DEPARTMENT OF THE INTERIOR

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Petrographic data for plutonic rocks and gneisses of the Glacier Peak Wilderness and vicinity, northern Cascades, Washington

by

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INTRODUCTION

This preliminary report contains petrographic data (modes, specific gravities, and rock classifications) for plutonic and gneiss units of the Glacier Peak Wilderness and vicinity, northern Cascades, Washington (fig. 1). The study area straddles the drainage divide of the range immediately south of North Cascades National Park Complex. Data are given for a total of 639 samples from 36 plutons and gneiss units of this area which transects a large south-central part of the crystalline rock province of the North Cascades. The sampling and related fieldwork were carried out in summers of 1980-82 as part of the U.S. Geological Survey's study of the mineral-resource potential of the wilderness and proposed additions to the wilderness (Church and others, 1984). The purpose of this report is to provide background reference data for other reports and geologic, geophysical, and geochemical maps of the area that are in various stages of preparation.

Locations of units sampled in this study are shown (capitalized symbols) on the geologic sketch map of figure 2. The tables of data for most units are accompanied by larger scale geologic sketch maps that were prepared from a 1:100,000-scale geologic map of the wilderness (Ford, unpublished data) or other sources as indicated. A complete discussion of the geology of the area and of individual units is beyond the scope of this report, which therefore does not reference the abundant previous work by others on most units. Principal references for individual areas of prior geologic mapping are shown on an index map of Ford (1983a, fig. 2).

The regional geologic setting of the area and description of units as they occur in areas to the north are given by Misch (1966). Studies by many (here uncited) earlier workers show that this part of the North Cascades is an area of great lithologic variety, structural complexity, and lengthy igneous activity. The record of igneous activity ranges from at least Triassic (Marblemount Meta Quartz Diorite and Dumbell Mountain plutons) to the Quaternary (Glacier Peak volcano). Depending on interpretation of its protolith, the Swakane Biotite Gneiss may indicate a record back to the Precambrian (Mattinson, 1972). Major episodes of plutonism occurred in the Late Cretaceous (Eldorado Orthogneiss and Sloan Creek, Tenpeak, Seven-fingered Jack, Entiat, and possibly Sulphur Mountain, Jordan Lakes, Mt. Chaval, and Riddle Peaks plutons, among others); the Eocene (Railroad Creek and Duncan Hill plutons, among others); and the Miocene (Cloudy Pass batholith and Mt. Buckindy and Cascade Pass plutons, among others). The Cretaceous and older plutons are generally well foliated and recrystallized, indicating emplacement before or during regional metamorphism. Major regional synkinematic metamorphism of 90-60 Ma age (Mattinson, 1972) formed extensive units of gneiss, migmatite, and schist (Chiwaukum Schist and schists of the Cascade and Napeequa Rivers) in the area; metamorphic facies vary from greenschist or locally subgreenschist to amphibolite (garnet, staurolite, kyanite, and sillimanite zones). Eocene plutons are in places foliated or show zones of cataclasis but are little recrystallized. Miocene plutons are shallow-level intrusions characterized by porphyry phases, dike complexes and roof-breccia complexes in places containing breccia pipes. They also contain areas of hydrothermal alteration and porphyry copper-molybdenum mineralization.

Data on the oxygen isotopic composition of many samples of the present report are given by White and others (1985). Magnetic susceptibility data for samples are given by Ford and others (1986). Results of geophysical studies of the area include a Bouguer gravity anomaly map (Sherrard and Flanigan (1983), an aeromagnetic map (Flanigan and Sherrard, 1985) and a geologic interpretation of the aeromagnetic map (Flanigan and others, 1983.

