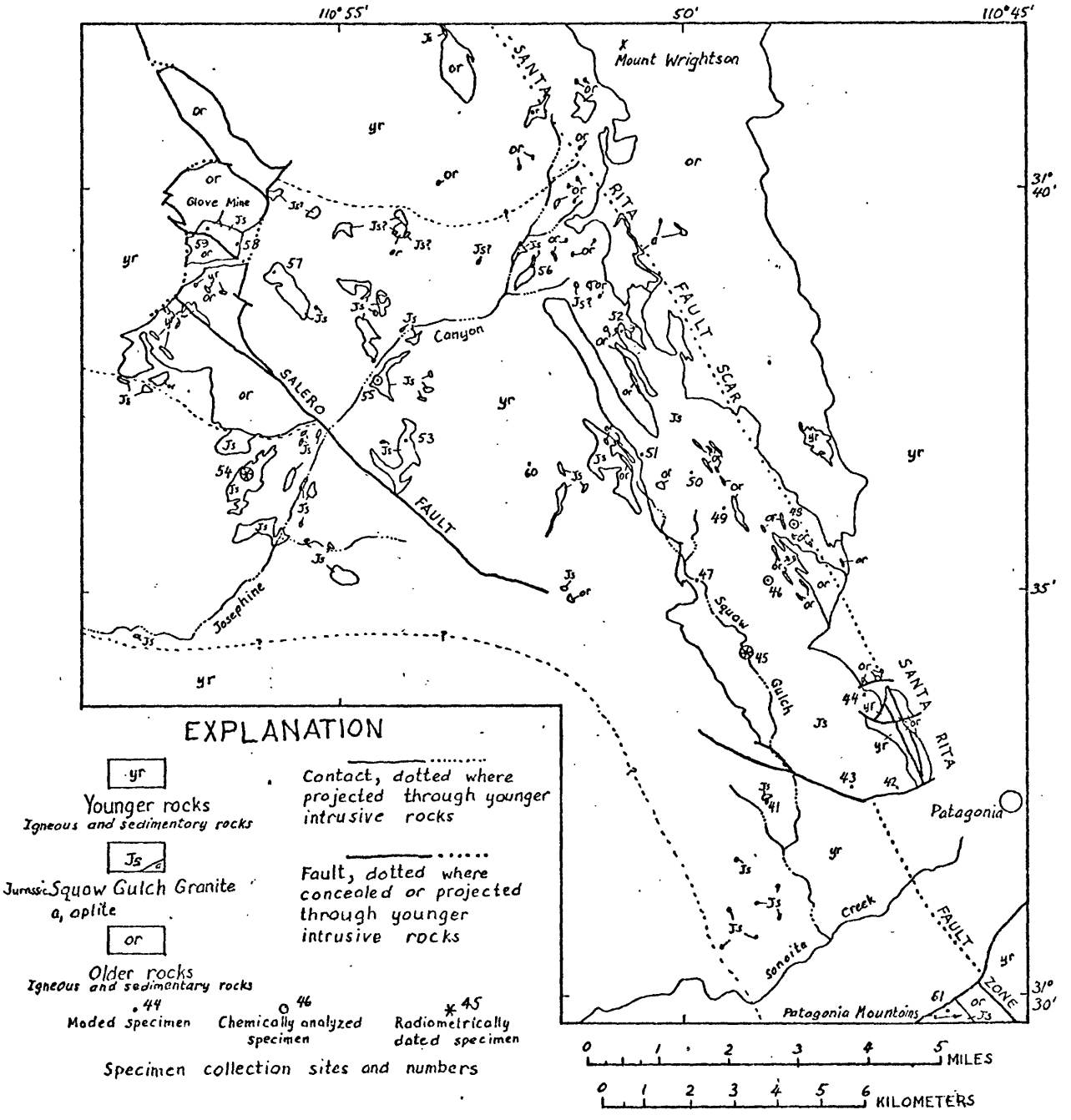


Figure 4.--Distribution of Squaw Gulch Granite and specimen collection sites.

Table 5.--Modes of Squaw Gulch Granite and related rocks

[Field numbers are abbreviated; symbols showing year of collection and collector's initial omitted. Full field number of specimen 41 thus is 65D915. Symbols: S, standard deviation; Tr, trace; ..., not determined]

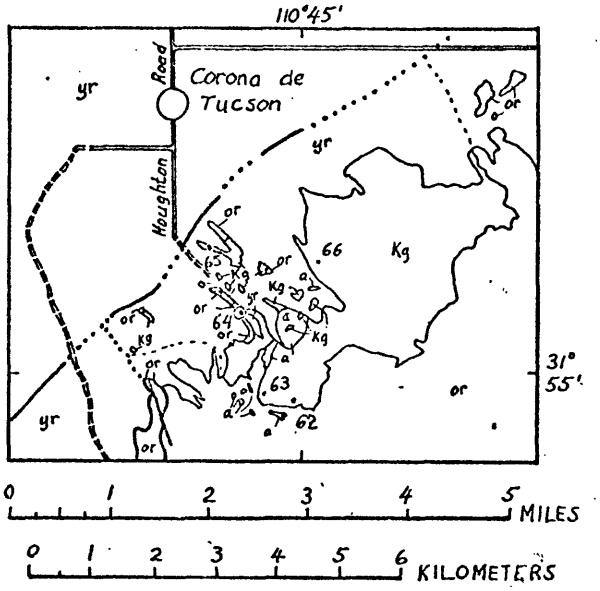
Specimen No.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	Mean 41-59	S	60	61
Field No.	915	229	984	906	949	209	237	190	184	167	166	174	446	605	450	353	920	644	2b19			395	420
Rock type	Granite (includes quartz monzonite)																	Quartz monzonite of Glove Mine area				Boulder in Schist Formation	Granite, Pelagonia Mountains
Quartz	27.5	12.0	11.9	30.0	23.2	31.2	24.0	35.2	37.4	29.4	26.6	22.4	39.6	16.4	36.5	32.9	33.0	14.6	26.0	26.9	8.6	20.6	31.2
Plagioclase, total	9.0	35.2	33.9	16.1	36.1	9.7	24.8	14.6	14.9	22.8	11.9	19.6	27.3	37.6	19.7	13.9	34.3	50.7	35.9	24.6	11.7	42.0	27.2
(plagioclase in perthite)	(9.0)	(12.9)	(24.1)	(6.1)	(11.3)	(2.1)	(5.9)	(6.6)	(10.4)	0	(1.9)	(17.6)	(3.5)	(5.3)	(2.6)	(8.8)	(5.4)	(2.7)	(2.7)	(7.8)	(5.9)	(1.3)	(24.7)
Orthoclase	63.0	46.2	51.7	52.5	37.6	57.2	48.8	47.9	45.0	46.6	59.0	56.5	30.8	41.3	40.4	52.3	30.5	27.6	35.1	45.8	10.2	22.2	41.6
Microcline	0	0	0	0	0	0	0	0	0	0	0	0	.7	0	0	0	0	0	0	Tr.		0	0
Biotite	.1	2.4	.9	.9	1.9	1.1	1.9	1.4	1.3	.6	1.6	.5	1.2	2.3	1.1	.2	2.0	5.3	2.4	1.5	1.2	5.8	.8
Magnetite	.4	.7	1.4	.5	.9	.7	.3	.8	1.0	.6	.9	.5	.4	.9	3	.6	.2	1.4	.5	.7	.3	1.3	.9
Apatite	0	.6	0	.05	.05	.05	.1	.1	.1	Tr.	Tr.	Tr.	0	.4	Tr.	Tr.	0	.3	.05	.1	.2	.4	Tr.
Zircon	0	.05	.1	Tr.	.05	.05	.05	.05	.3	Tr.	Tr.	.05	Tr.	.1	.05	Tr.	Tr.	.1	.05	.06	.07	.1	0
Sphene	0	1.7	.1	0	Tr.	0	.05	0	0	0	.05	.5	Tr.	1.0	0	.1	0	0	Tr.	.2	.4	.5	.2
Tourmaline	0	0	0	0	.2	0	0	0	.05	0	0	0	0	0	0	Tr.	0	0	0	Tr.		0	Tr.
Amphibole	0	1.1	0	0	0	0	0	0	0	0	0	0	0	Tr.	0	0	0	0	0	.6	.3	1.0	0
Rutile	0	0	0	0	0	Tr.	Tr.	0	0	Tr.	0	0	0	0	0	0	0	0	0	Tr.		0	0
Total	100.0	99.95	100.0	100.15	100.1	100.0	100.0	100.05	100.05	100.0	100.05	100.05	100.0	100.0	100.05	100.0	100.0	100.0	100.0	99.92		100.0	100.0
Femic	.5	6.6	2.5	1.4	3.1	1.9	2.4	2.3	2.7	1.2	2.5	1.5	1.6	4.7	1.4	.9	2.2	7.1	3.0	2.6	.8	2.1	2.0
Percent anorthite in plagioclase	0	0	0-5	0	0	0	0-5	0	0	0	0?	0?	0-5	0-5	0-5	0?	0	0	0	0-5		0-10	0
Quartz mixing index (see text)	.92	.85	.86	.74	.61	.87	.39	.92	.86	.73	.97	.69	.95	.92	.88	.81	.88	.67	.85	.81	.1	.86	.91

1/ Specimen 45 collected almost at same place as chemically analyzed specimen 63D282 (Table 8).
2/ Specimen 52 collected from a small wedge of granite between two small masses of altered rhyolite, that is erroneously shown as Josephine Canyon Diorite (Drewes, 1978).
3/ Specimen 59 dynamically metamorphosed.

Table 6.--Chemical and spectrographic analyses and CIPW norms of Squaw Gulch Granite

[Chemical analyses by rapid rock method (Shapiro and Brannock, 1962), with analyses of specimens 209, 190, and 450 supplemented by X-ray fluorescence method. Chemical analysts: Lowell Artis, S.D. Botts, G.W. Chloe, P.L.D. Elmore, John Glenn, and H. Smith. Spectrographic analyses by semiquantitative method. Spectrographic analysts: W.B. Crandell, J.C. Hamilton, and Barbara Tobin. Elements looked for but not found: Ag, As, Au, B, Bi, Cd, Eu, Ge, Hf, Hg, In, La, Nd, Pd, Pr, Pt, Re, Sb, Sm, Sn, Ta, Te, Th, Tl, U, W, and Zn. Symbols ±, standard deviation; <, less than; N, not detected; ....., not determined]

Specimen No.	45	46	48	55	Mean	45-55	±
Field No.	262	209	190	450			
Rock type	Granite and quartz monzonite						
Chemical analyses (weight percent)							
SiO_2	69.1	75.1	75.1	75.5	73.2	3.1	
Al_2O_3	15.2	13.3	13.0	12.6	13.5	1.2	
Fe_2O_3	1.9	1.0	1.3	1.0	1.3	.4	
FeO	1.0	.08	.18	.24	.38	.42	
MgO	.55	.55	.05	.23	.35	.25	
CaO	1.1	.25	.19	.35	.47	.42	
Na_2O	4.0	3.0	3.6	3.5	3.5	.4	
K_2O	5.2	5.9	5.5	4.7	5.3	.5	
H_2O-	.34	.37	.09	.17	.24	.13	
H_2O+	.93	.63	.14	.87	.77	.16	
TiO_2	.12	.17	.18	.21	.25	.12	
P_2O_5	.16	0	.01	.02	.05	.08	
MnO	.03	.03	.02	.02	.03	.01	
CO_2	.19	<.05	<.05	.15	.09	.10	
Total	100	100	100	100	100		
Spectrographic analyses (weight percent)							
Ba	0.07	0.02	0.01	0.03	0.03	0.03	
Be	.0003	.0003	.0007	.0002	.0004	.0002	
Ce	0	0	.015	0	.004	.008	
Co	0	0	0	.0003	.0001	.0002	
Cr	.0015	0	.00015	0	.00008	.00009	
Cu	.0007	.0015	.0015	.0007	.001	.0005	
Ga	.002	.002	.003	.001	.002	.001	
La	.005	.003	.007	.007	.006	.002	
Mo	.001	0	0	0	.0003	.0005	
Nb	.0015	.002	.0015	.001	.0015	.0004	
Pb	.002	.0015	.003	.002	.002	.001	
Sc	.0007	0	.0005	0	.0003	.0004	
Sr	.02	.005	.003	.007	.009	.008	
V	.002	.001	0	0	.001	.001	
Y	.003	.002	.007	.003	.004	.002	
Yb	.0003	N	.0007	.0003	.0004	.0002	
Zr	.015	.01	.007	.015	.01	.004	
CIPW norms							
Q	23.7	33.7	32.7	36.5			
C	1.8	1.5	.81	1.5			
or	30.7	34.9	32.5	27.8			
ab	33.8	25.4	30.4	29.6			
an	3.2	1.2	.88	.66			
di wo	0	0	0	0			
di en	0	0	0	0			
di fs	0	0	0	0			
hy en	1.4	1.4	.12	.57			
hy fs	0	0	0	0			
mt	2.1	0	.12	.23			
hm	.45	1.0	1.2	.84			
ul	.90	.23	.34	.40			
ap	.38	0	.02	.05			
cc	.45	0	0	.34			
Total	98.8	99.3	99.1	98.5			
Femic	5.6	2.6	1.8	2.4			



EXPLANATION

yr

Younger rocks

Igneous and sedimentary rocks

Kg/a

Cretaceous granitoid rocks of the Corona stock

a, aplite

or

Older rocks

Igneous and sedimentary rocks

Contact, dotted where concealed

Fault, dotted where concealed

.63 Moded specimen

o64 Chemically analyzed specimen

Specimen collection sites and numbers

Figure 5.--Distribution of granitoid rocks of the Corona stock and specimen collection sites. Geology east of longitude 110°45' mainly adapted from Finnell (1971).

