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Mafic Inclusions, Aggregates, and Dikes in Granitoid Rocks, Central Sierra Nevada Batholith, California—Analytic Data

By BERNARD BARBARIN, F.C.W. DODGE, R.W. KISTLER, and P.C. BATEMAN

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By Bernard Barbarin,[1] F.C.W. Dodge, R.W. Kistler, *and* P.C. Bateman

ABSTRACT

Analytic data are reported herein for a comprehensively studied suite of samples of mafic inclusions, aggregates or schliere, and dikes and their host granitoids from 12 localities in the central Sierra Nevada. Modes are given for 61 of the samples, and major-element oxides and selected trace-element concentrations are tabulated for 81. Chemical analyses are presented for coexisting hornblendes and biotites in the inclusions, dikes, aggregates, and their host granitoids.

INTRODUCTION

During the past 25 years, analytic data on granitoid rocks of the central Sierra Nevada have been included in numerous reports of the U.S. Geological Survey by geologists studying 15-minute quadrangles in the region between latitudes 37° and 38° N. (for example, Bateman, 1965a; Bateman and Busacca, 1983; Bateman and others, 1984; Bateman and Lockwood, 1970, 1976; Bateman and Wones, 1972a; Dodge and Calk, 1986). These data are typical of large parts of mapped granitoid bodies of the Sierra Nevada batholith. However, many of these large granitoid units contain mafic inclusions, streaky aggregates, and dikes that generally have not been collected and analyzed. This report provides modal, chemical, and isotopic data on such rocks and their hosts, and it provides chemical data on constituent hornblendes and biotites from a dozen localities selected from four mapped granitoid units. Limited additional data were obtained on samples taken from other localities; however, these data are incomplete and are not included herein.

Recent reports on the Sierra Nevada have referred to dark, fine-grained clots as "mafic inclusions" or "mafic enclaves" to avoid any genetic implications. Similar inclusions have been called basic concretions, autoliths, xenoliths, magmatic enclaves, or other names that usually have a genetic connotation. These inclusions, although variable in size, have well-defined shapes, are generally in sharp contact with their hosts, and typically are distinctly finer grained than their hosts. Less-compact aggregates of mafic minerals commonly have diffuse, irregular outlines and may show little difference in grain size compared with their hosts. Both gradations and abrupt discontinuities are present between aggregates and host granitoids, but only abrupt discontinuities are present between inclusions and host granitoids. Streaky aggregates consisting principally of mafic minerals are locally associated with the inclusions. Although all elongate mafic aggregates or segregations, including elongate inclusions, could be included under the term "schlieren," geologists in the Sierra Nevada have followed the usage of Cloos (1936), who restricted the term to composite layers within plutons that grade from mafic, fine-grained rock to more felsic, coarser grained rock. Therefore, we have simply called all irregular, streaky concentrations of mafic minerals, whether or not layered, aggregates. Mafic dikes occur as both continuous and fragmental sheetlike or tabular bodies that commonly cut primary foliations, whereas inclusions commonly define the foliations.

A Ph.D. thesis study by Adolf Pabst over 60 years ago resulted in the publication of his often-cited classic paper on inclusions in Sierra Nevada granitoids (Pabst, 1928). More recently, these mafic inclusions have been the prime subject of a few studies (Link, 1968; Reid and others, 1983; Furman and Spera, 1985), but they have also been mentioned in several broader investigations (Bateman, 1965b, in press; Loomis, 1983; Moore, 1963; Noyes and others, 1983; Piwinskii, 1968; Sherlock and Hamilton, 1958). The present study began when P.C. Bateman and F.C.W. Dodge started collecting inclusions and associated rocks as an adjunct to regional studies in the central Sierra Nevada. Subsequently, Bernard Barbarin collected additional samples from localities in regions mapped by Bateman, Dodge, and other U.S. Geological Survey geologists (Bateman, 1965a; Bateman and Busacca, 1982; Bateman and others, 1971; Bateman and Wones, 1972b; Dodge and Calk, 1987; Lockwood

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and Bateman, 1976) and conducted an intensive study of all collected samples. Barbarin's work was done while he was the recipient of a "Lavoisier" grant from the French government and with U.S. Geological Survey support.

OCCURRENCE AND DISTRIBUTION

Mafic inclusions, although widespread, are almost exclusively restricted to hornblende-bearing granitoids and are most common in felsic tonalites and mafic granodiorites. Commonly they are uniformly distributed over broad areas, although local concentrations are not uncommon. Local accumulations mainly occur near contacts of one granitoid body with another, but they are also found far from contacts. In compositionally zoned granitoid bodies, the abundance of inclusions commonly varies sympathetically with the mafic mineral content of the host, generally decreasing from margins to interiors of granitoid bodies. Moore (1963, p. 119) showed that thicker plutons have smaller proportions of inclusions than thinner ones, regardless of mafic mineral content. Inclusion abundance and age are not apparently correlative; inclusions are present in rocks ranging from Late Triassic to Late Cretaceous, the entire age span of granitoids in the central Sierra Nevada.

Unlike mafic inclusions, streaky aggregates of mafic minerals are locally concentrated in granitoids of all compositions; the occurrence of these aggregates rarely exceeds such local concentrations. Zones of aggregates are most common near contacts between granitoids of markedly different compositions or near contacts of granitoids with country rocks, but they also occur within plutons, far from external contacts. Mafic inclusions are typically associated with the aggregates, particularly near contacts and where the host granitoid composition is appropriate.

Mafic dikes occur sporadically, singly, and in small groups as well as in large, pervasive multitudes, as in the Independence and Sonora dike swarms (Moore and Hopson, 1961; Schweickert and Bogen, 1983). Dikes may be common in one part of a pluton but sparse or nonexistent elsewhere, and they are totally absent in many plutons, particularly those that are felsic. Typically, individual dikes are a few centimeters to a few meters thick and generally are vertical or dip gently, as along Stevenson Creek, a tributary of the San Joaquin River. Most dikes have sharp walls that cut across the foliation of enclosing rocks, although some appear to have been deformed and cleaved along with their hosts. Rarely, as at Hetch Hetchy, the dikes are disrupted or broken up into inclusion-like bodies, although such dikes maintained their original continuity. Some dikes are net veined with felsic aplitic material that may compose a large portion of the dike. Contacts between the felsic and mafic parts of these dikes are typically crenulate.

SAMPLING AND ANALYTICAL METHODS

Various numbering schemes were used when samples were originally collected. For consistency, samples were redesignated using a uniform system. The first two letters reflect the sample locality (see Table 1). These capital letters are followed by the number of samples collected from the locality; a lowercase letter following a number indicates whether more than one sample, and how many, have been collected from a single dike or inclusion. The alphanumeric string is followed by a dash and a capital letter designating sample type: H, host granitoid; A, aggregate; D, dike; I, inclusion; G, gabbroid; AP, aplite. For some samples this letter is followed by "m" or "c" indicating the margin or core of an inclusion or by "x" or "i" indicating exterior or interior of a dike. Thus, MHb9b-Ic refers to the core of an inclusion collected from Camp 61.

Location and the distribution of rock units from which samples were taken are given in table 1 and shown in figure 1. The size of sampled outcrop varies but typically is within an area of tens of square meters or less.

Modal analyses of medium- to coarse-grained rocks were determined by combining the point counts of selectively stained rock slabs (Norman, 1974) with those of thin sections; modal analyses of fine-grained rocks were determined from thin sections only. Sixty-one modal analyses, including 33 of inclusions, 13 of host rocks, 7 each of mafic aggregates and dike rocks, and 1 gabbro, are given in table 2. Chemical and trace-element analyses of 39 mafic inclusions, 15 host rocks, 14 dike rocks, 10 mafic aggregates, 1 aplite, 1 gabbro, and 1 hornfels inclusion are given in table 3; CIPW norms computed from the chemical analyses are given in table 4. All samples were thoroughly examined and carefully prepared to ensure that only the designated rock type was contained in the analyzed material.

Electron microprobe analyses of biotite and hornblende, 67 of each mineral, are given in tables 5 and 6. Each quoted analysis represents the mean of three to nine individual analyses of mineral grains from a specific rock type within a sample. Whenever possible, microprobe mounts were prepared to include parts of host rock, inclusion, and aggregate so that minerals from all the rock types could be analyzed from a single mount. Separate analyses are presented for hornblendes and biotites from cores or darker areas of a few inclusions.

The modal amounts of plagioclase, mafic plus accessory minerals, and quartz plus potassium feldspar, and the amounts of plagioclase, quartz, and potassium feldspar recalculated to 100 percent are plotted on ternary diagrams (fig. 2). Similarly, percentage of normative albite plus anorthite, quartz plus orthoclase, and all other constituents, and the percentage of normative albite plus anorthite, quartz, and orthoclase recalculated to 100 percent are plotted (fig. 3). In addition, the amounts of the mutually exclusive normative constituents olivine or quartz and diopside or corundum, indicators of silica and alumina under- or oversaturation, are shown in figure 4.

A total of 65 strontium and 11 neodymium isotopic analyses of host rock, inclusions, mafic aggregates, and dike rocks are given in tables 7 and 8, respectively. Errors reported are within two standard deviations of the mean. Values of $^{87}Sr/^{86}Sr$ are normalized to a value of $^{86}Sr/^{88}Sr=0.1194$ and replicate analyses of $SrCO_3$ standard NBS 987 give a value of $^{87}Sr/^{86}Sr=0.710236\pm3$. Values of $^{143}Nd/^{144}Nd$ are normalized to a value of $^{146}Nd/^{144}Nd=0.7219$ and replicate analyses of USGS rock standard BCR–1 give a value of $^{143}Nd/^{144}Nd=0.512642$.

HOST ROCKS

Compositions of host rocks are restricted to but span the entire granodiorite and tonalite fields. The amount of mafic minerals generally ranges between 10 and 25 percent, although it is greater for a few of the samples. Silica contents range between 60 and 70 weight percent and potassium-oxide contents range between 1.7 and 4.0 percent. Norms of the host rocks are more closely clustered on the ternary diagrams than are the modes. All the granitoid hosts are quartz normative and most are weakly alumina saturated, falling within the field defined by norms of other Sierra Nevada plutonic rocks. Trace-element contents are similar to those reported by Dodge and others (1982) for hornblende-bearing Sierra Nevada granitoid rocks.

AGGREGATES

Because of their inherent inhomogeneity, analytical data of the mafic aggregates or schliere are difficult to evaluate. Commonly, the analytical data overlap those of the other groups and all plots show considerable scatter.

INCLUSIONS AND DIKE ROCKS

Modes of inclusions tend to plot along the plagioclase-quartz join of the quartz-potassium feldspar-plagioclase diagram within the diorite, quartz diorite, and tonalite fields. Mafic and accessory minerals make up less than 25 to more than 60 volume percent of the inclusions but generally are between 30 and 55 percent. On the triangular plot of all constituents, the modes of host rocks and inclusions form an arcuate field with mafic inclusions forming the end of the field closer toward mafic plus accessory minerals and their hosts forming the end closer toward quartz plus alkali feldspar. Although the field is continuous, there is little overlap between the two groups. A similar relation is shown by norms, although norms are displaced toward the quartz plus orthoclase corner, which reflects the content of potassium in biotite in computing normative orthoclase. Also, at least in part because of biotite, the inclusions tend to lie on or near the orthoclase-albite plus anorthite join of the quartz-albite plus anorthite-orthoclase diagram, even though all the inclusions contain at least minor or trace amounts of modal quartz. In fact, about half the inclusions are olivine normative. Only two quartz-normative inclusions contain normative corundum. Silica contents range from 46 to 63 weight percent and generally are between 50 and 60 percent, and potassium-oxide contents range from 0.72 to 3.93 percent but commonly are between 1.5 and 2.5 percent. Of the trace elements, the "compatible" or transition elements Sc, V, Cr, and Co are concentrated in inclusions relative to host rocks. Concentration of Zr is about the same in inclusions as in host rocks. Concentration of Ba tends to be lower in inclusions, but concentration of Rb is generally greater. Rare-earth elements are commonly less fractionated in inclusions than in the host granitoids, and La/Yb ratios of the inclusions are about half those of the hosts, although total rare-earth-element contents are greater in the inclusions.

Generally, the analytic data on samples of mafic dikes are similar to those of the mafic inclusions, particularly the more quartz-rich inclusions.

MINERAL COMPOSITIONS

Biotite and hornblende in mafic inclusions, dikes, and aggregates have the same chemical composition as in the contiguous granitoids, regardless of differences in grain size, morphology, crystal habit, or location within the inclusions. Atomic Fe/Fe+Mg ratios clearly show this relation. Where compositions of the mafic minerals change from one locality to another within a pluton, parallel changes occur within the inclusions. These compositional variations also occur in biotite and hornblende from closely spaced inclusion-granitoid pairs from the same locality.