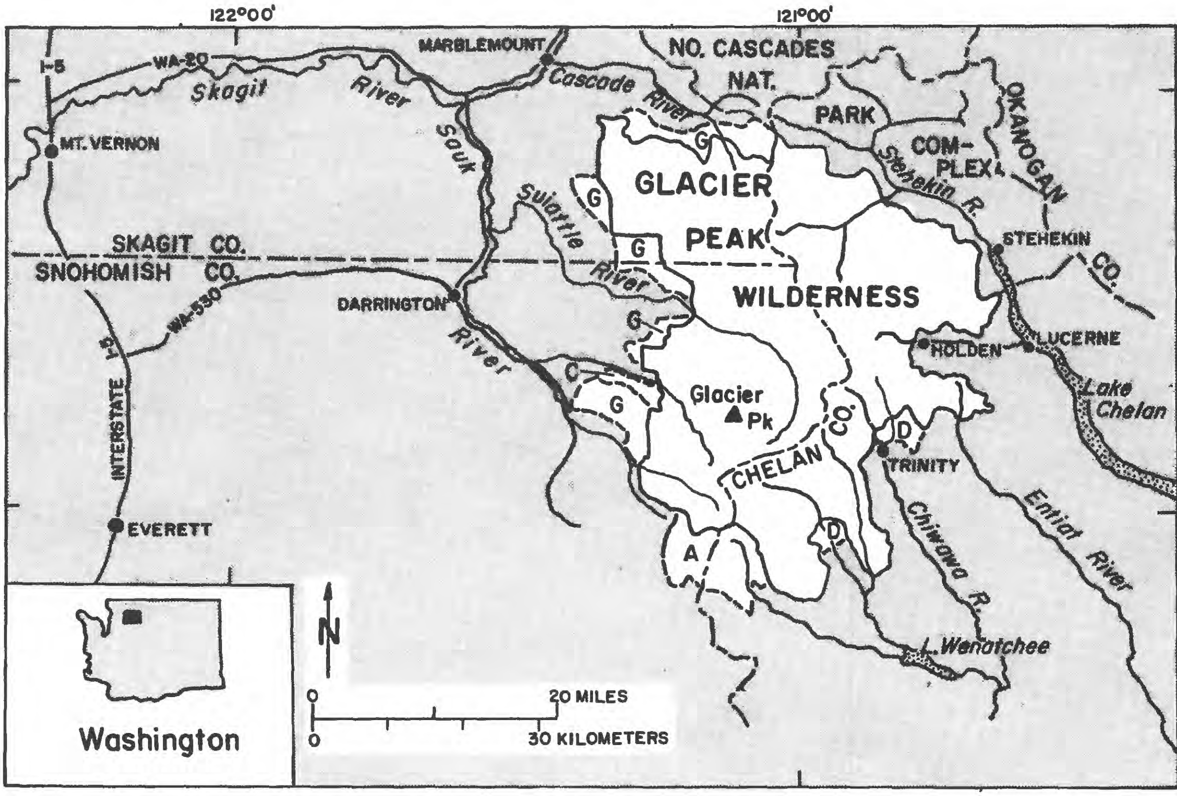
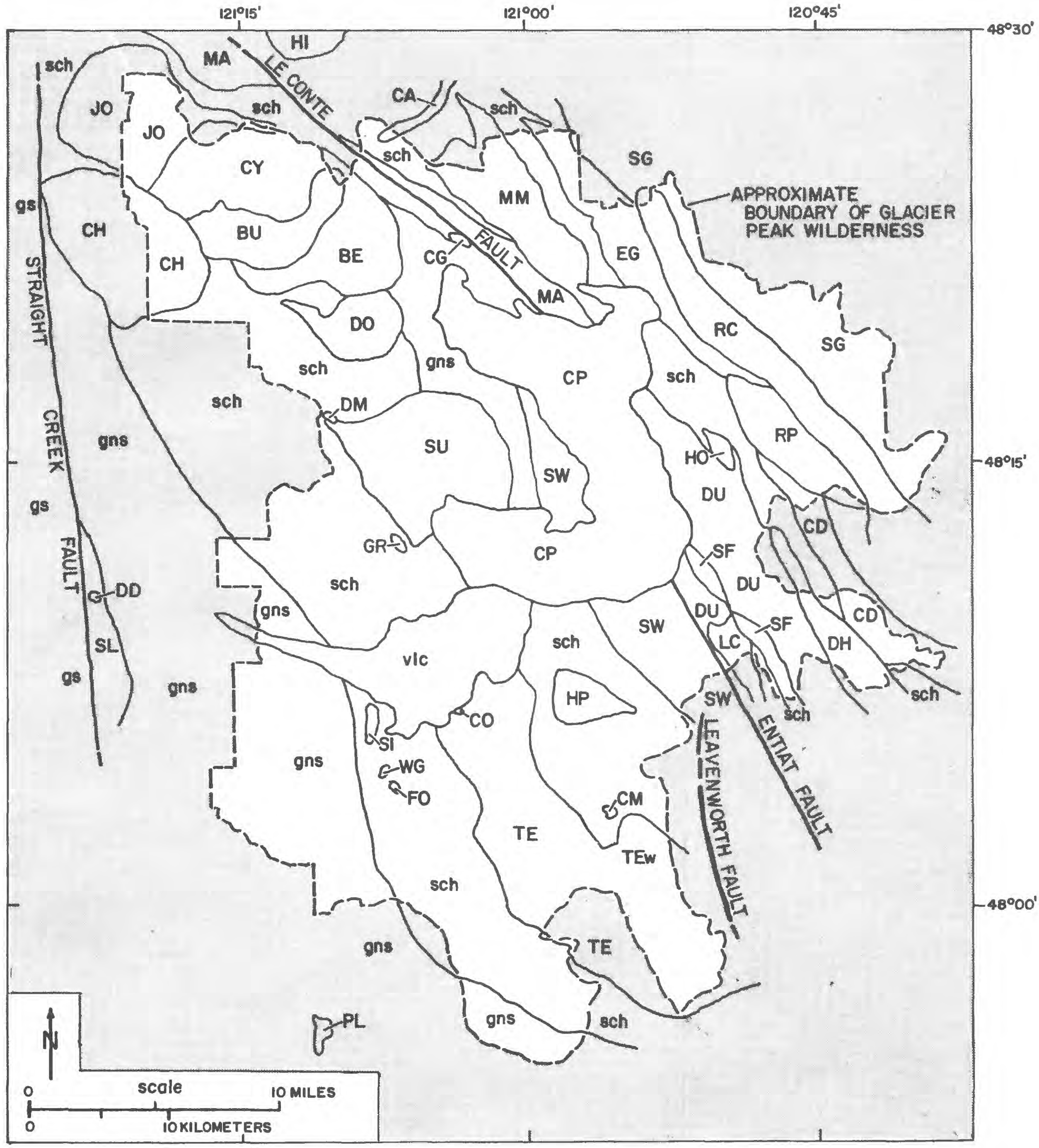