Table 7. -- Modes of granitoid rocks of the Corona stock

[Field number is abbreviated; symbols showing year of collection and collector's initial omitted. Full field number of specimen 62 thus is 67D1412. Symbols $\underline{s}$, standard deviation; Tr., trace; and ....., not determined]

Specimen No	62	63	64	65	66	Mean	$\underline{s}$
Field No	1412	1411	1415	1422	1420		
Quartz	41.7	25.9	28.1	24.4	25.2	29.1	7.2
Plagioclase, total....	32.2	25.0	34.8	38.3	52.8	36.6	10.3
(plagioclase in perthite)	0	0	(3.1)	(1.5)	(1.8)	(1.3)	(1.3)
K feldspar, total.....	20.9	45.8	34.3	35.1	12.0	29.6	13.2
(orthoclase).....	(20.9)	(45.8)	Tr.?	0	(12.0)	(15.7)	(19.0)
(microcline?)	0?	Tr.?	(34.3)	(35.1)	0	(13.9)	(19.0)
Biotite	4.0	2.4	2.4	1.1	5.5	3.1	1.7
Amphibole	0	0	0	0	2.8	.6	.3
Magnetite	1.1	.8	.2	.7	1.0	.8	.4
Apatite	.05	.05	.2	Tr.	.3	.1	.1
Sphene	0	0	0	.2	.3	.1	.1
Zircon	.05	.05	.05	.1	.05	.05	.02
Allanite	0	0	0	.1	.05	Tr.	.....
Total.....	100.0	100.0	100.05	100.0	100.0	100.05	
Femic	5.2	3.3	2.8	2.2	10.0	4.8	
Percent anorthite in plagioclase	5?	15?	.....		37	37?	.....
(plagioclase rims)....	(15)	(15)	(15)	(15)	(20)	(15-20)	.....
Quartz mixing index (see text)....	.94	.98	.98	.96	.98	.97	

Table 8.-- Chemical and spectrographic analyses and CIPW norms of quartz monzonite of the Cerro stock.

[Chemical analysis by rapid rock method (Shapiro and Brannock, 1962) supplemented by atomic absorption method. Chemical analysts: Lowell Artis, S.D. Botts, G.W. Chloe, P.L.D. Elmore, John Glenn, J. Kelsey, and H. Smith. Spectrographic analysis by semiquantitative method. Spectrographic analyst: J.L. Harris. Elements looked for but not found: As, Au, B, Bi, Cd, Eu, Ge, Hf, Hg, In, Li, Mo, Nd, Ni, Pd, Pr, Pt, RE, Sb, Sm, Sn, Ta, Te, Th, Tl, U, W, and Zn. Symbol, <, less than]

Specimen No.	64
Field No.	1415
[1] Chemical analysis (weight percent)	
SiO_2	73.9
Al_2O_3	13.3
Fe_2O_3	.58
FeO	.56
MgO	.33
CaO	1.0
Na_2O	3.9
K_2O	4.5
H_2O-	.07
H_2O+	.24
TiO_2	.11
P_2O_5	.04
MnO	.04
CO_2	<.05
Total	100
[2] Spectrographic analyses (weight percent)	
Ag	<.0001
Ba	.07
Be	.0002
Ce	.015
Cl	.0005
Ga	.001
La	.01
Nb	.001
Pb	.001
Sc	.0003
Sr	.02
V	.0015
Y	.005
Yb	.0005
Zr	.007
CIPW Norms	
Q	31.7
C	.41
or	26.7
ab	33.1
an	4.4
hy(en)	3.3
hy(fs)	0
hm	.58
il	1.3
ru	.43
ap	.10
cc	.11
Total	99.7
Femic	3.4

[1] A replicate analysis shows Al_2O_3, 14.5; H_2O-, 0.15; H_2O+, 0.47; TiO_2, 0.14; P_2O_5 0.08; and other minor differences.

[2] A replicate analysis differed only slightly.

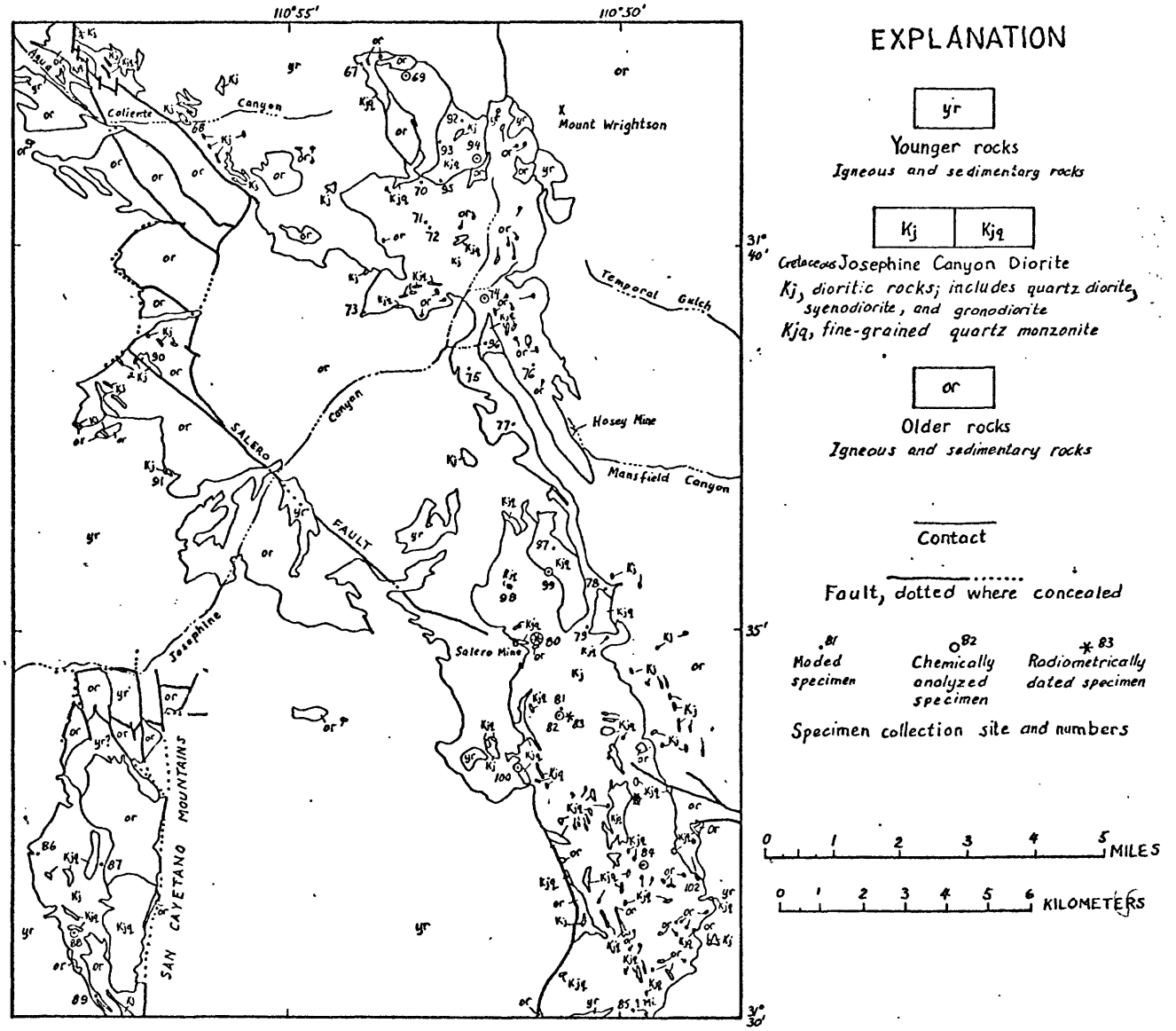


Figure 6.--Distribution of Josephine Canyon Diorite and specimen collection sites.

Table 9.-- Modes of Josephine Canyon Diorite

[Field numbers are abbreviated; symbols showing year of collection and collector's initial omitted. Full field number of specimen 67 thus is 65 D 731. Symbols s, standard deviation; Tr., trace; ...., not determined]

Specimen No.	1/67	2/68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	3/85	86	87	88	89	Mean	s	2/90	91	92	93	94	95	96	97	98	99	4/100	101	102	Mean	s
Field No.	731	791	780	1579	1580	407	455	351	300	173	271	238	254	316	279	273	292	263	3/332	571	675	560	545			631	821	830	835	404	405	398	239	238	236	330	226	262		
Rock type	Dioritic rocks. (includes quartz diorite, syenodiorite, and granodiorite)																									Josephine Canyon (?) Diorite		Fine-grained quartz monzonite													
Quartz	9.7	3.7	6.8	3.2	4.9	3.9	13.2	10.9	8.6	10.2	4.2	7.9	12.2	10.2	12.1	7.8	11.1	9.3	6.9	15.6	15.1	8.0	0.9	8.5	3.9	6.2	4.3	22.4	16.2	26.5	16.4	19.5	18.7	24.5	22.3	8.6	24.1	11.6	19.2	5.6
Plagioclase, total	59.1	60.9	63.6	65.1	59.6	62.8	50.1	55.8	59.1	62.6	63.7	63.1	50.0	47.2	53.1	53.4	51.7	54.3	47.7	49.9	46.1	50.3	66.6	56.1	6.3	50.4	55.4	43.3	49.1	28.7	43.4	37.7	31.9	32.9	27.1	17.1	25.0	34.9	33.3	8.6
(as anorthoclase in perthite)	0	0	0	0	0	0	0	(6.4)	0	0	0	0	(1.7)	0	0	0	0	0	0	(0.6)	0	0	0	(0.4)	(1.4)	0	0	(1.0)	0	0	0	(4.3)	0	0	0	0	0	0	(6.6)	(1.4)
Orthoclase	7.6	4.9	6.0	3.6	6.3	6.4	23.1	16.7	15.8	14.9	10.9	11.5	21.9	22.5	14.5	20.6	15.1	22.8	25.2	9.1	23.1	20.5	0	14.0	7.5	4.1	.5	22.8	28.1	34.9	31.8	32.4	43.0	38.4	40.5	66.0	43.4	35.4	37.9	11.2
Hornblende	11.2	18.5	7.4	13.9	14.0	18.9	0	10.1	6.1	0	10.6	0	0	0	2.4	3.2	1.6	4.9	11.5?	12.9	5.2	0	0	6.6	6.3	16.8	29.2	0	4.7	.65	1.7	2.4	.4	Tr.	.3	.1	0	6.8	1.6	2.9
Pyroxene (augite?)	0	0	4.3	4.8	6.3	1.7	6.5	.05	1.6	6.7	3.5	9.7	6.6	8.7	4.1	5.5	5.9	3.9	6.7	2.2	3.8	7.6	22.2	5.3	4.6	0	0	0	0	0	1.6	1.6	0	0	2.1	5.0	4.4	2.4	1.6	1.8
Biotite	9.2	6.1	8.0	5.8	5.0	2.1	4.3	3.2	4.8	7.9	3.3	3.7	5.7	6.6	10.7	4.3	10.7	1.4	.2	8.6	4.0	10.5	3.8	5.6	3.0	18.0	5.6	10.0	4.0	6.2	3.1	2.4	2.7	2.3	4.4	.6	.7	5.3	2.8	2.7
Magnetite	2.4	3.7	3.5	2.3	3.5	3.7	2.9	3.2	3.0	3.0	3.5	3.9	3.3	2.9	2.5	4.0	2.6	3.2	1.8	.9	2.2	2.6	5.3	3.0	.9	2.0	2.5	1.2	1.6	2.0	1.6	1.8	3.0	1.5	2.4	2.5	1.9	3.2	2.1	.6
Apatite	.1	.5	.3	.8	.3	.4	.4	.4	.6	.9	.05	.6	.3	.7	.5	1.1	.9	.1	Tr.	.4	.5	.3	1.2	.5	.3	.8	.7	.3	.3	.4	.2	.2	.3	.4	.3	Tr.	.3	.2	.3	.1
Sphene	.6	1.7	0	0	0	Tr.	0	.4	.1	0	.2	0	Tr.	.1	0	.1	.3	0	Tr.	.3	0	.05	0	.2	.4	1.6	1.8	0	.2	1.2	.1	.5	0	0	.5	Tr.	Tr.	0	.2	.4
Zircon	.05	Tr.	.1	.05	.05	.05	.05	.2	.2	.1	.05	.1	.05	.1	.1	.05	.05	.05	0	.1	.05	.1	0	.07	.05	.1	0	Tr.	.1	.05	.05	Tr.	Tr.	Tr.	.1	.1	.2	Tr.	.06	.06
Allanite	Tr.	Tr.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Tr.	0	0	0	Tr.	....	0	0	0	.1	0	.25	.3	0	0	0	0	0	0	.14	.25
Rutile	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	....	0	0	0	0	.05	Tr.	0	0	0	0	0	0	0	Tr.	
Tourmaline	0	0	0	0	0	0	0	0	.1	0	0	0	.1	0	0	0	.05	0	0	Tr.	0	Tr.	0	Tr.	....	0	0	0	0	0	Tr.	.2	0	0	0	Tr.	0	0	Tr.	
Hypersthene	0	0	0	0	0	0	0	0	0	.7	0	0	0	0	0	0	0	0	0	0	0	0	0	Tr.	....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total	99.95	100.0	100.0	100.05	99.95	99.95	100.05	99.95	100.0	100.0	100.0	100.0	100.05	100.0	100.0	100.05	100.0	99.95	100.0	100.0	100.05	99.95	100.0	99.9	....	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.1	
Femic	23.6	30.5	23.6	28.1	29.2	26.9	13.6	17.6	16.5	18.3	21.2	12.5	15.9	20.1	20.3	18.2	22.1	13.6	20.2	25.5	15.7	21.2	32.5	21.3	5.3	39.3	39.8	11.5	11.0	9.9	8.4	10.4	6.4	4.2	12.1	8.3	7.5	17.9	9.6	3.5
Percent anorthite in plagioclase	49-60	28	37-45	35-40	38-50	40-46	38-49	35-47	33-43	33-36	40-50	43-49	33-39	33-50	37-47	32-49	35-48	47-65	50	45-61	35	41-50	50-65	33-65	....	0-28	28-31	25-35	32-35	32-40	38-47	33-33	37-38	0	39-49	6?	28-32	50-57	28-35	....
(anorthoclase rims)	....	....	....	....	....	....	....	(28)	....	....	(25)	....	(28)	....	....	....	....	....	....	....	....	....	....	(27)	....	....	....	....	....	....	....	....	(26)	....	(25)	....	....	(36)	(0-23)	....
Quartz mixing index (see text)	.89	.63	.94	.68	.10	.89	.92	.96	.93	.81	.89	....	.78	.95	.97	.86	.75	.99	.97	.95	.92	.83	....	.89	.08	.71	.58	.89	.90	.94	.92	....	....	....	.95	....	.92	.80	.91	.94

1/ Specimen 67 collected from dioritic component of a mixed rock, dominantly of the quartz monzonite phase.
2/ Specimens 68 and 86 contain a little modal calcite.
3/ Specimen 85 was collected by E. S. Shomaker about 1 mile south of the Mount Wrightson quadrangle.
4/ Analysis of specimen 100 is omitted from average inasmuch as the specimen is more intensely altered than other rocks of this phase.