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FIGURES 1–4; TABLES 1–8

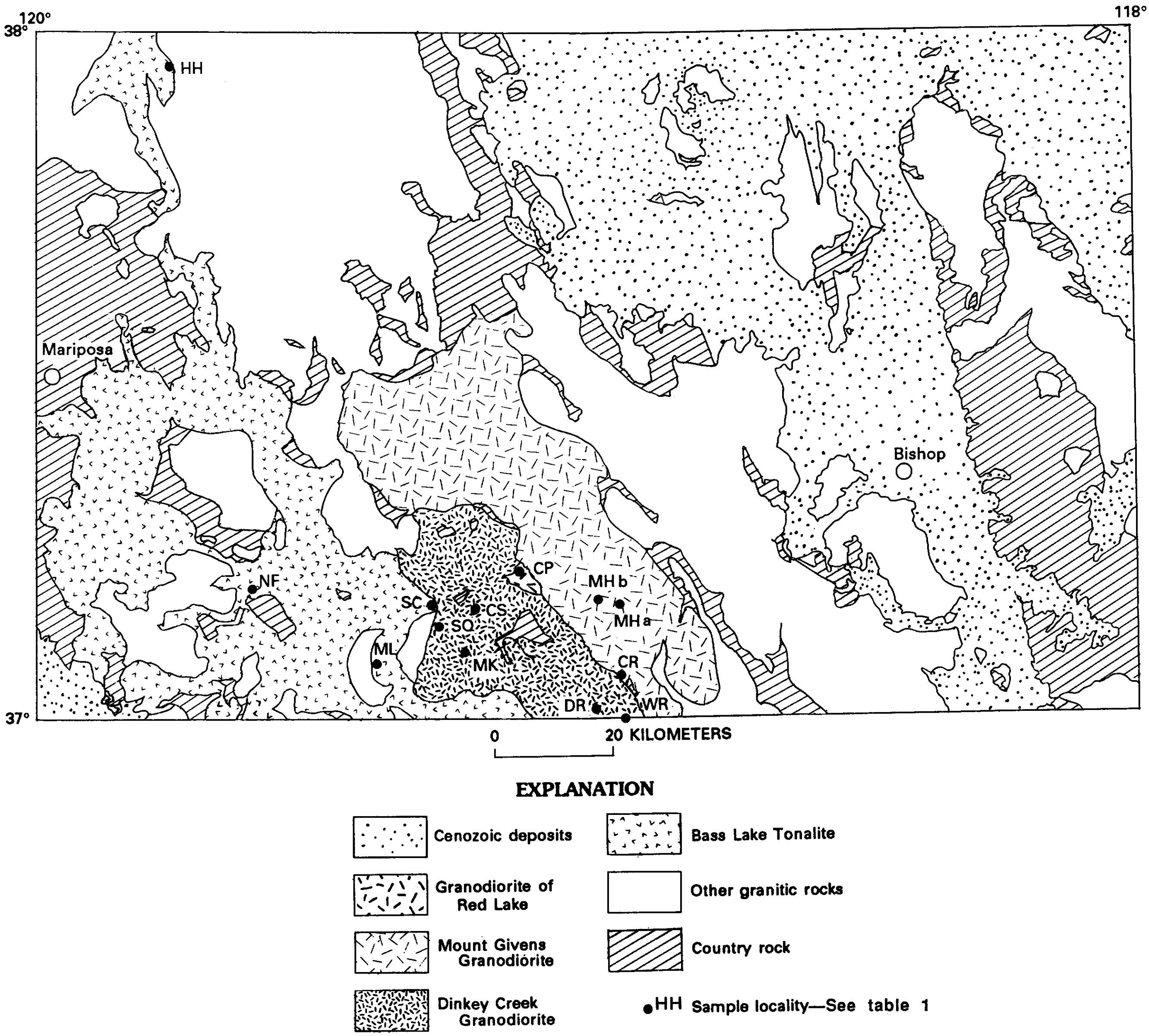

Figure 1. Simplified geologic map of the Sierra Nevada between latitudes 37° and 38° N. showing distribution of granitoid rock units and locations from which samples were taken.

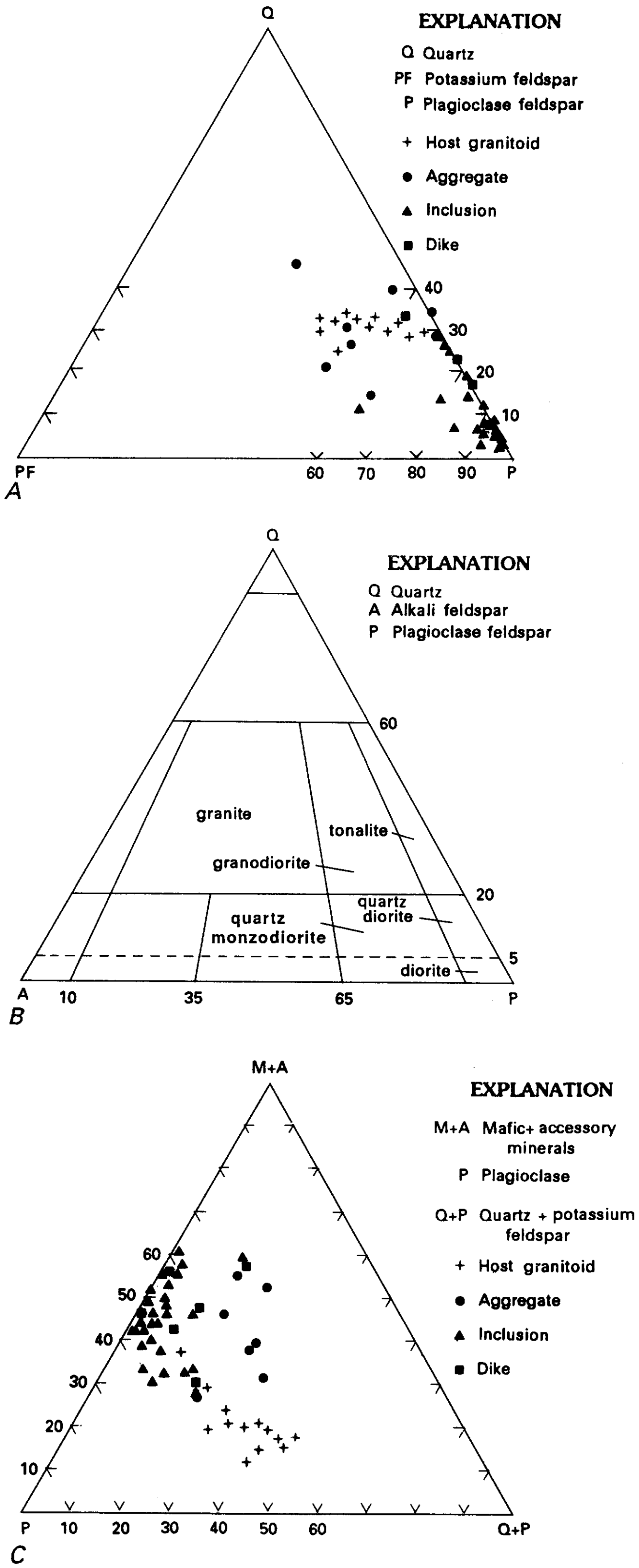

Figure 2. Modal plots of mafic inclusions, aggregates, dikes, and their host granitoids. *A*, Plot on plagioclase-quartz-potassium feldspar diagram. *B*, Classification from Streckeisen and others (1973). *C*, Plot on diagram of all modal constituents.

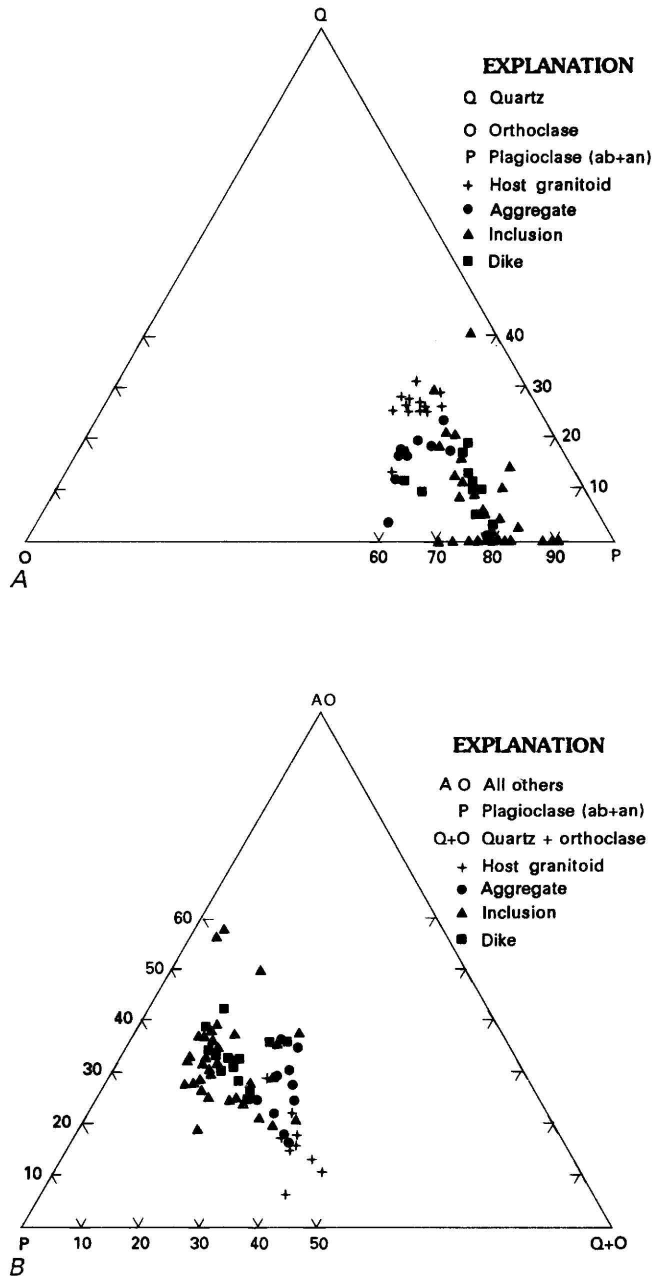

Figure 3. Normative plots of mafic inclusions, aggregates, dikes, and their host granitoids. *A*, Plot on albite + anorthite-quartz-orthoclase diagram. *B*, Plot on diagram of all normative constituents.

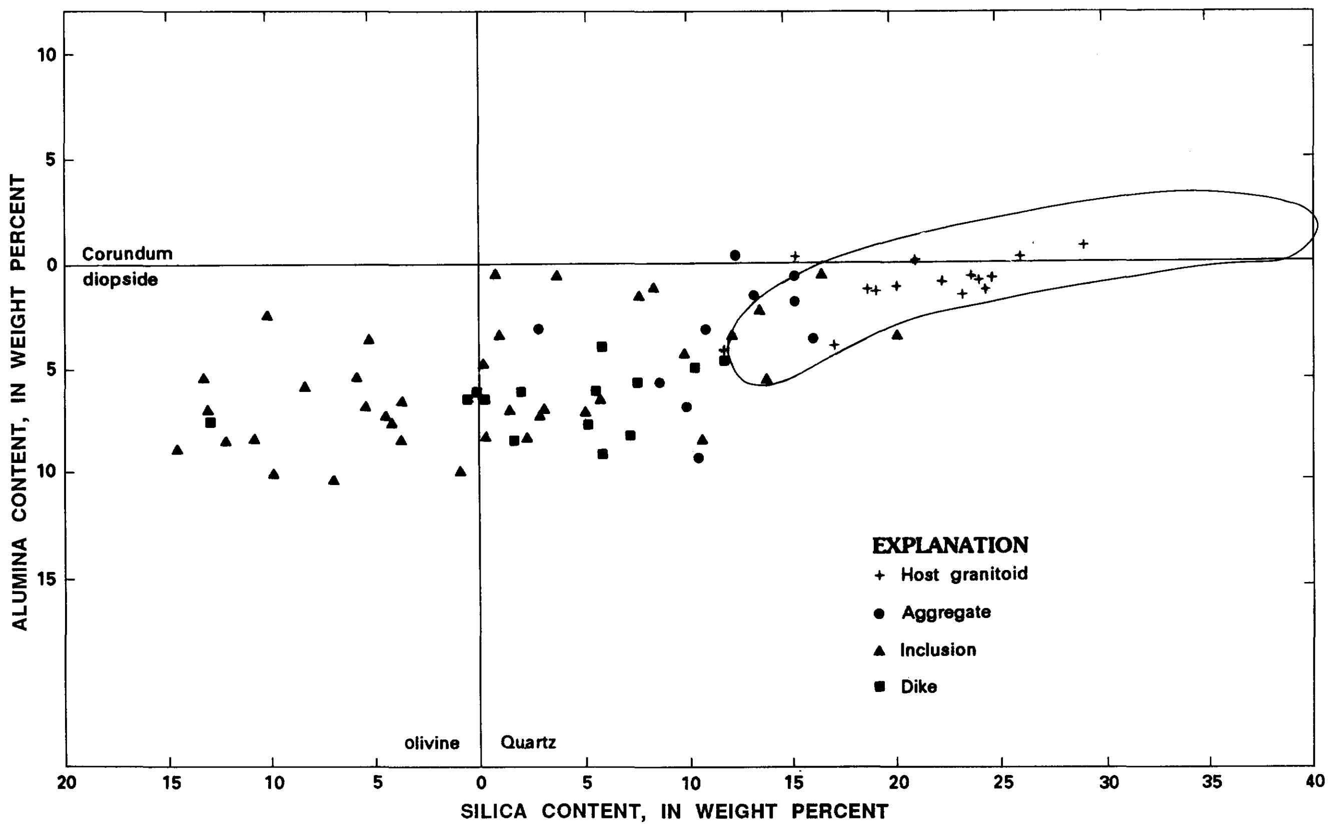

Figure 4. Plot of mutually exclusive normative constituents of mafic inclusions, aggregates, dikes, and their host granitoids showing silica and alumina over- or under-saturation. Outlined field includes more than 90 percent of CIPW norms of Sierra Nevada plutonic rocks from Bateman and others (1984).

Table 1. Location and rock unit of collected samples

Map Symbol (fig.1)	Locality	Lat. (N.)	Long. (W.)	Rock unit
HH	Hetch Hetchy	37°56.8'	119°47.2'	Bass Lake Tonalite
NF	North Fork	37°11.6'	119°35.8'	Do.
ML	Meadow Lakes	37°04.4'	119°24.5'	Do.
SC	Stevenson Creek	37°11.2'	119°20.9'	Do.
SQ	Shaver Lake quarry	37°09.3'	119°17.7'	Dinkey Creek Granodiorite
CS	Camp Sierra	37°11.6'	119°15.6'	Do.
MK	Markwood Creek	37°05.8'	119°14.7'	Do.
DR	Deer Creek	37°00.3'	119°04.0'	Do.
WR	Wishon Reservoir	36°59.9'	118°57.6'	Do.
CP	Chinese Peak	37°13.3'	119°09.3'	Granodiorite of Red Lake
MHa	Mono Hot Springs	37°19.5'	119°00.8'	Mount Givens Granodiorite
MHb	Camp 61	37°19.1'	119°03.7'	Do.
CR	Courtright Reservoir	37°04.4'	118°58.0'	Do.