Figure 1.--Index map showing location of the Glacier Peak Wilderness study area (unshaded) and principal access routes. Areas A, C, D, and G are proposed wilderness additions (see Church and others, 1984).

Figure 2. (facing page)--Sketch geologic map of the Glacier Peak Wilderness (unshaded) and vicinity showing generalized map units and major faults. Names of units from original sources given in Ford (1983a) or from Ford and others (in press). TE includes area (TEw) mapped as White Mountain pluton by Cater and Crowder (1967). Unit abbreviations used in this report are as follows:

BE	Tonalite of Bench Lake
BU	Mount Buckindy pluton
CA	Cascade Pass pluton
CD	Cardinal Peak pluton
CG	South Cascade Glacier stock
CH	Mount Chaval pluton
CM	Clark Mountain stocks
CO	Cool stock
CP	Cloudy Pass batholith
CY	Cyclone Lake pluton
DD	Dead Duck pluton
DH	Duncan Hill pluton
DM	Downey Mountain stock
DO	Downey Creek pluton
DU	Dumbell Mountain plutons
EG	Eldorado Orthogneiss
FO	Foam Creek stock
HI	Hidden Lake stock
HO	Holden Lake pluton
HP	High Pass pluton
GR	Grassy Point stock
JO	Jordan Lakes pluton
LC	Leroy Creek pluton
MA	Marblemount Meta Quartz Diorite
MM	Magic Mountain Gneiss
PL	Pear Lake pluton
RC	Railroad Creek pluton
RP	Riddle Peaks pluton
SI	Sitkum stock
SF	Seven-fingered Jack plutons
SG	Skagit Gneiss
SL	Sloan Creek plutons
SU	Sulphur Mountain pluton
SW	Swakane Biotite Gneiss
TE	Tenpeak pluton
WG	White Chuck Glacier pluton
gns	gneiss and schist, mixed
gs	greenschist and blueschist
vlc	volcanic materials