Table 18.-- Chemical and spectrographic analyses and CIPW norms of Josephine Canyon Diorite

[Chemical analyses by rapid rock method (Shapiro and Brannock, 1962), with analyses of specimens 64, 69, 77, 79, 83, 80, and 94 supplemented by X-ray fluorescence method. Chemical analysts: Lowell Artis, S. D. Botts, G.W. Chloe, P.L.D. Elmore, John Glenn, and H. Smith. Spectrographic analyses by semiquantitative method. Spectrographic analysts: W. B. Crandell, J. L. Finley, J. C. Hamilton, J. L. Harris, A. L. Sutton, and Barbara Tobin. Symbols: $\bar{x}$, standard deviation; <, less than; ....., not determined; N, not detected]

Specimen No.	69	79	80	82	84	88	88-88 Mean	88-88 $\bar{x}$	94	99	100	98-100 Mean	98-100 $\bar{x}$
Field No.	780	351	316	273	263	580			909	285	330		
Rock type	Diorite (includes quartz diorite, sgenodiorite, and granodiorite)								Quartz monzonite phase				
Chemical analyses (weight percent)													
SiO_2	59.7	61.1	60.2	60.7	58.7	58.8	59.9	1.0	69.9	67.3	67.1	68.1	1.6
Al_2O_3	17.8	15.5	16.0	15.7	16.6	17.0	16.4	.9	15.0	14.4	15.6	15.0	.6
Fe_2O_3	2.3	4.0	3.3	3.2	4.3	2.4	3.3	.7	3.1	3.1	2.3	2.8	.5
FeO	3.1	2.7	3.6	3.2	2.7	3.7	3.2	.4	1.5	1.4	.76	1.2	.9
MgO	2.9	3.2	3.0	2.4	3.3	2.6	2.9	.3	.60	.66	.10	.45	.3
CaO	5.2	4.9	5.2	4.8	4.9	5.9	5.1	.5	1.4	2.4	1.7	1.8	.5
Na_2O	3.8	3.9	3.4	3.8	3.8	3.4	3.6	.2	3.3	3.1	3.6	3.3	.3
K_2O	2.5	3.3	2.7	3.3	3.3	2.8	3.0	.4	2.6	4.8	4.6	4.7	2.0
H_2O-	.18	.15	.26	.28	.27	.19	.22	.05	.18	.38	.29	.28	.10
H_2O+	.48	.95	1.0	1.1	.71	1.1	.92	.19	.92	.72	.41	.68	.26
TiO_2	.85	.70	.87	.90	.96	.80	.76	.33	.45	.64	.60	.56	.10
P_2O_5	.23	.27	.29	.27	.26	.25	.27	.01	.15	.13	.45	.24	.18
MnO	.08	.90	.08	.11	.21	.11	.25	.32	.05	.08	.08	.07	.02
CO_2	.08	<.05	<.05	<.05	<.05	.58	.11	.22	<.05	<.05	.05	<.05	.03
Total	100	100	100	100	100	100	99		99	99	100	99	
Spectrographic analyses (weight percent)													
Ag	0	1/ 0	1/ 0	2/ 0	2/ 0	0	0	0	2/ <.0001	1/ 0	0	0	<.0001
Ba	.1	.1	.015	.1	.15	.15	.1	.16	.1	.05	.07	.15	.1	0.4
Be	0	.0002	.0001	0	0	0	.0002	.0002	.0001	.0001	.0001	.0003	.0003	.0002	.0002	.0001
Ce	0	0	N	0	N	0	0	0	0		.01	.02	.015	.05	.02	.62
Co	.002	.003	.003	.002	.007	.002	.002	.003	.003	.002	.002	.0007	.0015	0	.001	.001
Cr	.0007	.003	.0015	.005	.003	.0015	.003	.016	.009	.005	.0015	.001	.0015	.0005	.001	.0005
Cu	.03	.015	.07	.015	.02	.02	.015	.01	.02	.02	.01	.007	.015	.007	.01	.004
Ga	.001	.005	N	.002	N	.003	.006	.002	.003	.002	.001	.005	.003	.0015	.003	.002
La	.006	.006	.07	.007	.003	.005	.007	.005	.01	.02	.007	.01	.007	.015	.01	.004
Mo	.0003	0	0	.0007	0	.007	0	.0007	.001	.002	0	0	0	0	0	
Nb	0	0	.002	0	.002	.002	0	0	.0008	.001	.0007	0	.002	.001	.0009	.0008
Nd	0	0	N	0	N	.007	0	.005	.002	.003	0	.007	.007	0	.004	.004
Ni	<.003	.002	.002	.005	.015	.0015	.003	.007	.005	.005	.003	.0015	.0015	0	.0015	.001
Pb	.001	.0015	.003	.002	.001	.002	.002	.002	.002	.001	.001	.003	.002	.003	.002	.001
Sc	.001	.002	.007	.0015	.002	.001	.0015	.002	.002	.002	.001	.001	.001	.01	.003	.005
Sr	.1	.15	.015	.1	.015	.06	.15	.1	.09	.05	.06	.1	.05	.03	.06	.03
V	.015	.03	.02	.02	.03	.01	.02	.02	.02	.007	.01	.01	.01	.005	.009	.003
Y	.002	.003	.007	.003	.001	.002	.003	.003	.003	.002	.003	.005	.002	.006	.004	.002
Yb	.0002	.0003		.0003		.0005	.0003	N	.0003	.0001	.0003	.0005	.0005	.0003	.0004	.0001
Zr	.02	.015	.01	.01	.02	.03	.015	.01	.02	.007	.02	.02	.03	.03	.03	.006
CIPW norms													
q	12.6	14.4	14.9	13.3	10.1	12.7			37.3	25.2	18.6		
c	.25	0	0	0	0	0			4.6	.06	.64		
or	14.8	19.5	16.0	19.5	19.5	16.5			15.4	28.4	39.1		
ab	32.1	28.8	28.8	32.1	32.1	28.8			27.9	26.2	30.6		
an	23.5	17.3	20.4	16.0	18.5	22.9			6.0	11.1	5.2		
di wo	0	1.2	1.4	2.5	1.7	.54			0	0	0		
di en	0	.77	.99	1.7	1.5	.33			0	0	0		
di fs	0	.30	.34	.57	.09	.18			0	0	0		
hy en	7.2	7.2	6.5	9.2	6.8	6.1			1.5	1.6	.25		
hy fs	2.1	2.9	2.3	1.4	.17	3.4			0	0	0		
mt	4.1	5.8	4.8	4.6	6.2	3.5			3.7	2.9	.98		
hm	0	0	0	0	0	0			.55	1.1	1.6		
il	1.6	.19	1.7	1.7	1.8	1.7			.86	1.2	1.1		
ap	.66	.64	.69	.64	.62	.59			.36	.31	1.1		
cc	.18	0	0	0	0	1.3			0	0	1.1		
Total	94.1	99.0	99.8	98.2	99.0	98.5			98.2	98.1	99.3		
Femic	15.8	19.0	18.7	17.3	18.8	17.6			7.0	7.1	5.1		

1/ to 3/ Pairs of replicate analyses

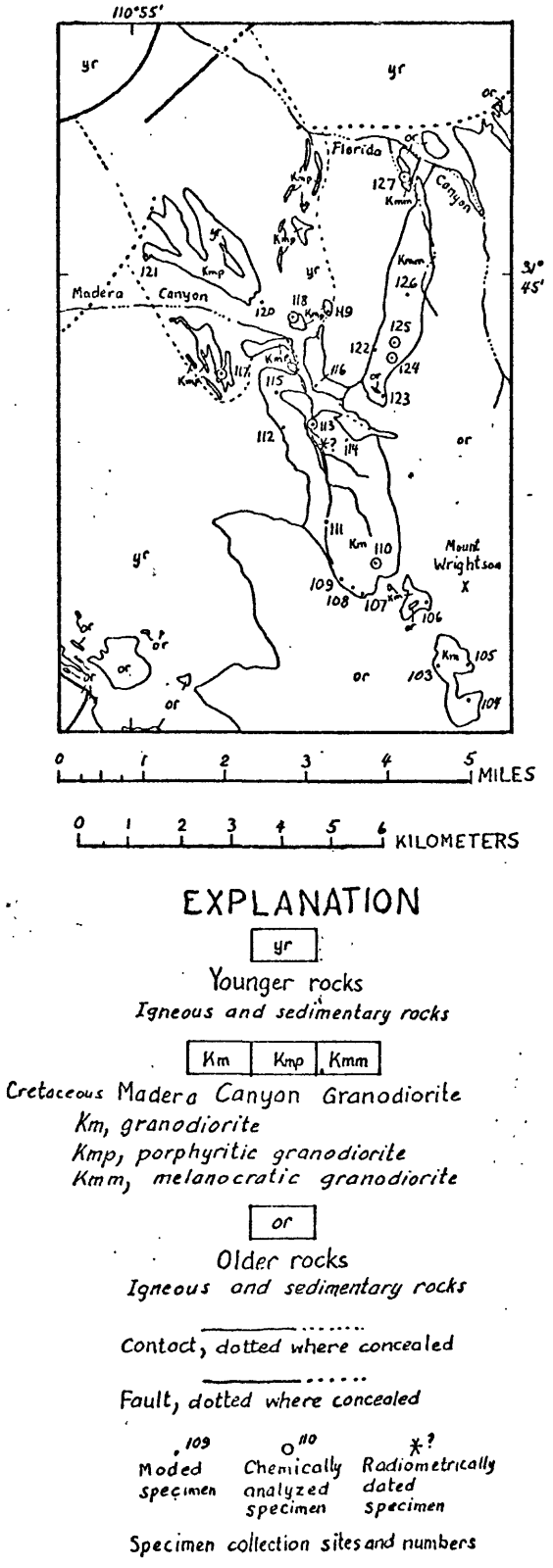


Figure 7.--Distribution of Madera Canyon Granodiorite and specimen collection sites.