Table 2. Modal analyses, in volume percent, of mafic inclusions, aggregates, dikes, and their host granitoids and associated gabbroid

[Analyses by B. Barbarin. Rock type indicated by letter following hyphen: H, host granitoid; A, aggregate; I, inclusion; D, dike. Letter following rock type: x, exterior; i, interior; m, margin; c, core]

	Bass Lake Tonalite								
	Hetch Hetchy						North Fork		
	Tonalite	Aggregate	Inclusion	Dike rock			Tonalite	Inclusion	
	HH1-H	HH3-A	HH4-I	HH6a-D	HH6b-D	HH6d-D	NF1-H	NF2-I	NF3-I
Quartz	26.6	20.8	2.7	3.9	9.6	20.2	25.9	4.2	1.7
K-feldspar	19.2	0.6	0	0.8	0.1	0.5	9.5	1.4	0
Plagioclase	37.3	50.4	49.9	49.1	47.5	49.4	44.8	50.3	51.0
Biotite	8.7	15.0	21.5	13.3	12.6	16.0	12.3	13.2	18.6
Hornblende	6.3	11.5	23.3	30.0	27.8	12.4	6.7	30.6	28.6
Sphene			1.1	2.1	1.3				
Opaque	1.9	1.7	1.1	0.3	0.3	1.5	0.9	0.3	0.1
Other			0.4	0.5	0.8				
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.1	100.0	100.0

	Bass Lake Tonalite—Continued					Dinkey Creek Granodiorite			
	North Fork—Continued			Meadow Lakes		Shaver Lake quarry			
	Dike rock		Gabbro	Tonalite	Inclusion	Granodiorite		Inclusion	
	NF4a-D	NF4b-D	NF5-G	ML1-H	ML2-I	SQ1-H	SQ2-H	SQ3-I	SQ5-I
Quartz	1.4	0.8	16.8	20.3	3.1	27.1	25.4	4.2	5.8
K-feldspar	0	0	0.4	2.8	0.4	13.9	12.3	0	0.6
Plagioclase	52.3	43.7	43.7	47.8	50.1	40.2	41.3	46.0	47.3
Biotite	9.8	16.9	15.4	15.9	12.1	12.1	12.0	18.0	18.2
Hornblende	32.9	36.2	22.7	11.6	29.6	4.4	7.5	30.6	27.2
Sphene	0.4	0			1.2				
Opaque	2.5	1.7	1.0	1.6	2.5	2.3	1.5	1.2	0.9
Other	0.7	0.7			1.0				
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

	Dinkey Creek Granodiorite—Continued								
	Shaver Lake quarry—Continued						Camp Sierra		
	Inclusion—Continued				Dike rock		Grano-diorite	Inclusion	
	SQ6-I	SQ9-I	SQ10-I	SQ11-I	SQ12-Dx	SQ12-Di	CS1-H	CS2-I	CS3-I
Quartz	1.2	17.2	5.2	0.8	13.4	11.9	22.2	20.9	9.7
K-feldspar	0	0.8	0.1	0.7	2.6	0.2	6.0	0.2	1.7
Plagioclase	49.7	49.0	46.4	37.6	25.6	40.5	52.3	50.3	58.2
Biotite	23.2	13.7	25.5	24.6	33.2	32.2	15.5	18.1	14.4
Hornblende	24.9	18.4	21.0	35.6	22.5	14.0	2.9	9.0	14.9
Sphene			1.4		1.0				
Opaque	1.0	0.9	0.4	0.7	0.8	1.2	1.1	1.5	1.1
Other			0		0.9				
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

	Dinkey Creek Granodiorite—Continued								
	Markwood Creek		Deer Creek				Wishon Reservoir		
	Grano-diorite	Inclusion	Tonalite	Inclusion			Grano-diorite	Aggregate	Inclusion
	MK1-H	MK2-I	DR1a-H	DR1b-I	DR4a-I	DR4b-I	WR1-H	WR2-A	WR3-I
Quartz	23.1	1.2	13.7	1.6	0.3	2.1	23.7	14.3	1.7
K-feldspar	8.5	0.4	0	0.1	0	0	6.0	9.0	0
Plagioclase	47.5	42.9	49.0	43.0	44.4	53.7	46.4	24.3	43.0
Biotite	11.7	18.0	16.7	18.8	2.6	5.9	13.0	23.9	23.7
Hornblende	8.4	36.7	19.2	34.7	46.9*	34.7*	10.1	26.0	30.6
Sphene				0.1	0	1.7			
Opaque	0.8	0.8	1.4	1.8	4.5	3.3	0.8	0.2	1.0
Other				1.2	0.3	0.6			
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 2. Modal analyses, in volume percent, of mafic inclusions, aggregates, dikes, and their host granitoids and associated gabbroid—Continued

	Granodiorite of Red Lake			Mount Givens Granodiorite					
	Chinese Peak			Mono Hot Springs		Camp 61			
	Grano-diorite	Inclusion		Grano-diorite	Inclusion	Granodiorite		Aggregate	
	RL1-H	RL2-I	RL3-I	MHa1-H	MHa2-I	MHb1-H	MHb3-H	MHb4-A	MHb5-A
Quartz	26.8	1.7	3.7	26.2	4.2	21.2	24.7	15.7	14.4
K-feldspar	12.3	3.3	2.7	16.8	5.5	19.6	20.5	12.2	19.1
Plagioclase	49.1	56.1	53.6	39.9	52.9	44.5	39.3	32.7	35.4
Biotite	8.7	20.1	32.9	8.2	8.0	8.3	9.0	18.3	14.2
Hornblende	2.1	16.5	6.0	7.6	28.3	5.0	5.3	16.9	12.2
Sphene								1.8	1.1
Opaque	1.0	1.5	1.1	1.3	1.1	1.4	1.2	2.2	1.6
Other								0.2	1.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

	Mount Givens Granodiorite—Continued								
	Camp 61—Continued								
	Inclusion								
	MHb6-I	MHb7-I	MHb8-I	MHb9a-Im	MHb9b-Ic	MHb10-I	MHb11-I	MHb12-I	MHb15-I
Quartz	4.8	2.3	4.5	0.3	2.3	1.8	12.5	7.8	16.6
K-feldspar	0	0.4	10.5	0	0	0	0.4	0.4	0.8
Plagioclase	51.4	55.2	25.6	47.9	55.3	44.9	54.7	58.6	50.4
Biotite	22.3	20.9	31.7	17.6	18.2	18.3	19.3	20.9	16.7
Hornblende	20.6	19.4	26.7	32.3	22.9	33.6	10.6	10.4	13.7
Sphene							0.7	0.3	
Opaque	0.9	1.8	1.0	1.9	1.3	1.4	1.1	1.2	1.8
Other							0.7	0.4	
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

	Mount Givens Granodiorite—Continued						
	Courtright Reservoir						
	Aggregate			Inclusion			
	CR3a-A	CR4-A	CR5-A	CR3b-I	CR6-I	CR8-I	CR10-I
Quartz	18.0	24.0	6.4	7.2	2.7	0.6	2.1
K-feldspar	0	3.4	9.8	4.4	0.9	0	1.6
Plagioclase	35.9	34.8	28.6	42.0	53.8	50.9	38.5
Biotite	37.6	26.8	39.9	8.4	19.8	16.7	5.3
Hornblende	5.0	7.4	9.2	36.0	18.2	29.6	51.6
Sphene	1.6	1.6	3.2		2.5	0.7	
Opaque	1.4	1.4	2.5	2.0	0.9	1.2	0.9
Other	0.5	0.6	0.4		1.2	0.3	
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Includes clinopyroxene.

Table 3. Chemical and trace-element analyses of mafic inclusions, aggregates, dikes, and their host granitoids, associated gabbroid, and aplite

[Chemical analyses by A.J. Bartel, K. Stewart, J. Taggart, H. Neiman, E. Engleman, M. Maneer, C. Stone, G. Mason, J. Ryder, and L. Espos using a combination of X-ray fluorescence and chemical methods. Trace-element analyses by P. Bruggman, J. Budahn, R. Knight, L.J. Schwartz, J. Storey, S. Danahey, R.B. Vaughn, J.G. Crock, J. Consul, and R. Lerner using X-ray fluorescence, instrumental neutron-activation, delayed neutron, induced coupled plasma, or emission-spectrographic methods. —, no data.]

	Bass Lake Tonalite									
	Hetch Hetchy									
	Tonalite	Aggregate		Inclusion	Dike rock					
	HH1-H	HH2-A	HH3-A	HH4-I	HH5a-D	HH5b-D	HH5c-D	HH5d-D	HH6a-D	HH6b-D
Chemical analyses (weight percent)										
SiO_2	66.9	57.2	59.4	50.4	51.9	53.4	56.2	57.2	53.1	54.4
Al_2O_3	15.2	17.5	17.0	19.1	18.8	18.3	17.6	17.5	18.4	17.7
Fe_2O_3	1.49	2.32	2.33	3.38	2.76	2.55	2.48	2.47	2.51	2.61
FeO	2.27	4.52	4.13	6.05	5.37	5.09	4.72	4.40	5.3	5.22
MgO	1.51	3.20	2.93	4.44	4.11	3.81	3.66	3.38	4.17	4.01
CaO	3.62	6.59	6.07	7.81	7.80	7.55	7.11	6.95	8.15	7.74
Na_2O	2.96	3.28	3.24	3.71	3.72	3.61	3.57	3.46	3.68	3.51
K_2O	3.47	2.03	1.89	2.07	1.98	2.05	1.86	1.78	1.71	1.62
H_2O+	0.38	0.73	0.72	1.03	0.94	0.94	0.88	0.85	0.93	1.00
H_2O-	0.19	0.20	0.20	0.22	0.25	0.25	0.24	0.25	0.22	0.19
TiO_2	0.50	0.91	0.85	1.11	1.43	1.33	1.19	1.08	1.18	1.18
P_2O_5	0.12	0.23	0.22	0.29	0.38	0.35	0.25	0.25	0.23	0.19
MnO	0.06	0.13	0.12	0.19	0.16	0.13	0.12	0.11	0.15	0.14
CO_2	<0.02	0.07	0.06	0.07	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Total	98.7	98.9	99.2	99.9	99.6	99.4	99.9	99.7	99.7	99.5
Trace-element analyses (parts per million)										
Rb	103.	65.3	68.8	86.1	74.1	63.8	61.3	54.9	58.1	61.8
Sr	360.	488.	455.	486.	665.	654.	619.	595.	580.	569.
Cs	—	—	—	—	—	—	—	—	—	—
Ba	1544.	707.	591.	423.	507.	721.	648.	617.	582.	576.
La	18.4	37.4	19.0	21.9	21.7	24.5	23.9	23.5	23.7	20.9
Ce	35.9	78.3	40.1	54.1	50.8	53.6	48.8	48.3	49.3	42.8
Pr	1.0	3.5	3.5	4.8	3.6	0.6	1.7	1.5	2.0	1.0
Nd	13.9	38.4	24.0	34.6	31.5	30.0	24.7	24.6	25.3	21.4
Sm	1.3	5.4	3.8	5.9	4.0	1.5	1.7	1.5	1.8	1.3
Eu	1.00	1.82	1.51	1.96	2.14	2.11	1.63	1.60	1.79	1.51
Gd	2.5	8.0	5.6	8.1	6.0	5.9	5.0	4.9	5.4	5.0
Tb	0.4	0.9	0.7	1.0	0.6	0.7	0.7	0.6	0.5	0.5
Dy	1.6	6.9	4.6	7.1	4.0	4.1	3.6	3.5	4.2	4.1
Ho	0.34	1.35	0.91	1.38	0.71	0.69	0.66	0.68	0.79	0.77
Er	1.0	3.5	2.5	3.8	1.7	1.5	1.6	1.6	2.0	2.2
Tm	0.07	0.54	0.31	0.52	0.20	0.22	0.20	0.20	0.25	0.27
Yb	1.23	3.25	2.30	3.58	1.48	1.35	1.45	1.48	1.90	1.76
Lu	0.18	0.47	0.33	0.50	0.18	0.15	0.18	0.19	0.25	0.26
Y	12.	28.	21.	29.	18.	17.	16.	15.	21.	19.
Zr	134.	164.	119.	152.	145.	137.	131.	123.	132.	118.
Hf	—	—	—	—	—	—	—	—	—	—
Nb	3.	7.	8.	8.	7.	7.	5.	5.	6.	3.
Ta	—	—	—	—	—	—	—	—	—	—
Th	12.8	10.9	4.5	4.6	3.99	5.76	5.76	5.00	4.4	6.16
U	3.19	1.80	3.03	2.73	1.80	3.21	2.29	3.33	2.55	2.38
Sc	7.5	22.	18.	24.	18.	16.	19.	17.	23.	24.
V	57.	130.	120.	170.	180.	160.	180.	160.	200.	220.
Cr	—	—	—	—	—	—	—	—	—	—
Co	8.	19.	16.	22.	22.	22.	23.	19.	23.	25.
Zn	—	—	—	—	—	—	—	—	—	—
Sb	—	—	—	—	—	—	—	—	—	—

Table 3. Chemical and trace-element analyses of mafic inclusions, aggregates, dikes, and their host granitoids, associated gabbroid, and aplite—Continued