Table 11. -- Modes of Madera Canyon Granodiorite

[Field numbers abbreviated; symbols showing year of collection and collector's initial omitted. Full field number of specimen 103 thus is 63D403. Symbols ±, standard deviation; Tr, trace; and ...., not determined]

Specimen No.	103	104	105	106	107	108	109	110	111	112	113	114	115	104–115 Mean	±
Field No. [1]	403	303	7-5	1581	833	836	828	769	837	843	826	810	807		
Rock type	Granodiorite														
Quartz	24.8	24.1	10.1	23.1	21.4	23.7	17.5	21.9	16.0	18.3	22.5	17.9	24.2	22.3	5.2
Plagioclase, total	52.7	47.9	40.3	45.2	36.2	39.0	44.6	41.8	42.8	47.5	47.1	48.7	43.4	43.3	6.0
(plagioclase in perthite)	0	(1.7)	(1.6)	(2.0)	(1.3)	(2.0)	(0.2)	0	(1.4)	(2.9)	(1.2)	0	(1.9)	(1.2)	(1.0)
Orthoclase	0	16.1	28.0	19.3	31.2	27.0	25.5	26.7	23.3	21.5	17.8	12.9	21.6	21.5	(8.2)
Sanidine	16.6	0	0	0	0	0	0	0	0	0	0	0	0	.8	2.8
Hornblende	0	0	9.3	3.5	1.8	2.3	6.3	4.9	9.7	3.9	5.7	10.9	2.4	5.1	3.9
Biotite	10.7	11.4	.5	5.4	6.4	5.7	3.7	3.7	5.6	6.5	4.3	6.2	6.4	5.6	2.9
Pyroxene	0	0	0	1.3	0	0	0	0	0	0	0	0	0	.1	.3
Magnetite	.7	.5	1.9	1.5	1.6	1.5	1.2	1.1	1.4	1.2	1.7	2.2	1.8	1.3	.5
Apatite	.3	Tr.	.3	.4	.2	.2	.5	.1	.3	.4	.2	.1	.1	.2	.1
Sphene	0	0	.6	.3	.5	.4	.6	.3	.5	.7	.7	1.1	.2	.5	.3
Zircon	.2	Tr.	Tr.	.05	.1	Tr.	.1	Tr.	Tr.	.05	.05	0	Tr.	.04	.06
Allanite	0	0	0	0	Tr.	0	0	0	0	0	0	0	0	Tr.	.....
Rutile	0	Tr.	0	0	0	0	0	0	0	0	0	0	0	Tr.	.....
Tourmaline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.....
Total	100.0	100.0	100.0	100.05	100.0	100.0	100.0	100.0	100.0	100.05	100.05	100.0	100.0	99.74	.....
Femic	11.9	11.8	12.6	12.4	10.6	10.3	12.4	10.1	17.9	12.7	12.6	20.8	10.8	12.9	3.2
Recalc anorthite in plagioclase (plagioclase rims)	28	32-42	5-37	35-42	33-37	28-37	32-34	29-35	33-40	33 (23)	32-37 (20)	32-37	28-31 (20)	28-37 (21)	.....
Quartz mixing index (see text)		.89	.88	.65	.85	.70	.96	.90	.97	.93	.97	.91	.94	.90	.07

Specimen No.	116	117	118	119	120	121	117–121 Mean	±	122	123	124	125	126	127	123–127 Mean	±	67-22, 79-22, 83-22 Mean	±
Field No. [1]	873	874	872	865	877	889			825	908	824	867	869	902				
Rock type	Porphyritic granodiorite								Melanocratic granodiorite									
Quartz	37.5	26.0	21.8	28.5	27.3	20.7	29.8	5.4	16.3	12.2	12.1	8.2	11.0	9.3	10.6	1.8	20.4	6.8
Plagioclase, total	28.9	37.8	47.6	46.0	42.0	43.2	42.3	3.8	34.1	37.3	50.1	47.6	45.5	43.0	45.9	5.1	45.8	5.3
(plagioclase in perthite)	0	(1.9)	(1.9)	(0.2)	(1.1)	(6.2)	(1.0)	(0.8)	(3.0)	(5.6)	(4.8)	(2.4)	(3.3)	(3.0)	(3.8)	(1.3)	(1.7)	(1.5)
Orthoclase	29.9	21.3	18.2	15.3	23.7 [2]	19.8	18.7	3.8	23.7	34.7	16.9	22.1	23.6	28.6	25.2	6.8	21.7	7.3
Sanidine	0	0	0	0	0	0	0	.....	0	0	0	0	0	0	0	.....	.....	.....
Hornblende	.7	4.0	5.5	.05	1.3	8.0	3.8	3.2	11.0	6.5	10.5	11.2	9.2	5.9	8.6	2.5	5.1	3.7
Biotite	2.5	9.2	4.7	9.2	4.6	9.9	7.5	2.6	11.2	4.4	7.3	6.1	7.0	5.9	6.0	1.2	6.1	2.6
Pyroxene	0	0	0	0	0	0	0	.....	0	0	0	0	0	0	0	.....	.....	.....
Magnetite	.3	.9	.9	.8	.7	1.7	.8	.6	1.6	2.3	4.2	2.9	1.7	1.6	1.9	.7	1.4	.6
Apatite	.1	.4	.2	.1	.3	.3	.3	.1	.8	.6	.6	.5	.6	.3	.5	.1	.3	.2
Sphene	.1	.3	1.1	.05	.1	1.3	.6	.6	1.1	1.9	1.0	1.4	1.3	.4	1.2	.6	.6	.5
Zircon	Tr.	.1	.05	.06	Tr.	.1	.06	.04	.15	.1	.15	Tr.	.05	.05	.07	.05	.05	.05
Allanite	0	0	0	0	Tr.	0	Tr.	.....	Tr.	0	.1	Tr.	Tr.	0	Tr.	.....	Tr.	.....
Rutile	0	0	0	0	0	0	0	.....	0	0	0	0	0	0	0	.....	Tr.	.....
Tourmaline	0	0	0	0	0	0	0	.....	0	0	0	0	0	Tr.	Tr.	.....	Tr.	.....
Total	100.0	100.0	100.05	100.0	100.0	100.0	99.86	.....	99.95	100.0	99.95*	100.0	99.95	100.05	99.97	.....	99.95	.....
Femic	2.9	14.9	12.4	10.2	7.0	21.3	13.1	5.4	25.9	15.8	20.9	22.1	19.9	13.1	18.3	3.8	14.0	4.4
Recalc anorthite in plagioclase (plagioclase rims)	0?	30-36	30	27-30 (20)	35 (21)	28-33 (20)	28-35 (20)	.....	0?	37	38-49	36	40	27 (20)	28-49 (20)	.....	28-49 [29-33]	.....
Quartz mixing index (see text)	.97	.86	1.0	.63	.78	.92	.89	.1	.60	.80	.81	.82	.80	.68	.78	.06	.86	.1

[1] Actual sample collection site is at dump ¼ mile southwest of source site shown on map, fig. 2 of final text.
[2] Modal orthoclase includes a little (microcline?).
[3] Hybridized

Table 12. -- Chemical and spectrographic analyses and CIPW norms of Madera Canyon Granodiorite

[Chemical analyses by rapid rock method (Shapiro and Brannock, 1962), with specimen 113 supplemented by X-ray fluorescence method and specimens 118, 124, and 127 supplemented by atomic absorption method. Chemical analysts: Lowell Artis, S.D. Botts, G.W. Chloe, P.L.D. Elmore, John Glenn, H. Smith, and Dwight Taylor. Spectrographic analyses by semiquantitative method. Spectrographic analysts: W.B. Crandell, J.L. Finley, and J.L. Harris. Elements looked for but not found: Ag, As, Au, Bi, Cd, Eu, Ge, Hf, Hg, In, La, Nd, Pd, Pr, Pt, Sb, Sm, Sn, Ta, Te, Th, Tl, U, W, and Zn. Symbols ±, standard deviation; <, less than; ....., not determined; N, not detected]

Specimen No.	110	113	Mean 110-113	117	118	Mean 117-118	124	125	127	Mean 124-127	Mean 110-127	±
Field No.	763	826		871	872		829	867	902			
Rock type	Granodiorite			Porphyritic granodiorite			Melanocratic granodiorite					
Chemical analyses (weight percent)												
SiO_2	67.9	65.7	66.8	68.6	67.5	68.1	60.5	.....	60.4	60.5	65.1	3.7
Al_2O_3	15.6	16.3	16.0	15.2	15.1	15.2	16.5	.....	16.1	16.3	15.8	.6
Fe_2O_3	1.7	2.1	1.9	2.1	2.2	2.2	2.5	.....	2.8	2.7	2.2	.4
FeO	1.4	1.7	1.6	1.2	1.4	1.3	3.3	.....	3.2	3.3	2.0	1.0
MgO	1.4	1.7	1.6	1.0	1.2	1.1	2.3	.....	2.6	2.5	1.7	.6
CaO	3.1	3.8	3.5	3.5	3.6	3.6	4.5	.....	4.0	4.3	3.8	.5
Na_2O	3.6	3.9	3.8	3.6	4.0	3.8	3.7	.....	3.8	3.8	3.8	.2
K_2O	3.8	3.0	3.4	3.2	3.3	3.3	4.1	.....	4.6	4.4	3.6	.6
H_2O-	.11	.12	.12	.12	.14	.13	.09	.....	.07	.08	.11	.02
H_2O+	.81	.62	.72	.51	.52	.52	.78	.....	.65	.72	.65	.13
TiO_2	.42	.55	.49	.58	.66	.62	.98	.....	.99	.99	.72	.24
P_2O_5	.13	.23	.18	.17	.19	.18	.44	.....	.49	.47	.28	.15
MnO	.06	.05	.06	.05	.07	.06	.17	.....	.19	.18	.10	.06
CO_2	<.05	.11	.06	<.05	<.05	<.05	<.05	.....	<.05	<.05	.06	.15
Total	100	100	100	100	100	101	100	.....	100	100	100	.....
Spectrographic analyses (weight percent)												
B	0	0	0	0	0	0	0	0.007	<0	0.002	0.001	0.003
Ba	.07	.1	.09	.1	.1	.1	.015	.015	.015	.015	.06	.04
Be	.0001	0	.00005	0	.00015	.0001	.0002	.0003	.0003	.0003	.00015	.0001
Ce	.01	0	.005	.016	.01	.01	N	N	.05	.05	.01	.02
Co	.0007	.001	.0009	.0005	.0007	.0006	.007	.005	.0015	.005	.002	.003
Cr	.001	.001	.001	.0007	.001	.0009	.0015	.003	.0015	.002	.001	.0007
Cu	.002	.02	.01	.0005	.007	.004	.015	.03	.005	.002	.01	.01
Ga	.001	.001	.001	.0015	.0015	.0015	N	N	.0015	.0015	.0009	.0007
La	.007	.005	.006	.01	.007	.009	.015	.015	.01	.015	.01	.004
Mo	0	.0003	.00015	0	0	0	0	0	0	0	.0004	.0001
Nb	0	0	0	.0003	0	.00015	.003	.007	.0015	.004	.002	.003
Ni	0	<.003	<.003	0	0	0	.015	.003	0	.006	.003	.006
Pb	.0007	.0005	.0006	.03	.0007	.015	.002	.001	.002	.002	.005	.01
Sc	.0007	.0007	.0007	.0007	.0007	.0007	.007	.015	.0015	.008	.004	.005
Sn	0	0	0	.003	0	.0015	0	.0015	0	.0005	.0006	.001
Sr	.05	.07	.06	.07	.05	.06	.015	.01	.05	.03	.05	.02
V	.007	.007	.007	.005	.005	.005	.015	.03	.007	.02	.01	.005
Y	.002	.0015	.002	.0015	.001	.001	.015	.003	.005	.008	.004	.005
Yb	.0002	.0015	.0002	.00015	.0001	.0001	N	N	.0003	.0003	.0003	.0005
Zr	.01	.01	.01	.015	.02	.02	.007	.01	.05	.02	.02	.01
CIPW norms												
Q	23.9	21.6	.....	27.1	23.4	.....	11.0	.....	9.4	.....	.....	.....
C	.36	.54	.....	0	0	.....	0	.....	0	.....	.....	.....
or	22.4	17.7	.....	18.9	19.5	.....	24.2	.....	27.2	.....	.....	.....
ab	30.4	33.0	.....	30.5	33.9	.....	31.3	.....	32.2	.....	.....	.....
an	14.2	16.7	.....	15.9	13.5	.....	16.3	.....	13.3	.....	.....	.....
di wo	0	0	.....	.03	1.2	.....	1.2	.....	1.3	.....	.....	.....
di en	0	0	.....	.03	1.0	.....	.75	.....	.87	.....	.....	.....
di fs	0	0	.....	0	0	.....	.35	.....	.37	.....	.....	.....
hy en	3.5	4.2	.....	2.5	2.0	.....	5.0	.....	5.6	.....	.....	.....
hy fs	.58	.57	.....	0	0	.....	2.3	.....	2.0	.....	.....	.....
mt	2.5	3.0	.....	2.6	2.8	.....	3.6	.....	4.1	.....	.....	.....
hm	0	0	.....	.48	.25	.....	0	.....	0	.....	.....	.....
il	.80	1.0	.....	1.1	1.3	.....	1.9	.....	1.9	.....	.....	.....
ap	.31	.55	.....	.40	.45	.....	1.0	.....	1.2	.....	.....	.....
cc	.11	.25	.....	.11	.11	.....	.11	.....	.11	.....	.....	.....
Total	99.1	99.1	.....	99.6	99.4	.....	99.0	.....	99.6	.....	.....	.....
Fe:mic	7.8	9.6	.....	7.0	9.1	.....	16.2	.....	17.5	.....	.....	.....