	Bass Lake Tonalite—Continued									
	Hetch Hetchy—Continued			North Fork						Meadow Lakes
	Dike rock		Aplite	Tonalite	Inclusion		Dike rock		Gabbro	Tonalite
	HH6c-D	HH6d-D	HH6e-AP	NF1-H	NF2-I	NF3-I	NF4a-D	NF4b-D	NF5-G	ML1-H
Chemical analyses (weight percent)										
SiO_2	54.3	58.4	72.5	63.6	51.3	51.2	49.6	48.4	58.6	62.4
Al_2O_3	18.1	17.4	14.0	16.8	17.9	18.2	20.1	19.8	14.8	16.9
Fe_2O_3	2.30	2.44	0.81	1.12	2.00	2.12	1.33	1.73	2.21	1.48
FeO	5.20	4.23	0.92	3.30	7.55	7.35	6.64	7.35	5.59	3.56
MgO	3.93	3.11	0.55	2.04	4.62	4.47	4.22	4.78	4.66	2.24
CaO	7.71	6.59	2.25	5.13	8.31	7.59	10.0	9.43	7.95	5.59
Na_2O	3.34	3.70	2.42	3.43	3.46	3.34	2.62	3.16	2.22	3.44
K_2O	1.77	1.62	4.93	1.88	1.75	2.15	1.40	1.46	1.53	1.97
H_2O+	0.96	0.78	0.27	0.79	1.17	1.30	1.15	1.30	1.03	0.73
H_2O-	0.22	0.18	0.16	0.19	0.24	0.25	0.31	0.30	0.20	0.05
TiO_2	1.12	0.98	0.23	0.53	0.77	0.85	1.71	1.26	0.60	0.86
P_2O_5	0.25	0.21	0.06	0.11	0.13	0.17	0.44	0.32	0.21	0.19
MnO	0.11	0.13	—	0.07	0.22	0.19	0.10	0.14	0.17	0.08
CO_2	<0.02	<0.02	<0.02	0.02	0.06	0.02	0.02	0.02	0.03	0.03
Total	99.3	99.8	99.1	99.0	99.5	99.2	99.6	99.5	99.8	99.5
Trace-element analyses (parts per million)										
Rb	54.4	68.8	90.1	66.5	61.7	87.8	34.3	40.6	43.9	64.
Sr	637.	525.	385.	276.	245.	253.	769.	620.	450.	513.
Cs	—	—	—	2.61	2.55	3.75	0.94	0.77	1.86	—
Ba	657.	419.	1693.	587.	336.	438.	519.	556.	588.	718.
La	25.7	24.6	35.8	11.8	12.5	15.3	17.5	15.4	14.0	—
Ce	52.3	47.4	63.4	25.3	37.0	44.2	45.4	39.1	29.7	—
Pr	1.8	2.2	4.3	2.8	5.1	5.2	5.7	4.8	3.3	—
Nd	26.6	22.6	22.8	13.0	29.5	25.4	30.2	24.4	14.7	—
Sm	1.9	2.1	2.0	3.1	8.3	6.9	6.6	5.7	3.8	—
Eu	1.65	1.54	0.90	0.93	1.48	1.34	1.87	1.72	1.13	—
Gd	5.3	4.8	3.2	3.6	9.7	7.7	5.6	5.2	3.9	—
Tb	0.6	0.7	0.2	0.6	1.6	1.3	0.8	0.9	0.6	—
Dy	3.9	3.6	2.4	3.4	10.6	8.7	4.4	5.1	4.3	—
Ho	0.72	0.73	0.45	0.78	2.46	1.90	0.89	1.07	0.95	—
Er	1.7	1.9	1.2	2.2	7.1	5.6	2.2	2.8	2.6	—
Tm	0.20	0.22	0.16	0.33	1.08	0.84	0.27	0.38	0.38	—
Yb	1.44	1.83	1.35	2.04	6.75	5.56	1.54	2.20	2.20	—
Lu	0.35	0.25	0.19	0.30	1.01	0.85	0.20	0.32	0.31	—
Y	18.	17.	15.	19.	48.	38.	17.	23.	21.	20.
Zr	128.	122.	127.	95.	106.	92.	57.	104.	91.	162.
Hf	—	—	—	3.18	3.57	3.09	1.40	2.72	1.96	—
Nb	6.	8.	6.	3.	6.	7.	9.	6.	6.	10.
Ta	—	—	—	0.576	0.578	0.591	0.554	0.394	0.324	—
Th	4.22	7.94	17.9	5.47	3.36	6.96	2.12	0.96	2.98	—
U	0.78	4.78	4.00	3.08	0.879	1.08	0.681	0.545	0.969	—
Sc	17.	18.	3.	13.8	38.2	31.5	19.0	26.1	33.3	—
V	160.	170.	20.	—	—	—	—	—	—	—
Cr	—	—	—	16.2	57.2	32.3	11.0	22.1	88.5	—
Co	20.	20.	3.	12.1	24.3	24.9	22.8	25.0	25.5	—
Zn	—	—	—	—	—	—	—	—	—	—
Sb	—	—	—	0.169	—	—	—	0.084	0.16	—

Table 3. Chemical and trace-element analyses of mafic inclusions, aggregates, dikes, and their host granitoids, associated gabbroid, and aplite—Continued

	Bass Lake Tonalite—Continued		Dinkey Creek Granodiorite								
	Meadow Lakes—Continued	Stevenson Creek	Shaver Lake quarry								
	Inclusion	Dike rock	Granodiorite		Inclusion						
	ML2-I	SC1-D	SQ1-H	SQ2-H	SQ3-I	SQ4-I	SQ5-I	SQ6-I	SQ7-I	SQ8-I	SQ9-I
					Chemical analyses (weight percent)						
SiO_2	48.7	54.4	66.6	65.1	52.2	63.2	51.3	57.1	54.6	58.3	56.6
Al_2O_3	18.5	18.3	15.1	15.3	17.8	15.6	17.8	17.1	17.4	15.7	17.6
Fe_2O_3	2.91	1.87	1.16	1.53	2.54	1.74	2.98	2.35	2.42	2.31	2.62
FeO	7.37	5.78	2.82	3.12	6.71	4.14	7.22	5.38	5.99	5.63	5.67
MgO	4.51	3.95	1.58	1.76	4.16	2.77	4.26	3.25	3.85	3.62	2.87
CaO	8.56	7.55	3.87	4.49	7.81	5.65	7.50	6.80	7.42	6.46	5.78
Na_2O	3.61	3.19	2.70	2.96	3.51	3.18	3.52	3.44	3.46	3.11	3.62
K_2O-	1.64	1.66	4.03	3.04	1.91	1.88	2.21	1.86	1.82	1.88	2.36
H_2O+	1.20	0.97	0.58	0.60	1.12	0.72	1.14	0.86	0.88	0.81	0.88
H_2O	0.06	0.18	0.04	0.16	0.05	0.22	0.28	0.20	0.24	0.22	0.20
TiO_2	1.99	1.12	0.55	0.64	1.12	0.82	1.16	1.01	1.05	0.96	1.28
P_2O_5	0.39	0.22	0.12	0.14	0.23	0.17	0.21	0.22	0.21	0.20	0.30
MnO	0.21	0.15	0.06	0.08	0.18	0.10	0.21	0.14	0.16	0.15	0.12
CO_2	0.05	0.07	0.04	<0.02	0.06	<0.02	0.08	0.13	0.07	0.08	0.08
Total	99.7	99.4	99.3	98.9	99.4	100.2	99.9	99.8	99.6	99.4	100.0
					Trace-element analyses (parts per million)						
Rb	56.	64.	132.	125.	103.	101.	142.	110.	96.4	161.	110.
Sr	483.	455.	310.	330.	336.	328.	292.	321.	344.	321.	281.
Cs	—	—	—	—	—	—	—	—	—	—	—
Ba	460.	457.	954.	755.	324.	323.	358.	359.	336.	321.	299.
La	—	14.0	—	21.2	—	13.9	18.5	15.2	18.9	26.8	12.7
Ce	—	29.5	—	45.7	—	34.9	54.1	41.2	53.7	57.0	35.8
Pr	—	2.0	—	5.0	—	3.9	7.9	3.9	6.4	5.9	5.2
Nd	—	17.9	—	21.9	—	19.7	39.0	29.4	36.3	26.7	25.0
Sm	—	1.8	—	3.9	—	3.5	8.1	5.3	6.6	4.8	5.6
Eu	—	1.49	—	1.18	—	1.13	1.70	1.46	1.70	1.19	1.19
Gd	—	4.9	—	4.6	—	4.5	10.2	7.4	7.9	5.5	6.4
Tb	—	0.4	—	0.6	—	0.6	2.0	1.1	1.3	0.7	1.0
Dy	—	3.8	—	3.4	—	2.3	9.3	6.5	7.0	3.9	5.2
Ho	—	0.68	—	0.74	—	0.64	1.85	1.28	1.38	0.77	1.01
Er	—	1.7	—	1.9	—	1.7	5.7	3.6	3.8	1.9	3.0
Tm	—	0.17	—	0.20	—	0.14	0.74	0.48	0.52	0.27	0.42
Yb	—	1.59	—	1.96	—	1.73	4.77	3.33	3.72	1.78	2.97
Lu	—	0.19	—	0.29	—	0.26	0.79	0.49	0.54	0.25	0.41
Y	31.	17.	21.	22.	40.	21.	37.	27.	31.	21.	28.
Zr	167.	109.	116.	143.	180.	137.	152.	134.	152.	176.	130.
Hf	—	—	—	—	—	—	—	—	—	—	—
Nb	19.	5.	8.	9.	14.	10.	16.	10.	13.	11.	13.
Ta	—	—	—	—	—	—	—	—	—	—	—
Th	—	—	—	6.5	—	6.41	4.5	—	4.1	10.4	4.5
U	—	1.7	—	4.18	—	3.21	3.84	4.79	1.51	2.17	2.97
Sc	—	19.	—	10.	—	14.	30.	19.	22.	18.	18.
V	—	140.	—	80.	—	108.	190.	130.	170.	145.	125.
Cr	—	—	—	—	—	—	—	—	—	—	—
Co	—	21.	—	12.	—	16.	21.	17.	22.	17.	17.
Zn	—	—	—	—	—	—	—	—	—	—	—
Sb	—	—	—	—	—	—	—	—	—	—	—

Table 3. Chemical and trace-element analyses of mafic inclusions, aggregates, dikes, and their host granitoids, associated gabbroid, and aplite—Continued

	Dinkey Creek Granodiorite—Continued									
	Shaver Lake quarry—Continued				Camp Sierra			Markwood Creek		Deer Creek
	Inclusion	Dike rock			Granodiorite	Inclusion		Granodiorite	Inclusion	Granodiorite
	SQ10- I	SQ12-aD	SQ12-Dx	SQ12-Di	CS1-H	CS2-I	CS3-I	MK1-H	MK2-I	DR1-aH
	Chemical analyses (weight percent)									
SiO_2	50.6	53.9	52.6	54.4	62.4	60.5	59.2	63.3	50.1	57.2
Al_2O_3	18.7	14.1	17.6	13.1	16.2	16.8	17.6	16.2	17.4	17.3
Fe_2O_3	2.90	3.51	2.81	3.37	1.46	2.12	1.79	1.76	3.19	2.27
FeO	6.84	8.18	7.19	8.94	4.34	4.80	4.52	3.47	7.66	5.09
MgO	4.03	4.61	3.98	4.81	2.30	2.15	2.41	2.16	4.83	3.57
CaO	7.14	6.28	6.88	5.73	5.22	5.46	6.19	5.06	8.32	7.26
Na_2O	3.63	2.57	3.65	2.21	2.98	3.50	3.52	3.19	3.35	2.98
K_2O	2.52	2.97	2.39	3.32	2.58	1.93	1.87	2.59	1.86	1.73
H_2O+	1.14	1.16	0.93	1.18	0.73	0.69	0.79	0.79	1.20	0.82
H_2O-	0.23	0.24	0.20	0.20	0.13	0.11	0.16	0.10	0.14	0.15
TiO_2	1.27	1.39	1.25	1.57	0.80	1.00	0.92	0.73	1.16	1.03
P_2O_5	0.29	0.30	0.27	0.33	0.17	0.31	0.20	0.16	0.23	0.23
MnO	0.18	0.24	0.20	0.24	0.09	0.08	0.09	0.09	0.22	0.13
CO_2	0.11	<0.02	<0.02	0.07	0.01	0.01	0.01	0.07	0.09	0.14
Total	99.6	99.5	100.0	99.5	99.4	99.5	99.3	99.7	99.8	99.9
	Trace-element analyses (parts per million)									
Rb	169.	161.	156.	196.	105.	96.	86.	100.	91.	62.6
Sr	330.	207.	276.	180.	378.	424.	431.	369.	318..	471.
Cs	—	—	—	—	—	—	—	—	—	—
Ba	237.	443.	316.	542.	760.	506.	573.	764.	255.	516.
La	—	74.1	26.1	170.0	—	—	—	—	28.9	16.9
Ce	—	155.0	64.7	322.0	—	—	—	—	60.3	41.0
Pr	—	18.8	9.7	33.1	—	—	—	—	—	7.7
Nd	—	73.7	40.8	118.0	—	—	—	—	31.6	26.9
Sm	—	15.0	9.9	18.3	—	—	—	—	—	5.1
Eu	—	2.03	1.66	2.34	—	—	—	—	1.71	1.76
Gd	—	14.3	9.9	17.0	—	—	—	—	—	7.1
Tb	—	2.2	1.6	2.5	—	—	—	—	—	1.1
Dy	—	12.8	9.1	12.6	—	—	—	—	—	5.2
Ho	—	2.46	1.79	2.65	—	—	—	—	1.01	1.17
Er	—	6.8	5.1	7.0	—	—	—	—	—	2.8
Tm	—	0.99	0.73	0.90	—	—	—	—	0.30	0.44
Yb	—	6.49	4.73	6.92	—	—	—	—	2.55	2.60
Lu	—	0.91	0.71	0.99	—	—	—	—	0.41	0.36
Y	33.	56.	40.	57.	27.	21.	23.	28.	47.	23.
Zr	177.	266.	184.	304.	191.	145.	162.	146.	146.	136.
Hf	—	—	—	—	—	—	—	—	—	—
Nb	16.	22.	19.	25.	9.	8.	7.	10.	15.	9.
Ta	—	—	—	—	—	—	—	—	—	—
Th	—	41.5	11.2	67.5	—	—	—	—	7.47	3.00
U	—	7.44	4.49	8.33	—	—	—	—	3.22	1.20
Sc	—	40.	30.	40.	—	—	—	—	22.	48.
V	—	210.	180.	225.	—	—	—	—	160.	300.
Cr	—	—	—	—	—	—	—	—	—	—
Co	—	22.	20.	24.	—	—	—	—	18.	25.
Zn	—	—	—	—	—	—	—	—	—	—
Sb	—	—	—	—	—	—	—	—	—	—

Table 3. Chemical and trace-element analyses of mafic inclusions, aggregates, dikes, and their host granitoids, associated gabbroid, and aplite—Continued

	Dinkey Creek Granodiorite–Continued							Granodiorite of Red Lake		
	Deer Creek–Continued				Wishon Reservoir			Chinese Peak		
	Aggregate	Inclusion			Grano-diorite	Aggregate	Inclusion	Grano-diorite	Inclusion	
	DR2-S	DR3-I	DR4a-I	DR5-I	WR1-H	WR2-A	WR3-I	RL1-H	RL2-I	RL3-I
					Chemical analyses (weight percent)					
SiO_2	55.6	48.3	46.1	49.1	60.8	56.0	48.1	69.3	52.7	53.0
Al_2O_3	15.5	18.4	19.9	20.0	16.0	13.4	17.8	15.2	18.2	18.6
Fe_2O_3	3.00	3.42	3.52	1.81	1.46	3.20	2.82	1.16	2.67	2.54
FeO	6.57	6.82	7.63	6.74	4.64	7.29	8.44	1.58	5.78	4.91
MgO	4.94	5.29	5.18	6.77	2.80	5.03	5.06	0.94	4.10	3.51
CaO	7.14	10.20	10.80	10.90	6.07	6.40	8.38	3.20	5.99	6.81
Na_2O	2.46	1.90	2.42	2.23	2.92	2.02	3.02	3.58	4.21	4.29
K_2O-	2.03	1.27	0.46	0.51	2.25	3.14	2.47	2.90	2.62	2.11
H_2O+	1.29	1.98	1.54	1.15	0.77	1.38	1.38	0.37	1.12	0.99
H_2O	0.31	0.31	0.22	0.19	0.05	0.26	0.10	0.04	0.19	0.24
TiO_2	1.32	1.50	1.60	0.57	0.88	1.36	1.35	0.42	1.12	1.30
P_2O_5	0.29	0.28	0.31	0.12	0.19	0.28	0.44	0.14	0.31	0.42
MnO	0.17	0.15	0.19	0.18	0.10	0.21	0.20	0.04	0.20	0.19
CO_2	<0.02	0.32	0.25	<0.02	0.03	0.09	0.07	0.04	0.06	<0.02
Total	100.6	100.1	100.1	100.3	99.0	100.1	99.6	98.9	99.3	98.9
					Trace-element analyses (parts per million)					
Rb	50.6	76.6	15.4	13.1	96.1	124.	1240.	93.	125.	95.
Sr	471.	382.	578.	575.	402.	257.	380.	572.	552.	539.
Cs	—	—	—	4.23	—	7.4	—	1.69	8.24	—
Ba	290.	550.	158.	186.	573.	732.	431.	1156.	1016.	556.
La	31.3	18.5	14.6	30.1	76.0	23.8	—	29.4	15.8	31.9
Ce	71.8	44.4	34.0	57.2	144.0	61.1	—	52.0	29.4	68.0
Pr	5.2	10.0	6.0	4.9	—	13.2	—	5.5	3.8	5.4
Nd	39.8	28.2	19.9	27.0	64.7	40.0	—	23.0	21.0	32.0
Sm	6.7	8.5	5.8	4.3	5.7	9.7	8.4	3.9	3.7	3.8
Eu	1.64	1.85	1.59	1.17	2.23	1.52	—	0.82	0.81	2.38
Gd	7.3	8.1	6.4	4.2	4.8	12.6	8.0	3.6	4.0	5.5
Tb	1.2	1.1	1.0	0.7	0.7	2.0	1.2	0.3	0.4	0.8
Dy	6.4	7.0	5.6	3.5	—	10.5	—	1.7	2.4	3.4
Ho	1.33	1.10	0.68	—	2.03	—	—	0.35	0.52	0.61
Er	3.2	3.7	3.1	1.9	—	5.5	—	0.9	1.4	1.4
Tm	0.54	0.45	0.26	0.32	0.69	0.47	—	0.12	—	0.19
Yb	3.56	2.89	1.76	2.22	5.21	3.52	—	0.91	1.22	1.45
Lu	0.50	0.44	0.29	0.36	0.73	0.52	—	0.13	0.21	0.22
Y	26.	31.	27.	18.	26.	38.	37.	14.	17.	17.
Zr	77.	149.	51.	92.	143.	185.	162.	162.	166.	156.
Hf	—	—	—	4.95	—	4.71	—	3.98	4.58	—
Nb	9.	11.	11.	5.	13.	14.	12.	8.	10.	10.
Ta	—	—	—	1.48	—	1.07	—	0.65	0.59	—
Th	5.56	—	—	17.8	17.9	3.58	—	10.9	3.31	8.05
U	2.37	0.367	0.443	6.2	7.68	2.6	—	1.92	3.3	3.14
Sc	29.	34.	14.	16.6	32.	29.6	—	3.53	21.1	13.
V	200.	250.	85.	—	7.68	—	—	—	—	160.
Cr	—	—	—	15.8	—	87.1	—	3.4	19.9	—
Co	24.	26.	29.	14.8	25.	31.7	—	4.13	19.2	18.
Zn	—	—	—	82.	—	163.	—	56.	212.	—
Sb	—	—	—	0.45	—	0.58	—	0.20	1.51	—

Table 3. Chemical and trace-element analyses of mafic inclusions, aggregates, dikes, and their host granitoids, associated gabbroid, and aplite—Continued

	Mount Givens Granodiorite									
	Camp 61									
	Granodiorite	Inclusion	Granodiorite			Aggregate		Inclusion		
	MHa1-H	MHa2-I	MHb1-H	MHb2-H	MHb3-H	MHb4-A	MHb5-A	MHb6-I	MHb7-I	MHb8-I
Chemical analyses (weight percent)										
SiO_2	64.7	52.3	66.9	67.1	66.6	54.9	61.7	55.3	53.4	52.0
Al_2O_3	15.9	17.6	15.4	15.2	15.1	13.3	15.4	17.0	17.6	17.1
Fe_2O_3	1.58	3.12	1.54	1.71	1.72	4.74	2.61	2.08	3.70	2.47
FeO	2.52	5.95	2.13	2.01	2.15	6.53	3.49	5.51	5.18	5.67
MgO	1.74	4.55	1.55	1.53	1.60	5.08	2.76	4.63	3.98	5.48
CaO	4.60	7.91	3.78	3.76	3.96	4.80	4.66	6.69	6.90	5.72
Na_2O	3.25	3.91	3.26	3.18	3.36	2.24	3.26	3.90	4.47	3.63
K_2O-	2.79	1.61	3.60	3.56	3.08	3.93	3.31	2.00	1.42	3.93
H_2O+	0.48	0.95	0.43	0.53	0.51	1.26	0.72	0.83	1.26	1.21
H_2O	0.04	0.07	0.03	0.14	0.25	0.18	0.16	0.03	0.06	0.08
TiO_2	0.54	0.96	0.57	0.53	0.62	1.38	0.78	0.99	0.80	0.99
P_2O_5	0.14	0.20	0.16	0.16	0.16	0.35	0.22	0.26	0.25	0.42
MnO	0.07	0.23	0.06	0.06	0.06	0.23	0.13	0.21	0.21	0.21
CO_2	0.04	0.04	0.04	<0.02	<0.02	<0.02	<0.02	0.03	0.09	0.05
Total	98.4	9[illegible].4	99.5	99.5	99.2	98.9	99.2	99.5	99.3	99.0
Trace-element analyses (parts per million)										
Rb	116.	94.	130.	129.	126.	207.	142.	141.	77.	291.
Sr	431.	376.	414.	425.	434.	262.	387.	356.	403.	360.
Cs	—	—	6.79	—	—	—	—	13.8	4.04	19.8
Ba	616.	195.	764.	863.	732.	845.	630.	359.	281.	611.
La	—	—	28.4	35.2	54.3	64.7	45.9	25.2	25.0	33.9
Ce	—	—	54.5	60.2	93.0	123.0	86.2	58.6	56.0	61.2
Pr	—	—	5.8	3.9	8.1	13.6	8.5	6.3	7.0	6.5
Nd	—	—	25.0	23.0	34.1	56.6	39.2	27.0	37.0	28.0
Sm	—	—	4.6	1.6	3.8	10.1	6.4	7.2	8.7	5.9
Eu	—	—	0.88	1.05	1.29	1.69	1.44	1.08	1.27	0.80
Gd	—	—	4.2	4.1	5.5	10.3	7.3	6.4	6.4	5.3
Tb	—	—	0.4	0.4	0.6	1.5	1.1	0.9	1.2	0.8
Dy	—	—	2.7	2.7	3.3	8.2	5.7	5.1	6.7	4.5
Ho	—	—	0.60	0.56	0.68	1.56	1.09	0.98	1.33	0.95
Er	—	—	1.7	1.4	1.7	4.1	2.9	2.2	3.2	2.5
Tm	—	—	0.24	0.14	0.14	0.56	0.37	0.25	0.39	0.33
Yb	—	—	1.52	1.49	1.81	4.06	2.86	2.35	2.76	2.26
Lu	—	—	0.25	0.21	0.26	0.61	0.42	0.39	0.42	0.35
Y	23.	42.	22.	21.	18.	38.	27.	31.	32.	31.
Zr	123.	141.	136.	130.	129.	266.	184.	151.	111.	225.
Hf	—	—	4.52	—	—	—	—	4.68	3.84	5.19
Nb	5.	15.	10.	8.	7.	20.	12.	11.	14.	8.
Ta	—	—	1.31	—	—	—	—	1.09	1.15	0.96
Th	—	—	24.1	22.3	21.1	38.2	27.6	8.25	8.77	7.83
U	—	—	5.6	5.00	4.30	10.20	9.20	8.1	15.8	4.1
Sc	—	—	7.82	7.5	6.5	30.	20.	28.8	35.9	22.4
V	—	—	—	66.	64.	190.	100.	—	—	—
Cr	—	—	9.4	—	—	—	83.2	30.2	—	92.9
Co	—	—	8.14	9.	9.	23.	13.	25.8	23.0	28.2
Zn	—	—	57.	—	—	—	161.	165.	—	188.
Sb	—	—	0.67	—	—	—	—	0.44	1.42	0.50

Table 3. Chemical and trace-element analyses of mafic inclusions, aggregates, dikes, and their host granitoids, associated gabbroid, and aplite—Continued

	Mount Givens Granodiorite—Continued									
	Camp 61—Continued								Courtright Reservoir	
	Inclusion—Continued								Grano-diorite	Aggregate
	MHb9a-Im	MHb9b-Ic	MHb10-I	MHb11-I	MHb12-I	MHb13-I	MHb14-I	MHb15-I	CR1-H	CR2a-A
Chemical analyses (weight percent)										
SiO_2	50.6	54.5	50.8	56.7	55.3	52.2	50.4	59.2	65.5	61.2
Al_2O_3	17.8	17.2	17.7	17.1	17.6	17.1	20.0	17.3	17.0	15.5
Fe_2O_3	2.89	2.40	2.86	2.56	3.26	3.79	3.45	2.10	0.80	2.04
FeO	6.40	5.22	6.13	4.76	4.48	5.24	5.54	3.97	2.01	3.95
MgO	5.33	4.65	5.42	3.86	3.65	5.55	3.77	3.08	0.95	2.70
CaO	6.87	7.23	7.41	5.39	7.03	6.60	6.55	5.93	2.73	4.07
Na_2O	3.89	4.07	3.95	3.79	4.19	3.98	4.74	4.09	3.39	3.00
K_2O-	2.53	1.67	2.18	2.23	1.35	2.25	2.26	1.49	5.95	4.02
H_2O+	1.27	1.05	1.20	1.13	0.97	1.24	1.07	0.78	0.43	0.80
H_2O	0.30	0.19	0.18	0.18	0.26	0.21	0.19	0.21	0.17	0.19
TiO_2	1.23	1.10	1.24	0.96	1.00	1.07	1.25	0.82	0.47	1.13
P_2O_5	0.37	0.32	0.37	0.24	0.25	0.27	0.47	0.20	0.14	0.33
MnO	0.23	0.20	0.23	0.16	0.17	0.25	0.16	0.13	0.06	0.10
CO_2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.06
Total	99.7	99.8	99.7	99.1	99.5	99.8	99.9	99.3	99.6	99.1
Trace-element analyses (parts per million)										
Rb	167.	103.	172.	177.	78.8	210.	193.	98.1	184.	120.
Sr	362.	364.	375.	419.	426.	329.	410.	403.	484.	533.
Cs	—	—	—	—	—	—	—	—	—	—
Ba	484.	370.	355.	379.	362.	377.	293.	293.	3161.	2622.
La	35.8	40.6	40.0	21.1	42.0	27.3	49.6	25.6	36.6	56.6
Ce	70.3	84.5	89.6	37.5	85.2	55.2	89.5	50.2	57.9	122.0
Pr	5.5	5.2	8.3	1.2	4.4	7.0	5.8	3.8	4.8	12.5
Nd	36.7	38.6	47.4	16.3	30.2	28.4	33.9	25.2	18.4	52.4
Sm	6.0	4.5	7.4	1.6	1.0	6.1	3.0	3.2	1.7	7.5
Eu	1.29	1.43	1.67	0.85	1.48	1.00	1.29	1.02	0.94	2.12
Gd	8.9	8.3	10.2	4.3	5.6	6.0	5.7	5.3	3.3	7.0
Tb	1.1	0.9	1.2	0.6	0.6	0.8	0.8	0.7	0.2	1.0
Dy	6.1	6.1	7.6	2.8	4.1	4.4	4.2	4.2	0.8	4.6
Ho	1.15	1.17	1.41	0.54	0.81	0.84	0.79	0.75	0.15	0.83
Er	2.9	3.0	3.7	1.3	2.0	2.2	1.9	1.9	0.4	2.0
Tm	0.33	0.40	0.47	0.11	0.29	0.28	0.23	0.21	<0.05	0.25
Yb	2.38	2.93	3.32	1.31	2.32	1.92	1.89	1.67	0.38	1.87
Lu	0.33	0.41	0.45	0.18	0.38	0.36	0.30	0.28	0.04	0.26
Y	30.	28.	33.	18.	22.	23.	21.	21.	12.	22.
Zr	160.	145.	140.	73.	154.	110.	173.	131.	130.	161.
Hf	—	—	—	—	—	—	—	—	—	—
Nb	12.	13.	13.	6.	16.	10.	10.	6.	4.	14.
Ta	—	—	—	—	—	—	—	—	—	—
Th	5.70	6.34	5.89	—	—	—	7.22	6.35	12.9	19.0
U	3.26	4.23	3.33	6.13	9.99	5.74	6.39	2.74	2.55	3.05
Sc	28.	20.	19.	20.	25.	26.	17.	16.	7.5	13.
V	170.	164.	180.	118.	136.	160.	190.	110.	45.	110.
Cr	—	—	—	—	—	—	—	—	—	—
Co	25.	21.	26.	19.	18.	24.	23.	15.	7.	12.
Zn	—	—	—	—	—	—	—	—	—	—
Sb	—	—	—	—	—	—	—	—	—	—

Table 3. Chemical and trace-element analyses of mafic inclusions, aggregates, dikes, and their host granitoids, associated gabbroid, and aplite—Continued