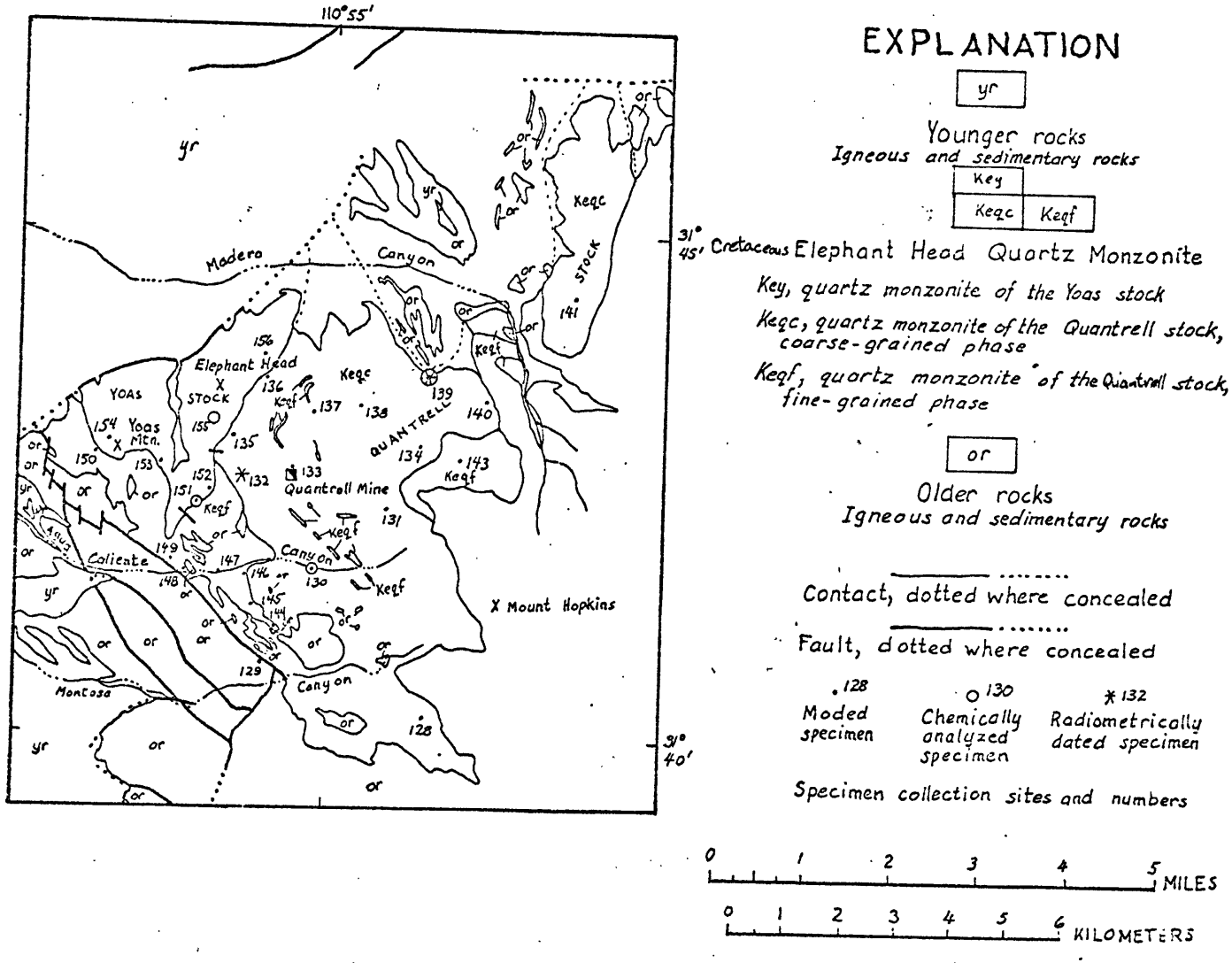


Figure 8.--Distribution of Elephant Head Quartz Monzonite and specimen collection sites.

Head

Table 13 .-- Modes of Elephant Quartz Monzonite

[Field numbers abbreviated; symbols showing year of collection and collectors initial omitted. Full field number of specimen 128 thus is 64D 579. Symbols: $\bar{x}$, standard deviation; Tr., trace; ..... , not determined]

Specimen No.	128	129	130	136	132	138	134	135	126	132	138	139	140	141	142	128-142 Mean	$\bar{x}$	143	144	145	147	148	149	150	143-150 Mean	$\bar{x}$	151	152	153	154	156	156	151-156 Mean	$\bar{x}$	128-156 Mean	$\bar{x}$
Field No.	579	469	701	739	754	749	846	753	688	880	879	876	849	866	801			842	670	698	703	742	740	736	767		747	781	783	785	787	895				
Intrusive mass	Quartrell stock																										Yoas stock									
Rock type	Coarse-grained quartz monzonite																	Fine-grained quartz monzonite									Coarse-grained quartz monzonite									
Quartz	32.1	22.9	23.7	27.2	27.4	32.2	33.3	26.9	24.0	29.9	27.0	16.7	34.8	29.5	27.7	27.8	4.3	35.9	29.3	31.6	25.2	26.1	24.9	25.3	32.7	29.1	3.8	21.6	28.0	20.6	35.5	19.4	27.0	25.4	6.1	27.6	4.6
Plagioclase, total	24.9	37.0	33.4	29.6	30.4	37.8	36.1	52.5	43.3	45.8	26.5	57.7	31.7	36.3	38.1	39.9	6.6	25.2	41.1	39.6	46.7	38.3	33.7	43.5	33.8	37.9	6.8	43.5	30.9	35.0	21.6	39.2	44.6	35.8	8.7	35.9	2.0
(in perthite)	(14.7)	(6.1)	(7.5)	(3.0)	(3.8)	(9.2)	(15.1)	(2.3)	(13.1)	(4.8)	(2.2)	(5.0)	(7.6)	(16.3)	(8.2)	(7.7)	(4.2)	(2.5)	(1.9)	(2.1)	0	(2.6)	(5.0)	(4)	(3.9)	(2.9)	(1.7)	(18.6)	(5.7)	(5.9)	(3.0)	(11.4)	(8.6)	(8.8)	(4.9)	(6.0)	(8.7)
K-feldspar, total	40.2	38.1	39.0	(41.9)	29.5	26.6	29.7	17.3	26.8	22.5	49.0	41.8	34.9	32.1	30.3	34.9	7.3	38.5	25.2	26.0	20.3	31.4	36.8	29.1	32.3	29.2	6.3	27.7	39.8	41.9	42.2	38.8	26.7	36.2	7.1	34.3	7.3
(orthoclase)	(40.7)	0	(39.0)	(41.9)	(29.5)	(26.6)	(29.7)	(16.1)	(26.8)	(22.5)	(49.0)	0	0	0	0	(20.8)	(17.8)	(38.6)	(21.4)	(26.0)	(20.1)	(31.4)	(36.8)	(29.9)	(32.3)	(28.8)	(6.7)	(6.4)	(37.7)	(41.9)	(42.2)	(38.8)	(26.7)	(32.2)	(13.9)	(25.4)	(15.1)
(microcline ?)	0	(38.1)	0	0	(19.7)	0	0	(11.2)	0	0	0	(41.8)	(34.9)	(32.1)	(30.3)	(13.4)	(16.6)	0	(3.8)	0	(2)	0	0	(1)	0	(.5)	1.3	(21.3)	(2.1)	0	0	0	0	(3.9)	(8.6)	(9.0)	(13.7)
Biotite	.8	1.1	3.3	1.1	1.4	2.2	.8	2.6	4.6	1.3	2.9	1.0	1.4	2.1	2.7	1.9	1.1	Tr.	2.6	1.2	5.5	1.7	1.3	5.2	.9	2.4	2.0	2.9	.3	1.2	.6	1.1	1.0	1.1	.7	1.9	1.9
Amphibole	.0	0	0	0	0	.3	0	0	0	0	.6	0	0	0	0	.04	.2	0	0	Tr.	0	0	.2	0	0	.03	.1	2.9	0	0	0	Tr.	0	.5	1.2	.1	.5
Magnetite	1.9	.8	.3	.5	.8	.6	.1	1.1	1.0	.6	.3	.8	.9	.6	.7	.7	.1	.8	1.8	.9	1.3	.9	.6	1.3	.1	1.0	.5	1.1	.6	1.1	Tr.	.8	.7	.7	.4	.8	.9
Apatite	Tr.	.1	.2	.05	.1	.1	Tr.	Tr.	.2	.05	.05	Tr.	.1	Tr.	Tr.	.07	.07	.1	.1	.1	.2	.2	.3	.2	.1	.2	.1	.2	.05	.1	Tr.	Tr.	.05	.07	.07	.09	.08
Sphene	Tr.	Tr.	Tr.	.2	.3	.1	0	.1	.1	.4	Tr.	0	.2	.2	.4	.1	.1	0	Tr.	.4	.8	.3	.5	.3	.05	.3	.3	.6	.3	Tr.	.1	.6	Tr.	.3	.3	.2	.3
Zircon	.1	.05	.05	.1	.1	.1	Tr.	Tr.	.05	Tr.	.1	Tr.	Tr.	0	.05	.05	.04	Tr.	Tr.	Tr.	Tr.	.1	.1	.05	.05	.04	.04	Tr.	.05	.05	Tr.	.1	Tr.	.04	.04	.05	.04
Allanite	0	0	0	0	Tr.	0	0	0	0	0	0	Tr.	0	.2	.05	Tr.	.....	0	0	.2	0	Tr.	0	.05	0	Tr.	.....	.05	Tr.	0	0	Tr.	0	Tr.	.....	Tr.	.....
Monazite (?)	Tr.	0	0	0	0	.05	0	0	0	0	0	0	0	0	0	Tr.	.....	0	0	0	0	0	0	0	0	0	.....	0	0	0	0	0	0	0	.....	Tr.	.....
Pyrite	0	Tr.	0	0	0	0	0	0	0	0	0	0	0	0	0	Tr.	.....	0	0	0	0	0	0	0	0	0	.....	0	0	0	0	0	0	0	.....	Tr.	.....
Tourmaline	0	0	0	0	Tr.	0	0	0	0	0	0	0	0	0	0	Tr.	.....	0	0	0	0	0	0	0	0	0	.....	0	0	0	0	0	0	0	.....	Tr.	.....
Total	100.0	100.05	99.95	100.05	100.0	100.05	100.0	100.0	100.05	100.05	99.95	100.0	100.0	100.0	100.0	100.0	.....	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.1	.....	100.05	100.0	99.95	100.0	100.0	100.05	100.1	.....	99.9	.....
Femic	23	2.0	3.9	1.9	2.7	3.4	.9	3.8	5.9	2.3	5.5	1.8	2.6	3.1	3.9	3.1	1.4	.9	4.4	2.8	7.8	3.2	3.6	7.1	1.2	3.9	2.5	2.2	1.3	3.5	.7	2.6	1.7	2.7	2.3	3.2	1.9
Percent anorthite in plagioclase (plagioclase rims)	0	0-5	0-5	0	0-5	0-5	5-10	0-10	5-10	5	5-10	5-10	10 (4)	5-10	5-10	5±	.....	0-5	0-5	5-10	0-5	5-10	0-5	0-5	0-5?	5±	.....	0-25?	5-10	•	0	0-5	0-5	0-30	.....	5±	.....
Quartz using index (x-test)	.....	93	61	79	88	73	79	57	78	67	90	65	93	90	94	79	13	.....	89	99	95	99	69	95	93	91	11	96	62	38	90	92	68	79	23	81	16

1/ Specimen 129 obtained from mine stump near shaft that bottoms in quartz monzonite.
2/ Specimen 148 obtained from a coarse-grained inclusion in a body of quartz diorite that includes a large mass of fine-grained quartz monzonite

Table 14.--Chemical and spectrographic analyses and CIPW norms of Elephant Head Quartz Monzonite, coarser-grained rocks

[Chemical analyses by rapid rock method (Shapiro and Brannock, 1962), with analyses of specimens 139 and 150 supplemented by atomic absorption. Chemical analysts: Lowell Artis, S. D. Botts, Gus Chloe, P. L. D. Elmore, John Glenn, H. Smith, and Dwight Taylor. Spectrographic analyses by semiquantitative method. Spectrographic analysts: W. B. Crandell and J. L. Harris. Elements looked for but not found: Ag, As, Au, B, Bi, Cd, Eu, Ge, Hf, Hg, In, La, Mo, Na, Nd, Pr, Pt, Re, Sb, Sm, Sn, Ta, Te, Th, Tl, U, W, and Zn. Symbols s, standard deviation; <, less than; and ....., not determined]

Specimen No.	130	139	Mean 130-139	151	155	Mean 151-155	Mean 130-155	s
Field No.	701	676		747	761			
Intrusive mass	Quantrell stock			Yoas stock				
Chemical analyses (weight percent)								
SiO_2	72.2	73.7	72.6	67.2	74.7	71.0	71.6	3.3
Al_2O_3	14.4	13.7	14.1	15.5	13.6	14.6	14.3	.9
Fe_2O_3	1.1	1.5	1.3	1.9	.90	1.4	1.4	.9
FeO	.74	.56	.65	1.2	.36	.78	.72	.36
MgO	.40	.13	.27	1.4	.10	.75	.51	.61
CaO	.75	.70	.73	2.9	.63	1.8	1.2	1.1
Na_2O	4.4	2.9	3.7	4.4	4.0	4.2	3.9	.7
K_2O	4.7	5.7	5.2	3.8	4.7	4.3	4.7	.8
H_2O-	.09	.09	.09	.22	.10	.16	.13	.06
H_2O+	.52	.34	.58	.52	.47	.50	.54	.20
TiO_2	.24	.43	.34	.49	.38	.44	.39	.11
P_2O_5	0	.06	.03	.16	.02	.09	.06	.07
MnO	.13	.05	.09	.10	.05	.08	.08	.04
CO_2	<.05	<.05	<.05	<.05	<.05	<.05	<.05	.....
Total	100	100	100	100	100	100	100	
Spectrographic analyses (weight percent)								
Ba	0.05	0.07	0.06	0.07	0.05	0.06	0.06	0.01
Be	.0005	.0015	.0001	.0003	.0003	.0003	.0003	.0001
Ce	.01	.02	.015	.01	0	.005	.01	.01
Co	0	0	0	.0007	0	.0004	.0002	.0004
Cr	0	0	0	.001	0	.0005	.0003	.0005
Cu	.0002	.00007	.0005	.01	.00003	.005	.003	.005
Ga	.001	.0015	.001	.0015	.0015	.0015	.002	.0003
La	.007	.015	.001	.007	.003	.005	.008	.005
Nb	.0015	.0003	.0009	.001	.001	.001	.001	.0005
Nd	0	.01	.005	0	0	0	.003	.005
Pb	.0005	.003	.002	.001	.001	.001	.001	.001
Sc	.0003	0	.0002	.0007	0	.0004	.0003	.0003
Sr	.01	.01	.01	.05	.005	.03	.02	.02
V	.0007	0	.0004	.005	0	.003	.001	.002
Y	.003	.002	.003	.002	.002	.002	.002	.0005
Yb	.0003	.0002	.0003	.0002	.0002	.0002	.0002	.00005
Zr	.03	.003	.03	.03	.01	.02	.03	.01
CIPW norms								
Q	26.4	33.7	.....	19.7	32.1	.....	.....	.....
C	.84	1.7	.....	0	.95	.....	.....	.....
or	27.8	33.7	.....	22.5	27.6	.....	.....	.....
ab	37.2	24.6	.....	37.3	33.8	.....	.....	.....
an	3.4	2.8	.....	11.3	2.7	.....	.....	.....
di wo	0	0	.....	.71	0	.....	.....	.....
di en	0	0	.....	.62	0	.....	.....	.....
di fs	0	0	.....	.002	0	.....	.....	.....
hy en	1.0	.32	.....	2.9	.25	.....	.....	.....
hy fs	.30	.32	.....	.01	0	.....	.....	.....
mt	1.6	.72	.....	2.8	.22	.....	.....	.....
hm	0	1.0	.....	0	.75	.....	.....	.....
il	.46	.82	.....	.93	.72	.....	.....	.....
ap	0	.14	.....	.38	.05	.....	.....	.....
cc	.11	.11	.....	.11	.11	.....	.....	.....
Total	99.1	99.3	.....	99.3	99.5	.....	.....	.....
Femic	3.5	3.4	.....	8.5	2.1	.....	.....	.....