	Mount Givens Granodiorite—Continued									
	Courtright Reservoir—Continued									
	Aggregate—Continued			Inclusion						Hornfels
	CR3a-A	CR4-A	CR5-A	CR2b-I	CR3b-I	CR6-I	CR7-I	CR8-I	CR9-I	CR12-I
Chemical analyses (weight percent)										
SiO_2	56.6	57.8	51.9	55.0	56.8	53.5	52.3	51.4	54.2	54.6
Al_2O_3	14.2	14.0	14.1	18.4	13.6	18.1	18.6	17.8	18.0	16.5
Fe_2O_3	2.81	2.99	5.23	2.78	2.93	3.64	3.49	3.25	2.72	1.05
FeO	6.83	5.91	6.90	5.19	6.54	4.82	4.96	5.42	5.11	5.98
MgO	4.42	3.84	5.28	3.44	5.30	4.12	4.15	5.13	4.18	2.57
CaO	4.02	4.36	4.42	5.74	6.00	6.17	6.81	7.73	5.09	16.30
Na_2O	2.48	2.55	2.25	4.21	2.81	4.29	4.57	4.42	4.24	0.94
K_2O-	3.42	3.66	5.04	2.16	2.05	2.10	2.06	1.70	2.67	0.14
H_2O+	1.50	1.19	1.39	1.05	1.66	1.16	0.92	0.99	1.76	0.38
H_2O	0.25	0.30	0.26	0.25	0.23	0.29	0.21	0.24	0.29	0.15
TiO_2	2.05	1.78	2.37	1.12	0.94	1.12	1.19	1.20	1.08	1.03
P_2O_5	0.55	0.54	0.71	0.37	0.11	0.34	0.42	0.34	0.31	0.33
MnO	0.16	0.15	0.20	0.14	0.25	0.15	0.15	0.18	0.18	0.35
CO_2	<0.02	0.09	<0.02	0.07	0.07	0.06	0.06	<0.02	0.09	<0.02
Total	99.3	99.2	100.1	99.9	99.3	99.9	99.9	99.8	99.9	100.3
Trace-element analyses (parts per million)										
Rb	163.	141.	286.	104.	84.8	115.	115.	101.	175.	3.
Sr	390.	395.	330.	553.	352.	522.	516.	510.	512.	275.
Cs	—	—	—	—	—	—	—	—	—	—
Ba	1382.	1945.	1109.	739.	819.	332.	347.	249.	403.	66.
La	79.0	83.2	96.5	28.3	23.5	38.7	41.9	41.0	31.8	30.6
Ce	192.0	188.0	210.0	58.3	53.5	69.6	79.3	85.1	56.6	56.3
Pr	21.4	21.8	24.6	5.3	6.9	5.4	4.4	7.4	5.3	6.0
Nd	82.6	85.9	91.9	26.7	31.0	26.0	34.3	32.9	19.0	26.5
Sm	12.5	13.3	14.3	3.5	6.1	2.9	3.0	5.0	3.4	5.4
Eu	3.12	3.29	3.64	1.31	1.68	1.19	1.42	1.57	0.90	1.75
Gd	10.6	12.5	11.6	4.5	6.4	4.9	5.7	5.9	3.5	6.8
Tb	1.4	1.6	1.3	0.5	0.9	0.4	0.9	0.7	0.3	1.0
Dy	6.3	8.2	7.4	2.8	4.1	2.4	3.7	3.5	2.1	6.3
Ho	1.15	1.50	1.36	0.49	0.82	0.51	0.61	0.66	0.40	1.36
Er	2.6	3.9	3.2	1.2	2.1	1.1	1.4	1.7	1.0	4.0
Tm	0.22	0.45	0.37	0.13	0.26	0.05	0.17	0.20	0.15	0.60
Yb	2.48	3.01	3.20	1.16	2.13	1.13	1.39	1.47	1.01	4.07
Lu	0.32	0.48	0.46	0.16	0.33	0.19	0.18	0.21	0.15	0.56
Y	30.	33.	29.	16.	21.	14.	20.	17.	18.	34.
Zr	289.	254.	312.	135.	101.	134.	193.	141.	136.	169.
Hf	—	—	—	—	—	—	—	—	—	—
Nb	23.	25.	21.	8.	7.	8.	12.	8.	9.	6.
Ta	—	—	—	—	—	—	—	—	—	—
Th	24.0	24.5	17.5	7.44	7.17	7.40	7.41	6.28	7.75	7.61
U	5.80	4.36	9.72	3.07	2.56	3.28	3.80	2.45	4.96	4.04
Sc	17.	18.	16.	13.	34.	16.	17.	23.	20.	27.
V	250.	220.	215.	170.	175.	180.	165.	190.	185.	260.
Cr	—	—	—	—	—	—	—	—	—	—
Co	25.	23.	27.	16.	20.	20.	19.	24.	24.	17.
Zn	—	—	—	—	—	—	—	—	—	—
Sb	—	—	—	—	—	—	—	—	—	—

Table 4. CIPW norms of mafic inclusions, aggregates, dikes, and their host granitoids, associated gabbroid, and aplite

[tr, trace; —, not calculated]

	Bass Lake Tonalite											
	Hetch Hetchy											
	Tonalite	Aggregate		Inclusion	Dike rock							
	HH1-H	HH2-A	HH3-A	HH4-I	HH5a-D	HH5b-D	HH5c-D	HH5d-D	HH6a-D	HH6b-D	HH6c-D	HH6d-D
Q	25.7	10.8	15.1	—	tr	2.9	7.7	10.3	1.6	5.2	5.3	11.7
or	20.5	12.0	11.2	12.2	11.7	12.1	11.0	10.5	10.1	9.6	10.5	9.6
ab	25.1	27.8	27.4	31.4	31.5	30.6	30.2	29.3	31.1	29.7	28.3	31.3
an	17.2	27.0	26.3	29.4	28.8	27.7	26.5	27.0	28.6	27.8	29.2	26.1
C	0.3	—	—	—	—	—	—	—	—	—	—	—
di	—	3.0	1.7	5.8	6.1	6.1	5.8	4.8	8.4	7.6	6.1	4.3
hy	6.0	11.6	11.0	3.9	12.8	11.8	11.2	10.7	12.3	12.0	12.8	10.1
mt	2.2	3.4	3.4	4.9	4.0	3.7	3.6	3.6	3.6	3.8	3.3	3.5
ne	—	—	—	—	—	—	—	—	—	—	—	—
ol	—	—	—	8.1	—	—	—	—	—	—	—	—
il	1.0	1.7	1.6	2.1	2.7	2.5	2.3	2.1	2.2	2.2	2.1	1.9
ap	0.3	0.5	0.5	0.7	0.9	0.8	0.6	0.6	0.5	0.4	0.6	0.5
cc	—	0.2	0.1	0.2	—	—	—	—	—	—	—	—
Total	98.3	98.0	98.3	98.7	98.5	98.2	98.9	98.9	98.4	98.3	98.2	99.0

	Bass Lake Tonalite—Continued									Dinkey Creek Granodiorite		
	Hetch Hetchy—Continued	North Fork						Meadow Lakes		Shaver Lake quarry		
	Aplite	Tonalite	Inclusion		Dike rock		Gabbro	Tonalite	Inclusion	Granodiorite		Inclusion
	HH6e-AP	NF1-H	NF2-I	NF3-I	NF4a-D	NF4b-D	NF5-G	ML1-H	ML2-I	SQ1-H	SQ2-H	SQ3-I
Q	33.8	20.8	—	—	0.4	—	15.6	18.6	—	23.9	23.2	0.5
or	29.1	11.1	10.3	12.7	8.3	8.6	9.0	11.6	9.7	23.8	18.0	11.3
ab	20.5	29.0	29.3	28.3	22.2	26.7	18.8	29.1	30.6	22.9	25.1	29.7
an	10.8	24.6	28.1	28.3	39.0	35.5	25.9	24.9	29.4	17.2	19.5	27.2
C	0.7	0.1	—	—	—	—	—	—	—	—	—	—
di	—	—	9.8	6.7	6.3	7.4	9.8	1.2	8.3	0.8	1.5	8.0
hy	2.0	9.5	9.3	11.1	15.9	1.0	14.6	9.0	0.7	7.0	7.2	15.1
mt	1.2	1.6	2.9	3.1	1.9	2.5	3.2	2.2	4.2	1.7	2.2	3.7
ne	—	—	—	—	—	—	—	—	—	—	—	—
ol	—	—	6.4	5.5	—	12.9	—	—	10.8	—	—	—
il	0.4	1.0	1.5	1.6	3.3	2.4	1.1	1.6	3.8	1.0	1.2	2.1
ap	0.1	0.3	0.3	0.4	1.0	0.7	0.5	0.4	0.9	0.3	0.3	0.5
cc	—	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	—	0.1
Total	98.6	98.1	98.0	97.8	98.4	97.8	98.6	98.7	98.5	98.7	98.2	98.2

	Dinkey Creek Granodiorite—Continued											
	Shaver Lake quarry—Continued										Stevenson Creek	Camp Sierra
	Inclusion—Continued							Dike rock				Granodiorite
	SQ4-I	SQ5-I	SQ6-I	SQ7-I	SQ8-I	SQ9-I	SQ10-I	SQ12a-D	SQ12a-Di	SQ12a-Dx	SC1-D	CS1-H
Q	20.4	—	9.8	5.0	12.8	8.3	—	5.8	—	7.4	5.9	18.9
or	11.1	13.1	11.0	10.8	11.1	14.0	14.9	17.6	14.1	19.6	9.8	15.3
ab	26.9	29.8	29.1	29.3	26.3	30.6	30.7	21.8	30.9	18.7	27.0	25.2
an	22.7	26.2	25.7	26.6	23.3	24.8	27.3	18.2	24.6	16.0	30.7	23.2
C	—	—	—	—	—	—	—	—	—	—	—	—
di	3.4	7.5	4.7	6.9	5.7	1.2	4.6	9.1	6.4	8.1	4.0	1.3
hy	10.2	10.5	12.3	13.8	13.4	12.9	5.0	17.3	15.2	19.5	15.4	10.7
mt	2.5	4.3	3.4	3.5	3.4	3.8	4.2	5.1	4.1	4.9	2.7	2.1
ne	—	—	—	—	—	—	—	—	—	—	—	—
ol	—	4.2	—	—	—	—	8.2	—	0.5	—	—	—
il	1.6	2.2	1.9	2.0	1.8	2.4	2.4	2.6	2.4	3.0	2.1	1.5
ap	0.4	0.5	0.5	0.5	0.5	0.7	0.7	0.7	0.6	0.8	0.5	0.4
cc	—	0.2	0.3	0.2	0.2	0.2	0.3	—	—	0.2	0.2	tr
Total	99.2	98.5	98.7	98.6	98.5	98.9	98.3	98.2	98.8	98.2	98.3	98.6

Table 4. CIPW norms of mafic inclusions, aggregates, dikes, and their host granitoids, associated gabbroid, and aplite—Continued

	Dinkey Creek Granodiorite—Continued											
	Camp Sierra—Continued		Markwood Creek		Deer Creek					Wishon Reservoir		
	Inclusion		Granodiorite	Inclusion	Granodiorite	Aggregate	Inclusion			Granodiorite	Aggregate	Inclusion
	CS2-I	CS3-I	MK1-H	MK2-I	DR1-H	DR2-A	DR3-I	DR4-I	DR5-I	WR1-H	WR2-A	WR3-I
Q	16.3	13.4	19.9	—	11.7	10.0	2.8	—	—	16.9	10.4	—
or	11.4	11.1	15.3	11.0	10.2	12.0	7.5	2.7	3.0	13.3	18.6	14.6
ab	29.6	29.8	27.0	28.4	25.2	20.8	16.1	20.5	18.9	24.7	17.1	24.1
an	24.4	26.7	22.2	27.0	28.7	25.3	37.9	42.1	43.1	23.9	18.2	27.7
C	—	—	—	—	—	—	—	—	—	—	—	—
di	0.5	2.2	1.1	10.1	4.0	6.7	7.2	6.5	8.3	3.9	9.1	8.7
hy	10.7	10.4	8.7	7.6	12.9	16.7	17.2	13.6	17.9	11.1	17.0	—
mt	3.1	2.6	2.6	4.6	3.3	4.4	5.0	5.1	2.6	2.1	4.6	4.1
ne	—	—	—	—	—	—	—	—	—	—	—	0.8
ol	—	—	—	6.9	—	—	—	3.7	3.8	—	—	14.4
il	1.9	1.8	1.4	2.2	2.0	2.5	2.9	3.0	1.1	1.7	2.6	2.6
ap	0.7	0.5	0.4	0.5	0.5	0.7	0.6	0.7	0.3	0.4	0.7	1.0
cc	tr	tr	0.2	0.2	0.3	—	0.7	0.6	—	0.1	0.2	0.2
Total	98.6	98.5	98.8	98.5	98.8	99.1	97.9	98.5	98.9	98.1	98.5	98.2

	Granodiorite of Red Lake			Mount Givens Granodiorite								
	Chinese Peak			Mono Hot Springs		Camp 61						
	Granodiorite	Inclusion		Granodiorite	Inclusion	Granodiorite			Aggregate		Inclusion	
	RL1-H	RL2-I	RL3-I	MHa1-H	MHa2-I	MHb1-H	MHb2-H	MHb3-H	MHb4-A	MHb5-A	MHb6-I	MHb7-I
Q	29.0	—	0.2	22.2	—	23.6	24.6	24.5	8.6	16.0	3.1	1.5
or	17.1	15.5	12.5	16.5	9.5	21.3	21.0	18.2	23.2	19.6	11.8	8.4
ab	30.3	35.6	36.3	27.5	33.1	27.6	26.9	28.4	19.0	27.6	33.0	37.8
an	14.7	23.0	25.3	20.6	25.7	16.8	16.7	17.0	14.6	17.6	23.0	23.8
C	0.8	—	—	—	—	—	—	—	—	—	—	—
di	—	3.5	4.7	0.9	9.8	0.6	0.7	1.3	5.6	3.3	6.8	6.7
hy	3.7	8.2	11.6	6.5	12.5	5.4	5.0	5.0	16.2	8.5	15.4	12.2
mt	1.7	3.9	3.7	2.3	4.5	2.2	2.5	2.5	6.9	3.8	3.0	5.4
ne	—	—	—	—	—	—	—	—	—	—	—	—
ol	—	5.3	—	—	1.0	—	—	—	—	—	—	—
il	0.8	2.1	2.5	1.0	1.8	1.1	1.0	1.2	2.6	1.5	1.9	1.5
ap	0.3	0.7	1.0	0.3	0.5	0.4	0.4	0.4	0.8	0.5	0.6	0.6
cc	0.1	0.1	—	0.1	0.1	0.1	—	—	—	0.1	0.2	—
Total	98.5	97.9	97.8	97.9	98.5	99.1	98.8	98.5	97.5	98.5	98.8	97.9

	Mount Givens Granodiorite—Continued											
	Camp 61—Continued									Courtright Reservoir		
	Inclusion									Granodiorite	Aggregate	
	MHb8-I	MHb9a-Im	MHb9b-Ic	MHb10-I	MHb11-I	MHb12-I	MHb13-I	MHb14-I	MHb15-I	CR1-H	CR2a-A	CR3a-A
Q	—	—	2.3	—	7.5	5.8	—	—	11.7	15.1	15.1	12.2
or	23.2	15.0	9.9	12.9	13.2	8.0	13.3	13.4	8.8	35.2	23.8	20.2
ab	30.5	32.4	34.4	33.4	32.1	35.5	33.7	35.2	34.6	28.7	25.4	21.0
an	18.8	23.6	23.7	24.1	23.1	25.2	22.2	26.6	24.5	12.6	17.0	16.4
C	—	—	—	—	—	—	—	—	—	0.4	—	0.4
di	5.3	6.5	8.2	8.3	1.7	6.4	7.1	2.2	3.0	—	0.6	—
hy	—	—	13.8	0.2	14.1	10.2	9.6	—	10.7	4.7	10.3	18.1
mt	3.6	4.2	3.5	4.2	3.7	4.7	5.5	5.0	3.0	1.2	3.0	4.1
ne	0.1	0.3	—	—	—	—	—	2.7	—	—	—	—
ol	13.2	13.0	—	12.0	—	—	4.3	10.1	—	—	—	—
il	1.9	2.3	2.1	2.4	1.8	1.9	2.0	2.4	1.6	0.9	2.2	3.9
ap	1.0	0.9	0.7	0.9	0.6	0.6	0.6	1.1	0.5	0.2	0.8	1.3
cc	0.1	—	—	—	—	—	—	—	—	—	—	—
Total	97.7	98.2	98.6	98.4	97.8	98.3	98.3	98.7	98.4	99.0	98.2	97.6

Table 4. CIPW norms of mafic inclusions, aggregates, dikes, and their host granitoids, associated gabbroid, and aplite—Continued

	Mount Givens Granodiorite—Continued								
	Courtright Reservoir—Continued								
	Aggregate		Inclusion						Hornfels
	CR4-A	CR5-A	CR2b-I	CR3b-I	CR6-I	CR7-I	CR8-I	CR9-I	CR12-I
Q	13.4	2.8	3.6	10.7	1.2	—	—	0.8	14.9
or	21.6	29.8	12.8	12.1	12.4	12.7	10.1	15.8	0.8
ab	21.6	19.0	35.6	23.8	36.3	38.7	37.0	35.9	8.0
an	16.0	13.5	24.9	18.4	23.9	24.6	23.7	22.2	40.4
C	—	—	—	—	—	—	—	—	—
di	1.3	3.1	0.6	8.3	3.3	5.3	10.0	0.4	30.9
hy	14.7	16.5	13.9	17.7	13.0	4.2	—	15.9	—
mt	4.3	7.6	4.0	4.3	5.3	5.1	4.7	3.9	1.5
ne	—	—	—	—	—	—	0.2	—	—
ol	—	—	—	—	—	5.9	9.8	—	—
il	3.4	4.5	2.1	1.8	2.1	2.3	2.3	2.1	2.0
ap	1.3	1.6	0.9	0.3	0.8	1.0	0.8	0.7	0.8
cc	0.2	—	0.2	0.2	0.1	0.1	—	0.2	—
Total	97.8	98.4	98.6	97.6	98.4	99.9	98.6	97.9	99.3

Table 5. Average chemical analyses, in weight percent, of biotite in mafic inclusions, dikes, aggregates, and their host granitoids

[Chemical analyses by B. Barbarin using an electron microprobe; n, number of analyzed spots included in average; at., atomic; FeO*, total iron as FeO; m, margin; c, core]

Unit	Bass Lake Tonalite								Dinkey Creek Granodiorite			
Locality	North Fork (NF)					Meadow Lakes (ML)			Shaver Lake quarry (SQ)			
Sample No.	1	2	3	4a	4b	1		2	1			4a
Description	H	I	I	D	D	H	I	I	H	A	I	H
n	6	6	7	5	5	4	4	6	5	6	5	4
SiO_2	35.1	34.8	36.7	36.4	37.2	36.9	37.0	37.2	36.0	36.0	36.1	36.0
Al_2O_3	16.1	15.8	15.4	15.6	15.8	15.7	15.4	15.8	15.3	14.8	14.7	15.6
FeO*	20.8	21.0	21.1	20.0	19.3	20.9	20.9	20.9	22.3	22.4	22.8	21.7
MgO	9.78	9.70	9.94	10.24	11.25	9.87	9.51	10.18	9.24	9.87	9.54	9.65
CaO	0.04	0.04	0.04	0.02	0.03	0.02	0.03	0.03	0.01	0.02	0.01	0.02
Na_2O	0.08	0.09	0.09	0.14	0.09	0.09	0.10	0.09	0.07	0.07	0.07	0.07
K_2O	9.47	9.34	9.57	9.52	9.42	9.50	9.45	9.46	9.43	9.45	9.48	9.66
TiO_2	3.17	3.38	3.21	3.93	3.14	3.07	3.53	2.91	3.45	3.25	3.47	3.13
MnO	0.30	0.30	0.28	0.12	0.28	0.29	0.29	0.22	0.35	0.34	0.34	0.31
Total	94.8	94.5	96.3	96.0	96.5	96.3	96.2	96.8	96.2	96.2	96.5	96.1
at.Fe/Fe+Mg	0.54	0.55	0.54	0.52	0.49	0.54	0.55	0.54	0.58	0.56	0.57	0.56

Unit	Dinkey Creek Granodiorite–Continued											
Locality	Shaver Lake quarry (SQ)–Continued											
Sample No.	4a–Continued		4b		5		6		9		10	
Description	A	I	I(dark)	I(light)	H	I	H	I	H	I	H	I
n	9	3	4	4	3	7	4	6	3	7	4	7
SiO_2	36.2	36.5	35.7	35.7	36.5	36.6	36.3	36.3	36.3	36.6	36.2	36.5
Al_2O_3	15.6	15.7	15.5	15.8	15.7	15.3	15.1	15.2	15.6	15.8	15.7	16.0
FeO*	21.6	21.3	20.8	20.8	21.5	21.4	21.4	21.4	21.7	21.5	21.5	21.4
MgO	9.75	9.93	9.94	10.20	9.40	9.79	9.35	9.74	9.68	9.86	9.46	9.90
CaO	0.03	0.02	0.04	0.02	0.03	0.03	0.01	0.04	0.03	0.06	0.03	0.05
Na_2O	0.07	0.08	0.07	0.07	0.08	0.09	0.08	0.07	0.08	0.08	0.07	0.08
K_2O	9.72	9.86	9.56	9.57	9.61	9.50	9.39	9.36	9.33	9.24	9.30	9.25
TiO_2	3.17	3.05	3.36	2.74	3.20	2.83	3.35	3.08	2.95	2.88	3.20	2.50
MnO	0.31	0.33	0.31	0.30	0.33	0.34	0.33	0.33	0.34	0.35	0.34	0.34
Total	96.5	96.8	95.3	95.2	96.4	95.9	95.3	95.5	96.0	96.4	95.8	96.0
at.Fe/Fe+Mg	0.55	0.55	0.54	0.53	0.56	0.55	0.56	0.55	0.56	0.55	0.56	0.55

Unit	Dinkey Creek Granodiorite–Continued											
Locality	Shaver lake quarry (SQ)–Continued				Markwood Creek (MK)			Deer Creek (DR)				
Sample No.	12		13		1	2		1	2	3	4	
Description	H	I	H	I	H	H	I	H	A	I	H	I
n	5	5	4	6	5	7	5	7	9	6	5	7
SiO_2	36.1	36.1	36.2	36.4	36.0	36.4	36.3	36.3	36.9	37.2	36.9	37.3
Al_2O_3	15.7	15.7	15.7	15.6	15.9	16.0	15.7	15.6	15.2	16.0	15.4	15.7
FeO*	21.7	21.6	21.8	21.6	22.2	22.4	22.2	20.4	20.1	19.6	19.6	18.0
MgO	9.50	9.47	9.35	9.54	9.35	9.37	9.5	10.64	10.84	11.27	11.17	12.11
CaO	0.01	0.02	0.01	0.02	0.03	0.01	0.01	0.01	0.03	0.02	0.03	0.05
Na_2O	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.15	0.16	0.14	0.15	0.14
K_2O	9.75	9.76	9.78	9.78	9.39	9.58	9.55	9.44	9.42	9.47	9.50	9.55
TiO_2	3.23	3.46	3.63	3.18	3.59	3.50	4.16	3.62	3.34	2.76	3.24	2.96
MnO	0.35	0.36	0.33	0.34	0.32	0.29	0.31	0.26	0.22	0.16	0.15	0.09
Total	96.4	96.5	96.9	96.5	96.9	97.6	97.8	96.4	96.2	96.6	96.1	95.9
at.Fe/Fe+Mg	0.56	0.56	0.57	0.56	0.57	0.57	0.57	0.52	0.51	0.49	0.50	0.46

Table 5. Average chemical analyses, in weight percent, of biotite in mafic inclusions, dikes, aggregates, and their host granitoids—Continued

Unit	Dinkey Creek Granodiorite–Continued										Granodiorite of Red lake	
Locality	Deer Creek (DR)–Continued					Wishon Reservoir (WR)					Chinese Peak (CP)	
Sample No.	5			6		1	2		3		1	
Description	H	I	I	H	I	I	A	I	H	I	H	I(c)
n	5	3	4	5	5	4	6	4	4	7	5	5
SiO_2	36.9	37.0	37.3	36.5	36.9	36.2	37.0	36.9	37.0	37.2	37.0	37.1
Al_2O_3	16.2	16.4	16.0	16.1	16.0	15.8	15.9	15.7	15.8	15.8	14.9	14.6
FeO*	19.1	18.3	19.2	18.8	18.4	20.3	21.3	21.1	21.6	21.2	20.7	20.4
MgO	11.44	12.04	11.38	11.97	12.10	11.06	10.50	10.69	10.23	10.45	10.47	10.50
CaO	0.02	0.05	0.02	0.03	0.02	0.03	0.02	0.03	0.03	0.01	0.01	0.01
Na_2O	0.17	0.12	0.12	0.16	0.17	0.09	0.08	0.08	0.08	0.08	0.10	0.10
K_2O	9.42	9.64	9.59	9.54	9.54	9.46	9.32	9.23	9.22	9.30	9.17	9.23
TiO_2	2.88	2.26	3.00	2.49	3.10	2.96	2.48	2.28	2.70	2.56	3.77	3.88
MnO	0.14	0.11	0.13	0.13	0.10	0.37	0.30	0.29	0.28	0.29	0.48	0.42
Total	96.3	95.9	96.7	95.7	96.3	96.3	96.9	96.3	96.9	96.9	96.6	96.2
at.Fe/Fe+Mg	0.48	0.46	0.49	0.47	0.46	0.51	0.53	0.53	0.54	0.53	0.53	0.52

Unit	Granodiorite of Red Lake–Continued		Mount Givens Granodiorite									
Locality	Chinese Peak (CP)–Continued		Mono Hot Springs (MHa)			Camp 61 (MHb)						
Sample No.	1	2	1	2		1	6	7	8	9		
Description	I(m)	I	H	H	I	H	I	I	I	H	I(c)	I(m)
n	6	5	4	4	6	7	6	5	4	3	5	6
SiO_2	37.3	36.4	37.3	36.8	36.8	38.3	35.8	36.2	36.2	35.9	36.3	36.1
Al_2O_3	14.8	14.7	15.8	16.0	15.7	15.6	15.1	15.5	15.5	15.5	15.4	15.4
FeO*	20.0	20.7	19.9	21.1	21.4	18.6	18.6	18.7	17.9	18.7	18.7	18.7
MgO	10.79	10.60	11.2	10.4	10.4	12.4	11.6	11.7	12.6	11.6	11.7	11.7
CaO	0.03	0.03	0.02	0.02	0.02	0.03	0.01	0.01	0.05	0.02	0.03	0.04
Na_2O	0.11	0.10	0.08	0.08	0.09	0.09	0.08	0.09	0.07	0.08	0.08	0.08
K_2O	9.25	9.66	9.26	9.25	9.17	9.49	9.47	9.47	9.66	9.45	9.55	9.45
TiO_2	3.62	3.68	2.72	2.42	2.51	2.37	3.23	2.43	1.93	2.87	3.06	2.80
MnO	0.43	0.40	0.44	0.29	0.30	0.47	0.39	0.46	0.35	0.41	0.35	0.39
Total	96.3	96.3	96.7	96.4	96.4	97.4	94.3	94.6	94.3	94.5	95.2	94.7
at.Fe/Fe+Mg	0.51	0.52	0.50	0.54	0.54	0.46	0.47	0.47	0.45	0.48	0.47	0.47

Unit	Mount Givens Granodiorite–Continued						
Locality	Camp 61 (MHb)–Continued						
Sample No.	10			11		12	
Description	H	I(c)	I(m)	H	I	H	I
n	4	6	4	6	5	4	7
SiO_2	36.2	36.3	36.3	36.7	36.8	36.8	36.8
Al_2O_3	15.3	15.6	15.7	15.5	15.4	15.4	15.3
FeO*	18.7	18.7	18.3	18.8	18.8	18.7	18.8
MgO	11.8	11.8	11.9	11.7	11.5	11.7	11.8
CaO	0.02	0.04	0.06	0.02	0.02	0.01	0.03
Na_2O	0.07	0.07	0.07	0.08	0.08	0.09	0.08
K_2O	9.51	9.48	9.37	9.58	9.59	9.66	9.54
TiO_2	2.85	2.72	2.35	2.62	3.11	2.61	2.67
MnO	0.37	0.38	0.41	0.42	0.39	0.43	0.39
Total	94.8	95.1	94.5	95.4	95.7	95.4	95.4
at.Fe/Fe+Mg	0.47	0.47	0.46	0.47	0.48	0.47	0.47

Table 6. Average chemical analyses, in weight percent, of hornblende in mafic inclusions, dikes, aggregates, and their host granitoids and associated gabbroid

[Chemical analyses by B. Barbarin using an electron microprobe; n, number of analyzed spots included in average; at., atomic; FeO*, total iron as FeO; m, margin; c, core]

Unit	Bass Lake Tonalite								Dinkey Creek Granodiorite			
Locality	North Fork (NF)					Meadow Lakes (ML)			Shaver Lake quarry (SQ)			
Sample No.	1	2	3	4a	5	1		2	1			4a
Description	H	I	I	D	G	H	I	I	H	A	I	H
n	4	6	6	5	5	5	3	5	5	4	6	4
SiO_2	44.2	43.5	46.3	46.5	46.7	45.4	45.6	45.6	44.6	44.5	44.3	44.3
Al_2O_3	8.77	8.81	8.35	8.85	8.48	8.69	8.75	8.61	8.33	8.31	8.39	8.25
FeO*	18.1	18.2	18.6	16.1	16.6	18.5	18.9	18.5	19.7	19.8	20.3	19.2
MgO	10.07	9.87	10.08	11.31	11.50	9.99	9.68	10.01	9.70	9.67	9.34	9.82
CaO	12.5	12.7	12.4	12.3	12.1	12.2	12.4	12.4	11.9	11.8	12.0	12.9
Na_2O	1.07	1.01	1.00	1.09	0.99	1.09	0.97	1.01	1.13	1.30	1.18	1.04
K_2O	0.75	0.84	0.82	0.44	0.83	0.88	0.93	0.89	0.92	0.91	0.94	0.86
TiO_2	1.23	0.96	0.91	1.27	1.11	1.43	1.24	1.45	1.39	1.54	1.33	1.28
MnO	0.51	0.51	0.50	0.29	0.49	0.46	0.44	0.43	0.53	0.52	0.54	0.50
Total	97.2	96.4	99.0	98.2	98.8	98.6	98.9	98.9	98.2	98.4	98.3	98.2
at.Fe/Fe+Mg	0.50	0.51	0.51	0.45	0.45	0.51	0.52	0.51	0.53	0.54	0.55	0.52