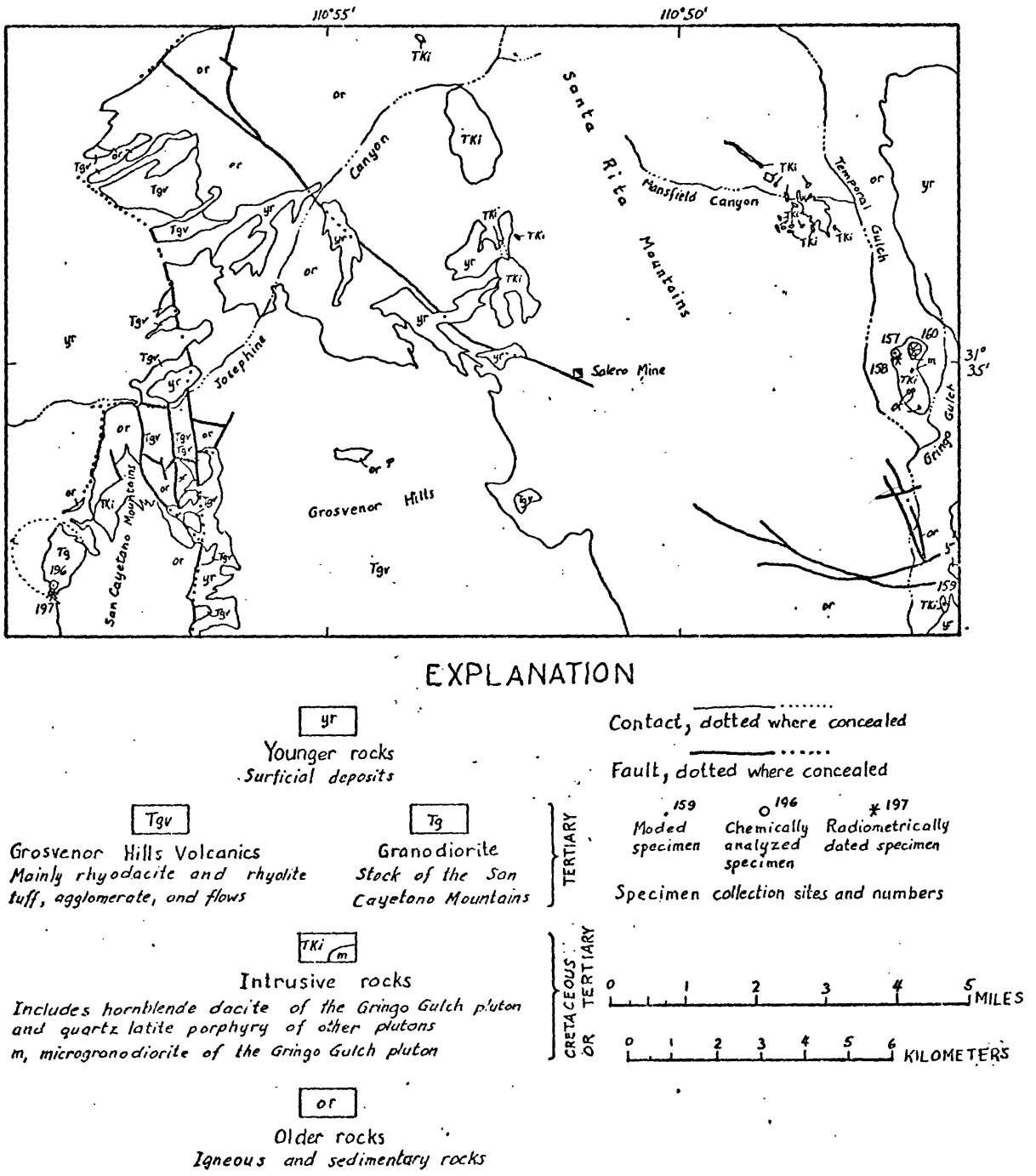


Figure 9.--Distribution of rocks of Gringo Gulch pluton and other rocks, and specimen collection sites.

Table 18.--Modes of Gringo Gulch pluton and a related plug

[Field number is abbreviated; symbols showing year of collection and collector's initial omitted. Full field number of specimen 157 thus is 63D-199. Symbols Tr., trace; ....., not determined]

Specimen No.....	157		158		159	160
Field No.....	199		661		257	281
Intrusive mass	Pluton				Plug	Pluton
Rock type	Hornblende dacite porphyry	Phenocrysts		Phenocrysts		Granodiorite
Quartz.....	1.3	0	4.2	8	0	19.8
Plagioclase.....	73.5	5.0	58.6	21.8	16.8	52.1
Orthoclase.....	9.9	0	18.9	0	0	14.9
Pyroxene (augite?)...	5.0	.5	.7	.3	.5	0
Hornblende.....	3.3	3.3	9.0	5.3	5.8	5.4
Biotite.....	.9	0	2.4	1.0	0	4.7
Magnetite.....	5.5	1.2	5.9	2.6	1.4	2.5
Apatite.....	.6	0	.3	0	0	.4
Sphene.....	Tr.	0	0	0	0	0
Zircon.....	0	0	Tr.	0	0	.2
Allanite.....	0	0	0	0	0	Tr.
Total.....	100.0	10.0	100.0	31.7	18.5	100.0
Femic.....	15.2	5.0	18.3	9.2	7.7	13.2
Percent anorthite in plagioclase.....	60-68		0-37		35-55	35-47
(plagioclase rims)...	(37)		.....			(24)

Table 16.--Chemical and spectrographic analyses and CIPW norms of rocks of the Gringo Gulch pluton

Chemical analyses by rapid rock method (Shapiro and Brannock, 1962), with specimen 157 supplemented by X-ray method chemical analyses: Lowell Artis, S.D. Botts, G.W. Chloe, F.L.D. Elmore, and H. Smith. Spectrographic analyses by semiquantitative method. Spectrographic analyst, J.C. Hamilton. Elements looked for but not found: Ag, As, Au, B, Bi, Cd, Ce, Eu, Ge, Hf, Hg, In, Li, Mo, Nd, Pd, Pr, Pt, Re, Sb, Sm, Sn, Ta, Te, Th, Tl, U, W, and Zn.

Specimen No.	157	160
Field No.	199	281
Rock type	Hornblende dacite porphyry	Micro-granodiorite
Chemical analyses (weight percent)		
SiO_2	59.0	66.9
Al_2O_3	16.3	15.9
Fe_2O_3	3.4	2.7
FeO	2.8	1.4
MgO	2.6	1.4
CaO	4.7	2.8
Na_2O	4.4	4.0
K_2O	2.4	3.2
H_2O-	1.1	.36
H_2O+	1.4	.90
TiO_2	.98	.56
P_2O_5	.21	.18
MnO	.14	.06
CO_2	.12	.10
Total	100	100
Spectrographic analyses (weight percent)		
Ba	0.05	0.15
Be	.0002	0
Co	0	.0007
Cr	0	.001
Cu	.001	.01
Ga	.002	.003
La	0	.005
Nb	.003	0
Ni	0	.0007
Pb	.002	.007
Sc	0	.0007
Sr	.003	.07
V	0	.01
Y	.0015	.002
Yb	.0003	.0002
Zr	.007	.007
CIPW norms		
Q	11.5	24.1
C	0	1.0
or	14.2	18.9
ab	37.2	33.8
an	17.6	12.1
di wo	1.5	0
di en	1.1	0
di fs	.17	0
hy en	5.3	3.5
hy fs	.80	0
mt	4.9	3.1
hm	0	.67
il	1.9	1.1
ap	.50	.43
cc	.27	.23
Total	100.9	98.8
Femic	16.4	8.9

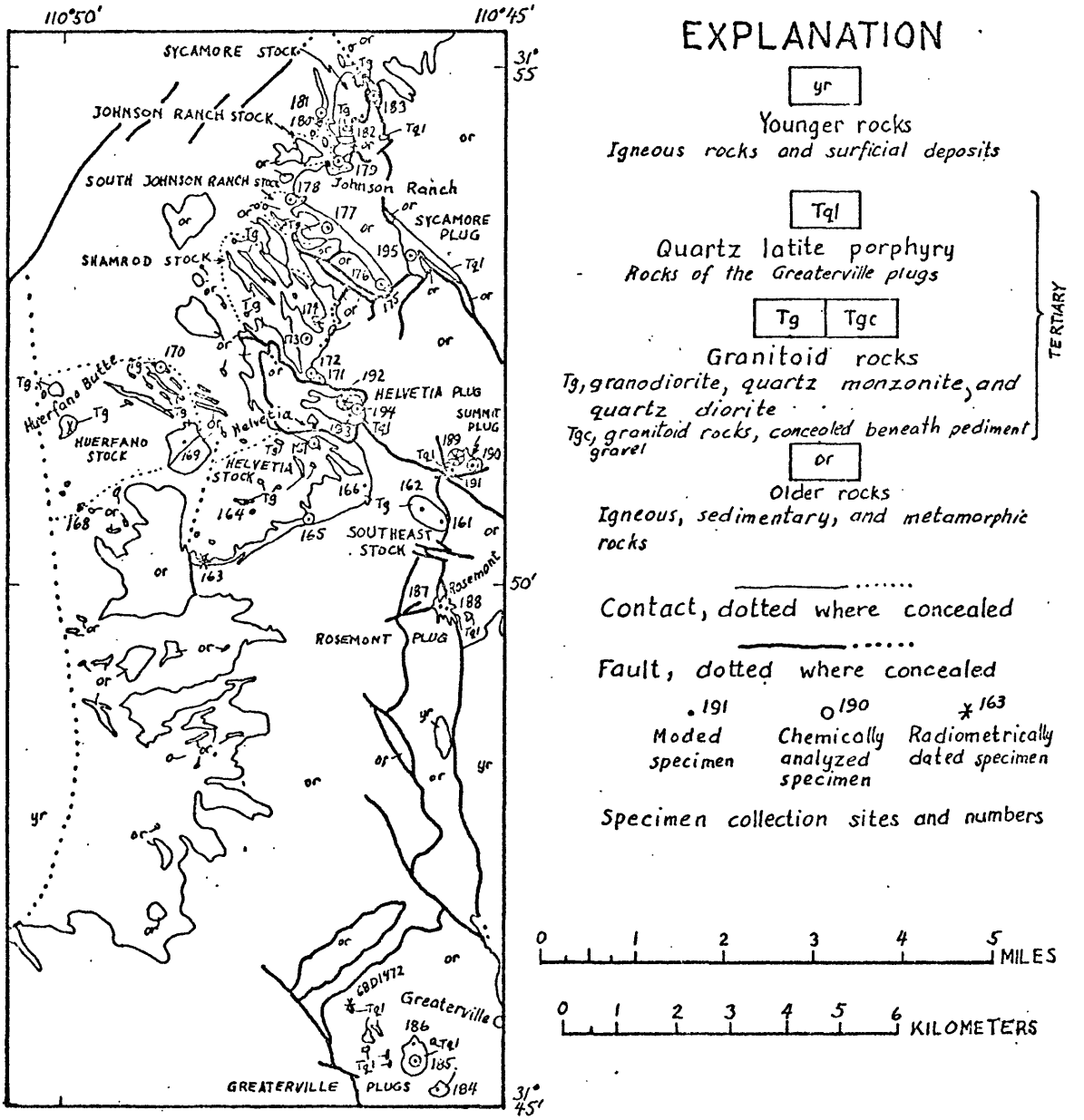


Figure 10.--Distribution of granitoid rocks of the Helvetia stocks and porphyry of the Greaterville plugs, and specimen collection sites.