Unit	Dinkey Creek Granodiorite—Continued											
Locality	Shaver Lake quarry (SQ)—Continued											
Sample No.	4—Continued				5		6		9		10	
Description	A	I	I (dark)	I (light)	H	I	H	I	H	I	H	I
n	7	3	6	4	4	7	4	6	3	7	4	7
SiO_2	44.8	45.1	44.1	44.7	45.3	44.6	45.0	44.8	44.5	45.1	44.2	44.4
Al_2O_3	8.31	8.52	8.13	8.16	8.08	8.66	8.21	8.32	8.48	8.49	8.67	8.91
FeO*	18.9	19.2	18.4	18.1	19.0	19.6	19.0	19.4	19.1	19.3	19.5	19.7
MgO	10.00	9.89	10.23	10.40	9.91	9.33	9.73	9.49	9.81	9.71	9.22	9.30
CaO	12.6	12.6	13.2	13.0	11.9	12.0	12.1	12.2	11.8	12.4	12.1	12.4
Na_2O	1.12	1.02	0.97	0.98	1.10	1.11	1.09	1.02	1.17	1.01	1.07	0.99
K_2O	0.88	0.90	0.83	0.85	0.88	0.99	0.89	0.91	0.92	0.89	0.95	0.92
TiO_2	1.44	1.19	1.19	1.21	1.30	1.31	1.38	1.24	1.43	1.20	1.32	1.19
MnO	0.50	0.49	0.49	0.47	0.53	0.53	0.50	0.49	0.48	0.54	0.53	0.51
Total	98.6	98.9	97.5	97.9	98.0	98.1	97.9	97.9	97.7	98.6	97.6	98.30
at.Fe/Fe+Mg	0.51	0.52	0.50	0.49	0.52	0.54	0.52	0.54	0.52	0.53	0.54	0.54

Unit	Dinkey Creek Granodiorite—Continued											
Locality	Shaver lake quarry (SQ)—Continued				Markwood Creek (MK)			Deer Creek (DR)				
Sample No.	12		13		1	2		1	2	3	4	
Description	H	I	H	I	H	H	I	H	A	I	H	I
n	5	6	3	7	5	5	7	7	9	6	5	7
SiO_2	44.2	44.3	44.7	44.5	45.1	44.6	44.2	45.4	46.0	47.1	45.9	45.5
Al_2O_3	8.68	8.70	8.35	8.68	8.51	8.87	9.32	8.52	8.14	8.27	8.70	9.47
FeO	19.7	19.6	19.6	19.6	19.8	20.1	20.0	17.8	15.6	15.0	16.2	16.1
MgO	9.34	9.35	9.53	9.43	9.72	9.52	9.37	10.89	10.95	13.01	12.12	11.81
CaO	11.8	11.9	11.7	11.8	12.0	12.0	12.1	11.9	12.4	11.9	11.7	11.8
Na_2O	1.13	1.06	1.15	1.06	1.06	1.12	1.10	1.09	1.03	0.99	1.06	1.05
K_2O	0.97	0.95	0.95	0.96	0.92	1.00	1.05	0.83	0.82	0.63	0.63	0.59
TiO_2	1.36	1.20	1.32	1.27	1.39	1.37	1.38	1.48	1.49	1.65	1.64	1.69
MnO	0.53	0.53	0.52	0.52	0.49	0.49	0.48	0.46	0.43	0.31	0.32	0.28
Total	97.7	97.6	97.8	97.8	99.0	99.1	99.0	98.4	96.9	98.9	98.3	98.3
at.Fe/Fe+Mg	0.54	0.54	0.54	0.54	0.53	0.54	0.55	0.48	0.47	0.39	0.43	0.43

Table 6. Average chemical analyses, in weight percent, of hornblende in mafic inclusions, dikes, aggregates, and their host granitoids and associated gabbroid—Continued

Unit	Dinkey Creek Granodiorite—Continued										Granodiorite of Red lake	
Locality	Deer Creek (DR)—Continued					Wishon Reservoir (WR)					Chinese Peak (CP)	
Sample No.	5			6		1	2		3		1	
Description	H	I	I	H	I	I	A	I	H	I	H	I(c)
n	5	3	4	5	5	4	6	4	4	7	4	5
SiO_2	46.6	46.2	46.8	45.4	46.3	46.0	46.4	46.0	46.3	46.5	46.4	46.3
Al_2O_3	8.94	9.25	8.75	9.09	8.64	7.87	8.32	8.75	8.57	8.44	8.26	8.07
FeO	16.1	16.1	16.1	16.2	16.1	17.7	18.4	18.9	18.4	18.5	16.8	17.3
MgO	12.13	11.94	12.15	12.02	12.30	11.21	10.54	10.11	10.42	10.38	11.54	11.07
CaO	12.5	11.5	11.4	11.2	11.2	12.3	12.4	12.5	12.3	12.5	12.1	12.2
Na_2O	0.98	0.96	0.95	1.05	0.93	0.99	0.97	0.92	1.01	0.96	1.36	1.27
K_2O	0.63	0.60	0.54	0.75	0.56	0.75	0.83	0.85	0.81	0.80	0.81	0.80
TiO_2	1.56	1.64	1.38	1.80	1.41	1.20	1.42	1.08	1.28	1.19	1.30	1.29
MnO	0.32	0.29	0.37	0.30	0.33	0.55	0.47	0.46	0.46	0.47	0.58	0.65
Total	99.8	98.5	98.4	97.8	97.8	98.6	99.8	99.6	99.6	99.7	99.2	99.0
at.Fe/Fe+Mg	0.43	0.43	0.43	0.43	0.42	0.47	0.50	0.51	0.50	0.50	0.45	0.47

Unit	Granodiorite of Red Lake—Continued		Mount Givens Granodiorite									
Locality	Chinese Peak (CP)—Continued		Mono Hot Springs (MHa)			Camp 61 (MHb)						
Sample No.	1	2	1	2		1	6	7	8	9		
Description	I(m)	I	H	I	I	H	I	I	I	H	I(c)	I(m)
n	5	5	4	4	6	5	6	5	5	3	6	9
SiO_2	47.6	46.5	46.8	45.8	45.7	48.4	45.3	45.9	47.5	45.4	45.1	45.2
Al_2O_3	7.31	7.25	8.11	8.80	8.64	7.42	7.28	7.19	6.07	7.84	7.81	7.98
FeO*	16.5	16.5	17.1	18.9	18.8	16.1	15.8	15.9	14.8	16.0	16.2	16.4
MgO	11.96	11.93	11.5	10.0	10.0	12.4	12.1	12.1	13.5	12.0	11.9	11.6
CaO	12.1	11.7	12.3	12.4	12.4	12.6	13.3	13.1	12.7	13.0	13.2	13.2
Na_2O	1.20	1.29	1.04	1.01	0.97	1.05	0.96	0.99	0.78	1.10	1.06	1.01
K_2O	0.67	0.70	0.78	0.85	0.82	0.71	0.67	0.69	0.51	0.81	0.79	0.78
TiO_2	1.23	1.26	1.28	1.22	1.27	1.10	1.14	1.22	0.65	1.32	1.23	1.18
MnO	0.61	0.58	0.59	0.47	0.47	0.64	0.60	0.63	0.54	0.58	0.56	0.58
Total	99.2	97.7	99.5	99.5	99.1	100.4	97.2	97.7	97.1	98.1	97.9	97.9
at.Fe/Fe+Mg	0.44	0.44	0.46	0.52	0.51	0.42	0.42	0.43	0.38	0.43	0.43	0.44

Unit	Mount Givens Granodiorite—Continued						
Locality	Camp 61 (MHb)—Continued						
Sample No.	10			11		12	
Description	H	I(c)	I(m)	H	I	H	I
n	4	4	6	5	6	5	7
SiO_2	45.1	45.5	45.9	47.0	46.7	46.6	46.5
Al_2O_3	7.90	7.64	7.52	7.26	7.95	7.49	7.42
FeO*	15.7	16.5	16.1	15.8	15.8	15.9	16.2
MgO	12.2	11.6	12.0	12.4	12.2	12.3	12.1
CaO	13.0	13.3	13.1	12.2	12.2	12.1	12.1
Na_2O	1.15	0.97	0.95	0.94	0.94	1.04	0.98
K_2O	0.79	0.71	0.68	0.69	0.71	0.74	0.74
TiO_2	1.29	1.02	1.12	1.00	1.14	1.07	1.03
MnO	0.53	0.56	0.56	0.60	0.61	0.57	0.57
Total	97.7	97.8	97.9	97.9	98.3	97.8	97.6
at.Fe/Fe+Mg	0.42	0.44	0.43	0.42	0.42	0.42	0.43

Table 7. Rb-Sr isotopic data on mafic inclusions, dikes, aggregates, and their host granitoids

[Rb and Sr concentrations by energy dispersive X-ray fluorescence. Analyses by A.C. Robinson and M. Wilcox. c, coarse; f, fine]

Sample	Rb(ppm)	Sr(ppm)	$^{87}Rb/^{86}Sr$	$^{87}Sr/^{86}Sr$
Bass Lake Tonalite				
HH1-H	103	360	0.83	0.70723±6
HH2-A	65.3	488	0.39	0.70650±6
HH3-A	68.8	455	0.44	0.70677±6
HH4-I	86.1	486	0.51	0.70676±5
HH5a-D	74.1	665	0.32	0.70653±3
HH5b-D	63.8	654	0.28	0.70640±3
HH5c-D	61.3	619	0.29	0.70608±4
HH5d-D	54.9	595	0.27	0.70643±3
HH6a-D	58.1	580	0.29	0.70566±4
HH6b-D	61.8	569	0.31	0.70565±5
HH6c-D	54.4	637	0.25	0.70652±5
HH6d-D	68.8	525	0.38	0.70612±3
HH6e-AP	90.1	385	0.68	0.70684±6
NF1-H	66.5	276	0.70	0.70562±4
NF2-I	61.7	245	0.73	0.70573±4
NF3-I	87.8	253	1.00	0.70616±4
NF4a-D	34.3	769	0.13	0.70633±3
NF4b-D	40.6	620	0.19	0.70565±4
NF5-G	43.9	450	0.28	0.70541±4
Dinkey Creek Granodiorite				
SQ1-H	132	310	1.23	0.70930±4
SQ2-H	125	330	1.10	0.70914±5
SQ3-I	103	336	0.89	0.70886±5
SQ3a-A	161	207	2.25	0.71089±5
SQ3b-Ac	196	180	3.15	0.71215±5
SQ3b-Af	156	276	1.64	0.70980±6
SQ4-I	101	328	0.89	0.70881±5
SQ5-I	142	292	1.41	0.70945±4
SQ6-I	110	321	0.99	0.70893±5
SQ7-I	96.3	344	0.81	0.70874±4
SQ8-I	161	321	1.45	0.70966±4
SQ9-I	110	281	1.13	0.70916±5
SQ11-I	169	330	1.48	0.70969±3
DR1a-H	62.6	471	0.38	0.70787±5
Dinkey Creek Granodiorite—Continued				
DR2-A	76.6	382	0.58	0.70797±3
DR3-I	50.6	471	0.31	0.70744±4
DR4a-I	15.4	578	0.08	0.70745±4
DR5-I	13.1	575	0.07	0.70739±3
WR1-H	96.1	402	0.69	0.70834±3
WR2-A	124	257	1.40	0.70920±4
WR3-I	124	380	0.94	0.70852±3
Mount Givens Granodiorite				
MHb1-H	130	414	0.91	0.70765±4
MHb2-H	129	425	0.88	0.70762±3
MHb3-H	126	434	0.84	0.70757±8
MHb4-A	207	262	2.29	0.70942±6
MHb5-A	142	387	1.06	0.70781±3
MHb6-I	141	356	1.15	0.70783±5
MHb7-I	77.0	403	0.55	0.70717±4
MHb8-I	291	360	2.34	0.70925±3
MHb9a-Im	167	362	1.33	0.70814±5
MHb9b-Ic	103	364	0.82	0.70731±5
MHb10-I	172	375	1.33	0.70816±5
MHb13-I	210	329	2.43	0.70875±8
MHb14-I	193	410	1.36	0.70819±6
MHb15-I	98.1	403	0.70	0.70737±3
CR1-H	184	484	1.10	0.70807±5
CR2a-A	120	533	0.65	0.70734±3
CR2b-I	104	553	0.54	0.70721±3
CR3a-A	163	390	1.21	0.70805±5
CR3b-I	84.8	352	0.70	0.70733±3
CR4-A	141	395	1.03	0.70780±4
CR5-A	286	330	2.51	0.70966±4
CR6-I	115	522	0.64	0.70732±4
CR7-I	115	516	0.64	0.70735±5
CR8-I	101	510	0.57	0.70727±5
CR9-I	175	512	0.99	0.70774±6
CR10-I	0.2	275	0.003	0.70987±1

Table 8. Sm-Nd isotopic data on mafic inclusions, aggregates, and associated rocks

[Sm and Nd concentrations from table 3. Data for SLb96X3, host granitoid, from Domenick and others (1983)]

Sample No.	Sm (ppm)	Nd (ppm)	$^{147}Sm/^{144}Nd$	$^{143}Nd/^{144}Nd$
Bass Lake Tonalite				
HH1-H	1.3	13.9	0.057	0.51231±3
HH4-I	5.9	34.6	0.103	0.51237±2
HH6a-D	1.8	25.3	0.043	0.51246±2
Dinkey Creek Granodiorite				
Slb96X3	5.6	32.2	0.105	0.51218±1
SQ2-H	3.9	21.9	0.107	0.51220±2
SQ5-I	8.1	39.0	0.126	0.51225±2
SQ9-I	5.6	25.0	0.135	0.51233±2
DR2-A	6.7	26.9	0.151	0.51229±3
Mount Givens Granodiorite				
MHb3-H	3.8	34.1	0.067	0.51237±2
MHb4-A	10.1	56.6	0.108	0.51246±2
MHb13-I	6.1	28.4	0.130	0.51248±2

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