Table 17.--Modes of granitoid rocks of the Helvetia stocks

[Field numbers abbreviated, symbols showing year of collection and collector's initial omitted. Full field number of specimen (161) thus is 66D 1143. Symbols $\bar{x}$, standard deviation, Tr, trace, ----, not determined]

Specimen No.	161	162	161-162 Mean	163	164	165	166	167	163-167 Mean	168	169	170	168-170 Mean
Field No.	1143	1155		1651	1107	1654	1190	1163		1426	1109	1403	
Intrusive mass	Southeast stock			Helvetia stock						Huerfano stock			
Rock type	Aplite	quartz monzonite		Dominantly granodiorite						Granodiorite			
Quartz	35.2	31.7	33.5	27.7	23.6	31.9	29.5	34.9	29.5	26.1	25.7	34.0	28.6
Plagioclase, total	31.8	42.2	38.8	50.9	49.7	43.7	47.7	46.8	47.8	48.8	48.9	47.7	48.5
(plagioclase in perthite)	(1.0)	(2.2)	(1.1)	(0.4)	(0.9)	(0.6)	0	(1.8)	(0.7)	0	(0.8)	0	(0.3)
K feldspar, total	30.8	19.4	24.5	19.7	25.2	21.6	20.2	15.4	20.4	21.2	20.8	15.3	19.1
(orthoclase)	(30.8)	(19.4)	(24.6)	(19.7)	(25.2)	(21.6)	0	0	(13.1)	(21.2)	1/(20.8)	0	(14.0)
(microcline?)	0	Tr.	Tr.	(0.8)	Tr.	0	(20.2)	(15.4)	(7.3)	0	Tr.	(15.3)	(5.1)
Biotite	1.7	2.9	2.3	1.3	1.3	1.2	2.4	2.3	1.8	3.2	3.6	2.0	2.9
Amphibole	0	0	0	0	0	0	0	0	0	0	0	0	0
Magnetite	.3	1.0	.7	.2	.2	.7	.1	.5	.3	.5	.6	.7	.6
Apatite	Tr.	.2	.1	.05	.05	.3	Tr.	.1	.1	.05	.2	.2	.2
Sphene	.1	Tr.	.05	.2	0	.05	.05	Tr.	.05	.05	.1	.1	.1
Zircon	.1	Tr.	.05	Tr.	0	Tr.	.05	Tr.	Tr.	.1	Tr.	Tr.	.05
Allanite	0	Tr.	Tr.	0	0	0	0	0	0	0	.1	0	.05
Tourmaline (?)	0	Tr.	Tr.	0	0	0	0	0	0	0	0	0	0
Total	100.0	100.0	100.1	100.05	100.05	100.05	100.0	100.0	99.95	100.0	100.0	100.0	100.1
Femic	2.2	4.1	3.2	1.7	1.5	2.8	2.6	2.9	2.3	3.9	4.6	3.0	3.9
Percent anorthite in plagioclase (plagioclase rims)	0-5?	30	-----	13-30	5-10	5-10	25-31 (10)	25 (10)	25-30 (10)	5-10	27 (10)	29 (5)	27-29 (5-10)
Quartz mixing index (see text)				.87	.77	.99	.82	.69	.83	.82	.70	.79	.77

Specimen No.	171	172	173	174	171-174 Mean	175	176	177	178	175-178 Mean	179	180	179-180 Mean
Field No.	1168	1313	1337	1612		1225	1286	1375	1302.6		1390	1406?	
Intrusive mass	Shamrod stock					South Johnson Ranch stock					Johnson Ranch stock		
Rock type	Dominantly quartz monzonite					Granodiorite and quartz monzonite							
Quartz	19.1	23.0	23.0	24.5	22.4	27.5	33.0	29.8	30.8	30.0	37.9	24.2	31.1
Plagioclase, total	54.1	42.6	44.0	41.6	45.6	52.9	38.4	45.7	35.9	43.2	33.3	44.7	39.0
(plagioclase in perthite)	(4.4)	(4.5)	(2.9)	(7.5)	(4.8)	(1.8)	0	0	0	(0.5)	0	0	0
K feldspar, total	24.6	32.1	30.0	30.0	29.2	15.1	23.2	13.0	24.9	19.1	26.4	19.7	23.1
(orthoclase)	0	0	0	0	0	0	0	0	0	0	0	0	0
(microcline?)	(24.6)	(32.1)	(30.0)	(30.0)	(29.2)	(15.1)	(23.2)	(13.0)	(24.9)	(19.1)	(26.4)	(19.7)	(23.1)
Biotite	1.6	1.3	2.6	3.3	2.2	4.2	5.0	10.1	8.0	6.8	2.1	8.9	5.5
Amphibole	0	0	0	0	0	0	0	0	0	0	0	1.0	.5
Magnetite	.4	.8	.2	.3	.4	.2	.3	1.1	.2	.5	.2	.5	.4
Apatite	.1	.2	.2	.2	.2	.05	.05	.2	.2	.1	.05	.3	.2
Sphene	.05	.05	.05	.05	.05	.05	Tr.	0	0	Tr.	.05	.7	.4
Zircon	.05	0	0	.05	Tr.	Tr.	.05	.1	Tr.	Tr.	.05	.05	.05
Allanite	0	0	0	0	0	0	0	0	0	0	0	0	0
Tourmaline (?)	0	0	Tr.	0	Tr.	0	0	0	0	0	0	0	0
Total	100.0	100.05	100.05	100.0	100.05	100.0	100.0	100.0	100.0	100.0	100.05	100.05	100.2
Femic	2.2	2.3	3.0	3.9	2.9	4.5	5.4	11.5	8.4	7.4	2.4	11.4	7.1
Percent anorthite in plagioclase (plagioclase rims)	----- (5)	12	15	----- (5-10)	12-15 (5-10)	24-27	24-29	27	14-17	14-29	13	27-30	27-30
Quartz mixing index (see text)													

Specimen No.	181	182	183	181-183 Mode	181-183 Mean	$\bar{x}$
Field No.	1402	1402	1404			
Intrusive mass	Sycamore stock					
Rock type	Quartz diorite					
Quartz	9.1	15.0	11.5	28.1	5.6	
Plagioclase, total	52.1	57.2	53.2	45.4	5.6	
(plagioclase in perthite)	0	0	0	(1.4)	(2.1)	
K feldspar, total	.8	4.0	2.1	22.1	5.8	
(orthoclase)	0	(4.0)	(1.3)	6.0	(12.0)	
(microcline?)	0	0	(0.8)	(9.7)	(16.2)	(11.6)
Biotite	34.3	23.7	31.4	10.3	3.6	2.7
Amphibole	3.5	0	0	Tr.	----	
Magnetite	1.2	1.3	1.4	.4	.3	
Apatite	.7	.5	.2	.5	.1	.1
Sphene	.2	.1	.1	.1	.1	.2
Zircon	.1	.1	.1	.03	.0	
Allanite	0	0	0	Tr.	----	
Tourmaline (?)	0	0	0	Tr.	----	
Total	100.15	100.05	99.95	100.2	99.83	
Femic	38.1	28.0	33.8	11.3	3.3	
Percent anorthite in plagioclase (plagioclase rims)	5?	30?	32-37	32-50	5-30	
Quartz mixing index (see text)						

1/ Modal orthoclase, specimen 165, includes some sanidine (?).

Table 18.-- Chemical and spectrographic analyses and CIPW norms of granitoid rocks of the Helvetia stocks

[Chemical analyses of specimens 167, 173, 178 and 181 by rapid rock method (Shapiro and Brannock, 1962), supplemented by atomic absorption method; other specimens analyzed by single solution method (Shapiro, 1968). Chemical analysts: Lowell Artis, S. D. Botts, G.W. Chloe, P. L. D. Elmore, John Glenn, J. Kelsey, and H. Smith. Spectrographic analyses by semiquantitative method. Spectrographic analysts: W.B. Crandell and J.L. Harris. Elements looked for but not found: As, Au, B, Bi, Cd, Eu, Ge, Hf, Hg, In, La, Nd, Pd, Pr, Pt, Rb, Sb, Sm, Sn, Ta, Te, Th, Tl, U, W, and Zn. Symbols: ±, standard deviation; <, less than; ....., not determined; Tr., trace]

Specimen No.	165	163	Mean 165-163	170	172	183	Mean 183-183	178	177	176	Mean 178-176	179	181	183	Mean 181-183	165-179 Mean	±
Field No.	1054	1163		1403	1313	1337		1286	1376	1392a		1390	1406b	1404			
Intrusive mass	Helvetia stock			Huerfano stock	Shamrock stock			South Johnson Ranch stock				Johnson Ranch stock	Sycamore stock				
Rock type	Granodiorite and quartz monzonite												Quartz diorite			Granodiorite and quartz monzonite	
Chemical analyses (weight percent)																	
SiO_2	71.1	72.8	72.0	71.9	71.9	71.8	71.9	72.5	71.2	72.3	72.0	73.1	55.4	56.4	55.9	72.9	.7
Al_2O_3	15.1	14.6	14.9	15.2	15.0	15.9	15.5	14.2	14.3	14.7	14.4	14.8	16.9	16.0	16.5	14.9	.5
Fe_2O_3	.94	.96	.95	.50	.68	.78	.73	.59	.40	.53	.69	.50	2.9	3.5	3.2	.69	.2
FeO	.60	.40	.50	.69	.56	.56	.56	.96	.95	.96	1.1	.69	5.7	4.6	5.2	.76	.3
MgO	.43	.33	.38	.35	.25	.36	.31	.58	.40	.46	.48	.36	4.3	3.3	3.8	.46	.2
CaO	1.6	1.4	1.5	2.3	2.0	1.7	1.9	2.3	3.1	1.9	2.4	1.9	6.2	6.3	6.3	2.0	.5
Na_2O	4.5	4.1	4.3	4.3	4.3	4.6	4.5	3.9	3.0	3.6	3.3	3.9	3.4	2.8	3.1	4.0	.5
K_2O	4.0	4.0	4.0	3.7	4.1	3.4	3.8	4.0	3.2	4.0	3.7	3.7	2.2	2.8	2.5	3.8	.3
H_2O-	.12	.14	.13	.20	.11	.13	.12	.21	.20	.10	.17	.36	.18	.33	.26	.57	.6
H_2O+	1.0	.37	.69	.51	.58	.46	.52	.79	.78	.44	.67	.74	.75	.15	1.1	.63	.2
TiO_2	.23	.12	.18	.20	.20	.14	.17	.23	.35	.16	.25	.17	1.1	1.1	1.1	.20	.07
P_2O_5	0	.06	.03	.10	.08	.06	.07	.11	.18	.08	.12	.05	.23	.36	.30	.08	.05
MnO	.11	.05	.08	0	.07	.06	.07	.07	.12	.06	.08	.02	.17	.08	.13	.06	.04
CO_2	.08	<.05	<.05	<.05	<.05	<.05	<.05	.10	<.05	<.05	<.05	<.05	<.05	.94	.47	<.05	<.05
Total	100	99	100	100	100	100	100	100	100	99	100	100	99	100	99	100	
Spectrographic analyses (weight percent)																	
Ag	0	0	0	<.0001	<.0001	0	<.0001	<.0001	<.0001	0	<.0001	<.0001	0	<.0001	<.0001	<.0001	
Ba	.15	.07	.1	.07	.07	.07	.07	.07	.07	.1	.08	.07	.07	.07	.07	.08	.03
Be	.0003	.0002	.0003	.0003	.0002	.0003	.003	.0002	.0002	.0003	.0002	.0003	.0001	.0001	.0001	.0003	.0001
Ca	.01	0	.005	.01	.01	.05	.03	0	0	.02	.01	.01	.01	.01	.01	.01	.02
Co	.0003	0	.0015	0	0	0	0	0	0	0	0	0	.003	.002	.003	Tr.	
Cr	<.0003	0	0	0	0	0	0	0	0	.0003	.0001	0	.0015	.0015	.0015	Tr.	
Cu	.001	.0002	.0006	.0007	.0003	.0002	.0003	.003	.001	.0001	.001	.0005	.02	.01	.015	.0028	.0009
Ga	.0015	.0015	.0015	.001	.001	.0015	.001	.001	.001	.0015	.001	.001	.002	.001	.0015	.001	.0003
La	.007	0	.004	.007	.007	.02	.015	0	.007	.007	.005	.007	.005	.007	.006	.007	.006
Mo	0	0	0	0	0	0	0	0	0	0	0	0	.0003	0	.0002	0	
Nb	.0007	.001	.0009	.002	.001	.001	.001	.001	.001	.001	.001	.001	0	.0007	.0004	.001	.0004
Nd	0	0	0	0	0	0	0	0	0	0	0	0	.005	.003	.004	0	
Pb	.0015	.0007	.001	.0005	.001	.0007	.0009	.001	.001	.002	.001	.002	.0003	.001	.0007	.001	.0008
Sc	.0005	.0003	.0004	0	0	.0003	.0002	.0003	.0003	.001	.0005	0	.002	.001	.0015	.0003	.0003
Sr	.007	.05	.06	.03	.02	.05	.04	.015	.02	.03	.02	.03	.1	.05	.08	.03	.01
V	.0015	.0015	.0015	.0007	.001	.0015	.001	.0015	.002	.002	.002	.0007	.02	.01	.015	.001	.0005
Y	.0015	.002	.002	.003	.002	.002	.002	.003	.003	.003	.003	.003	.005	.003	.004	.003	.0006
Yb	.00015	.0002	.0002	.0003	.0002	.0002	.0002	.0003	.0003	.0003	.0003	.0003	.0005	.0003	.0004	.0003	.00006
Zr	.01	.007	.009	.015	.01	.007	.009	.005	.01	.007	.007	.01	.007	.02	.01	.009	.003
CIPW norms																	
Q	26.0	30.6		27.5	26.8	28.0		31.7	33.3	31.3		31.6	6.3	12.8			
C	.41	1.2		.30	.16	1.9		.59	.81	1.3		1.2	0	0			
or	23.9	23.8		21.3	24.3	20.1		22.6	18.9	23.8		21.8	13.1	16.5			
ab	38.8	34.9		36.4	36.4	38.9		28.8	25.4	30.7		31.0	28.9	23.7			
an	8.1	6.3		10.4	9.1	7.7		10.1	13.9	8.6		8.8	24.5	22.8			
di wo	0	0		0	0	0		0	0	0		0	1.9	.06			
di en	0	0		0	0	0		0	0	0		0	1.1	.04			
di fs	0	0		0	0	0		0	0	0		0	.70	.62			
hy en	1.1	.83		.87	.62	.90		1.9	2.5	1.2		.90	9.6	8.2			
hy fs	0	0		.43	.27	.26		1.1	1.6	1.2		.68	6.9	3.9			
mt	1.4	1.1		.73	.99	1.1		.78	1.5	.77		.44	4.2	5.1			
hm	0	.20		0	0	0		0	0	0		0	0	0			
il	.46	.23		.38	.38	.27		.44	.67	.31		.32	2.1	2.1			
ru	0	0		0	0	0		0	0	0		0	0	0			
ap	0	.14		.24	.19	.14		.26	.43	.19		.12	.55	.85			
cc	0	.11		.11	.11	.11		.23	.11	.11		.11	.11	2.1			
Total	100.2	99.9		99.3	99.3	99.3		99.0	99.1	99.5		99.0	99.0	98.2			
Fmaf	3.0	2.6		2.8	2.6	2.8		4.2	6.8	3.8		2.6	24.2	22.4			

Table 19.--Modes of quartz latite porphyry of the Greaterville plugs

[Field number is abbreviated; symbols showing year of collection and collector's initial omitted. Full field number of specimen 184 thus is 65-D894. Symbols: s, standard deviation; Tr., trace; and ----, not determined; a (?) following number indicates uncertainty in reported value; a (?) preceding number indicates uncertainty in identification of position within crystal]

Specimen No.	184	185	186	184-186 Mean	1/187	1/188	187-188 Mean	189	190	191	189-191 Mean	192	193	194	192-194 Mean	195	184-195 Mean	s
Field No.	894	893	921		1098	1129		1185	1183	1209		1245	1244	1236		1224		
Intrusive mass.	Plugs at Greaterville				Rosemont plug			Summit plug				Helvetia plug				Sycamore plug		
Quartz	20.9	22.9	24.4	22.7	22.8	29.6	26.2	27.9	26.1	21.0	25.0	24.1	30.6	21.8	25.5	25.2	24.8	3.2
Plagioclase, total	47.1	45.2	56.1	49.5	41.5	43.5	42.5	41.9	37.0	47.0	42.0	44.9	43.4	42.0	43.4	45.3	44.6	4.6
(plagioclase in perthite)	(0.3)	(Tr.)	(Tr.)	(0.1)	0	0	0	(Tr.)	(Tr.)	0	Tr.	(Tr.)	0	(1.6)	(0.5)	3.1	(0.4)	1.0
K feldspar, total	26.6	26.3	13.6	22.2	33.0	23.2	28.1	26.3	31.8	27.6	28.6	27.4	22.4	33.0	27.6	26.2	26.5	5.3
(sanidine)	0	0	0	0	0	0	0	(26.3)?	(31.8)	(27.0)	(28.6)	(27.4)?	(22.4)?	(33.0)	(27.6)	(26.2)	(16.2)	(4.5)
(orthoclase)	(26.6)	(26.3)	(13.6)	(22.2)	(33.0)	(23.2)	(28.1)	0	0	0	0	0?	0?	0?	0	0	(11.6)	(13.7)
(microcline)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	(Tr.)	(Tr.)	----
Biotite	4.2	3.9	4.2	4.1	2.1	2.7	2.4	3.0	3.3	3.5	3.3	2.7	2.2	1.8	1.9	2.9	3.0	.8
Magnetite	.3	1.1	.2	.5	.6	.8	.7	.7	1.3	.8	.9	.3	1.0	1.1	.8	.1	.7	.4
Pyrite	0	0	1.2	.4	0	Tr.	Tr.	0	0	0	0	Tr.	0	Tr.	Tr.	Tr.	.1	.1
Apatite	Tr.	.3	.2	.2	Tr.	.1	.05	.2	.2	.1	.2	.4	.1	.05	.2	.2	.2	.1
Sphene	.8	.2	.1	.4	Tr.	.05	Tr.	Tr.	.2	Tr.	.07	.1	.3	.3	.2	.1	.2	.2
Zircon	.1	.05	Tr.	.05	Tr.	Tr.	Tr.	Tr.	.1	Tr.	Tr.	.05	Tr.	Tr.	Tr.	0	Tr.	----
Allanite	0	.05	0	Tr.	0	0	0	0	0	0	0	.05	0	Tr.	Tr.	0	Tr.	----
Rutile	0	0	0	0	Tr.	.1	.05	0	0	0	0	0	0	Tr.	Tr.	0	Tr.	----
Total	100.0	100.0	100.0	100.05	100.0	100.05	100.0	100.0	100.0	100.0	100.07	100.0	100.0	100.05	99.6	100.0	100.1	----
Femic	5.4	6.6	5.9	5.7	2.7	3.7	3.2	3.9	5.1	5.4	4.5	3.6	3.6	3.2	3.2	3.3	4.3	1.1
Percent anorthite in plagioclase	?0-10	29-37	32-34	29-37	27	----	27	20-28	23	?12	20-28	25?	12	23-24	23-25	?10	20-37	----
(plagioclase rims)	----	(23)	(24)	(?5-24)	----	----	----	----	----	----	(?12)	----	----	(10)	(?11)		(5-24)	----
Quartz mixing index (see text)	.75	.84	.87	.82	----	----	----	.86	----	.81	.84	.94	.98	.92	.95	.77	.86	.08

1/ Modes of specimens 187 and 188 are less reliable than those of the others because they are finer grained and more strongly altered. Quartz : K-feldspar ratio of specimen 183 adjusted 15 percent, based on ratios typical of this group of rocks.

Table 20.--Chemical and spectrographic analyses and CIPW norms of quartz latite porphyry of the Greaterville plugs

[Chemical analyses of specimen 185 by single solution method (Shapiro, 1963); other specimens analyzed by rapid rock method (Shapiro and Brannock, 1962), supplemented by atomic absorption method. Chemical analysts: Lowell Artis, S. D. Botts, G. W. Chloe, Fl. D. Elmore, John Glenn, J. Kibey, and H. Smith. Spectrographic analyses by semiquantitative method. Spectrographic analyst: J. L. Harris. Elements looked for but not found: As, Au, B, Bi, Cd, Co, Eu, Ge, Hf, Hg, In, Li, Nd, Ni, Pd, Pr, Pt, Re, Sb, Sm, Sn, Ta, Te, Th, Tl, U, W, and Zn. Symbols: ±, standard deviation; <, less than; . . . ----, not determined]

Specimen No.	185	189	190	Mean 189-190	192	194	Mean 192-194	195	Mean 185-195	±
Field No.	893	1185	1183		1245	1236		1224		
Intrusive mass	Plug at Greaterville	Summit plug			Hetretia plug			Sycamore plug		
Chemical analyses (weight percent)										
SiO_2	1/69.4	72.5	72.2	72.4	2/72.9	72.6	72.8	70.9	71.8	1.3
Al_2O_3	16.0	14.4	14.7	14.6	14.2	14.4	14.3	15.0	14.8	.7
Fe_2O_3	1.8	1.2	1.2	1.2	.86	.94	.90	.78	1.1	.4
FeO	.82	.36	.52	.44	.76	.60	.68	.84	.65	.2
MgO	.51	.46	.46	.46	.49	.47	.48	.58	.50	.05
CaO	2.3	1.7	1.2	1.5	1.4	1.6	1.5	2.3	1.8	.5
Na_2O	4.2	3.8	3.5	3.7	4.2	4.2	4.2	3.7	3.9	.3
K_2O	3.5	4.4	4.6	4.5	4.0	3.9	4.0	3.8	4.0	.4
H_2O-	.21	.17	.08	.13	.09	.05	.05	.22	.13	.1
H_2O+	.89	.67	.74	.71	.51	.57	.51	.98	.72	.2
TiO_2	.39	.14	.17	.16	.15	.15	.15	.16	.19	.1
P_2O_5	.14	.07	.08	.08	.08	.06	.07	.11	.09	.03
MnO	.06	.02	.07	.05	.03	.04	.04	.16	.06	.05
CO_2	.05	<.05	<.05	<.05	<.05	<.05	<.05	.28	.05	.01
Total	100	100	100	100	100	100	100	100	100	
Spectrographic analyses (weight percent)										
Ag	3/0	0	<.0001	<.0001	4/0	<.0001	<.0001	<.0001	<.0001	----
Ba	.1	.07	.1	.09	.07	.07	.07	.07	.08	.02
Be	.0001	.0003	.0003	.0003	.0003	.0002	.0003	.0002	.0002	.00008
Ce	.01	.03	0	.015	.02	.03	.03	.01	.02	.01
Cr	0	.0003	0	.00015	.002	0	.001	0	.0004	.0006
Cu	.0003	.05	.15	.1	.015	.07	.04	.0003	.05	.06
Ga	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.001	.0015	.0002
La	.005	.01	0	.005	.007	.01	.009	.007	.007	.004
Mo	.0003	.0003	0	.00015	0	0	0	.0003	.00015	.00015
Nb	.001	.001	.001	.001	.001	.001	.001	0	.0008	.0004
Pb	.0003	.0007	.0007	.0007	.0005	.0003	.0004	.001	.0006	.0003
Sc	.0005	.001	.0003	.0007	.0007	.0003	.0005	.0003	.0005	.0003
Sr	.05	.03	.03	.03	.03	.03	.03	.015	.03	.01
V	.003	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.002	.0016
Y	.002	.002	.0015	.0002	.0015	.002	.0002	.002	.002	.0003
Yb	.0002	.0002	.00015	.0002	.00015	.0002	.0002	.0002	.0002	.00003
Zr	.015	.007	.01	.009	.01	.007	.009	.01	.01	.003
CIPW norms										
Q	26.3	29.6	31.5	----	29.7	29.5	----	29.8	----	----
C	1.6	.58	2.1	----	.73	.62	----	1.5	----	----
or	20.6	26.0	27.3	----	23.7	23.1	----	22.5	----	----
ab	35.4	32.2	29.7	----	35.7	35.7	----	31.4	----	----
an	10.2	7.7	5.1	----	6.1	7.3	----	8.9	----	----
di wo	0	0	0	----	0	0	----	0	----	----
di en	0	0	0	----	0	0	----	0	----	----
di fs	0	0	0	----	0	0	----	0	----	----
hy en	1.3	1.1	1.2	----	1.2	1.2	----	1.9	----	----
hy fs	0	0	0	----	.50	.15	----	.93	----	----
mt	1.7	.82	1.4	----	1.3	1.1	----	1.1	----	----
hm	.62	.64	.23	----	0	0	----	0	----	----
il	.74	.27	.32	----	.29	.29	----	.36	----	----
ap	.33	.17	.19	----	.19	.14	----	.26	----	----
cc	.11	.11	.11	----	.11	.11	----	.64	----	----
Total	98.9	99.2	99.2	----	99.5	99.5	----	98.7	----	----
Femic	4.8	3.1	3.5	----	3.6	3.3	----	4.6	----	----

1/ Average of two replicate analyses.
2/ A replicate analysis shows Fe_2O_3, 0.28; FeO, 1.2; MgO, 0.24; CaO, 2.1; P_2O_5, 0.15; and other minor differences.
3/ A replicate analysis shows Cu, 0.03; Ni, 0.0005; Pb, 0.002; Sc, 0.003; Mo and Be, not detected; and other minor differences.
4/ A replicate analysis shows Ag <0.0001; La, 0.003; Pb, 0.005; Sc, 0; and other minor differences.

Table 21.--Modes of granodiorite of the San Cayetano stock

[Field numbers are abbreviated; symbols showing year of collection and collector's initial omitted. Full field number of specimen 196 thus is 64D570. Symbol Tr., trace]

Specimen No.	196	197	196-197 Mean
Field No.	570	687	
Quartz	23.2	22.4	22.8
Plagioclase, total	50.6	47.7	49.2
(in perthite)	(Tr.)	0	(Tr.)
Orthoclase	15.4	20.7	18.1
Hornblende	4.5	3.2	3.9
Biotite	6.2	5.3	5.3
Magnetite	.8	.4	.6
Apatite	.2	.2	.2
Sphene	.1	.1	.1
Zircon	.05	Tr.	Tr.
Total	100.05	100.0	100.2
Femic	10.8	9.2	10.0
Percent anorthite in plagioclase	32-35	29-32	29-35
Quartz mixing index (see text)	.99	.94	.97

Table 22.--Chemical and spectrographic analyses and CIPW norm of granodiorite of the San Cayetano stock

[Chemical analysis by rapid rock method (Shapiro and Brannock, 1962) supplemented by X-ray fluorescence method. Chemical analysis: Lowell Artis, S.D. Botts, and P.L.D. Elmore. Spectrophic analysis by semiquantitative method. Spectrographic analysis by A.L. Sutton, Jr. Elements looked for but not found: Ag, As, Au, B, Bi, Cd, Ce, Eu, Ge, Hf, Hg, In, Li, Mo, Nb, Nd, Pd, Pr, Pt, Re, Sb, Sm, Sn, Ta, Te, Th, Tl, U, W, and Zn. Symbol <, less than]

Specimen No.	196
Field No.	570
Chemical analysis (weight percent)	
SiO_2	69.5
Al_2O_3	15.2
Fe_2O_3	1.0
FeO	1.1
MgO	1.4
CaO	3.2
Na_2O	4.4
K_2O	2.8
H_2O-	.27
H_2O+	.58
TiO_2	.31
P_2O_5	.14
MnO	.09
CO_2	<.05
Total	100
Spectrographic analysis (weight percent)	
Ba	0.1
Be	.0002
Co	.001
Cr	.007
Cu	.0005
Ga	.002
La	.003
Ni	.005
Pb	.0015
Sc	.001
Sr	.07
V	.007
Y	.002
Yb	.00015
Zr	.01
CIPW norm	
Q	24.6
or	16.5
ab	37.2
an	13.5
di wo	.42
di en	.16
di fs	.10
hy en	3.0
hy fs	.66
mt	1.5
il	.59
ap	.33
Total	99.1
Femic	7.3

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