121°15'
121°00'
120°45'
48°30'
48°15'
48°00'
LE CONTE FAULT
STRAIGHT CREEK FAULT
ENTIAT FAULT
LEAVENWORTH FAULT
APPROXIMATE BOUNDARY OF GLACIER PEAK WILDERNESS
HI
MA
CA
sch
JO
CY
SG
MM
gs
CH
BU
BE
CG
EG
DO
RC
gns
CP
DM
SU
SW
HO
RP
DU
GR
CD
SF
DD
vlc
LC
DH
SL
HP
CO
SI
WG
FO
CM
TE
TEw
PL
N
scale
0
10 MILES
10 KILOMETERS

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METHODS

Most samples are medium to coarse in grain size, and therefore (volume) percentages of quartz, K-feldspar, plagioclase, and total mafic minerals were determined by the stained-slab method of Norman (1974). Except for a few samples counted only in thin section, modes were determined by counting approximately 1,000 points on rock slabs of generally about 70 cm^2 or greater area that were etched (HF acid) and stained for K-feldspar (yellow) and plagioclase (red). Results are given in following tables and shown diagrammatically on triangular plots of (1) K-feldspar, quartz, and plagioclase (recalculated to 100 percent) used for modal classification; and (2) quartz, total mafic minerals, and total feldspar. The plots of modal data show areas (shaded) of two standard deviations of the data, based on (+ and -) one standard deviation from the mean (small triangles) for each end member. In the quartz-mafics-feldspars plots (2), samples lying inside the area of standard deviation are not plotted.

Many of the samples were also used for other studies, including major- and minor-element chemistry, geochronology, oxygen and strontium isotopic analysis, and magnetic susceptibility determinations. Most of those samples were additionally point counted in thin section to determine amounts of individual mafic and other minerals, such as pyroxene, biotite, hornblende, epidote, and muscovite. Primary and secondary minerals were not discriminated in the thin-section mode counts. All green and brown amphiboles were counted as "hornblende," a term which for some units, such as the Riddle Peaks and Chaval plutons and the Marblemount Meta Quartz Diorite, includes a variety of primary and secondary amphiboles. "Epidote" includes all minerals of the epidote group, except for allanite, an accessory mineral reported separately. All white micas are included under "muscovite." The stained-slab modes were recalculated using the thin section data. All results are plotted in the modal classification diagrams of units to show the complete variation of our determinations, but sample plot numbers are given only for chemically analyzed samples.

Specific gravity was measured with a direct-reading beam balance, by first balancing a sample of generally fist size or larger dry in air and then rebalancing in water after a sufficient immersion period to allow all possible escape of air bubbles from cracks and surfaces. The method commonly yields results somewhat less than by other methods probably due to presence of air remaining in deep interior cracks or pockets.

In this report most plutonic rocks are named using the classification and nomenclature of Streckeisen (1967), based on modal proportions of quartz, K-feldspar, and plagioclase (fig. 3). Figure 3 is also used to indicate compositional varieties of rocks not included in Streckeisen's (1967) diagram, such as alaskite (<5 percent mafic minerals) and gneiss that may be nonmagmatic (Swakane Biotite Gneiss) or magmatic (Dumbell Mountain plutons) in origin. Rocks in the plagioclase corner of the diagram require knowledge of plagioclase composition for naming. Plagioclase An contents have not been determined by optical or other methods in this preliminary study, and we therefore use CIPW normative plagioclase compositions determined from available chemical analyses to distinguish diorite or quartz diorite (An<50) from gabbro or quartz gabbro.

Locations of the units studied are shown in figure 2, on indexes accompanying geologic sketch maps of units, or are described using USGS quadrangle map names (fig. 4). Sample sites are shown on a 1:100,000-scale topographic map base (Ford, 1983b). Approximate locations of sites sampled for chemical as well as petrographic studies are shown on geologic sketch maps of the units.

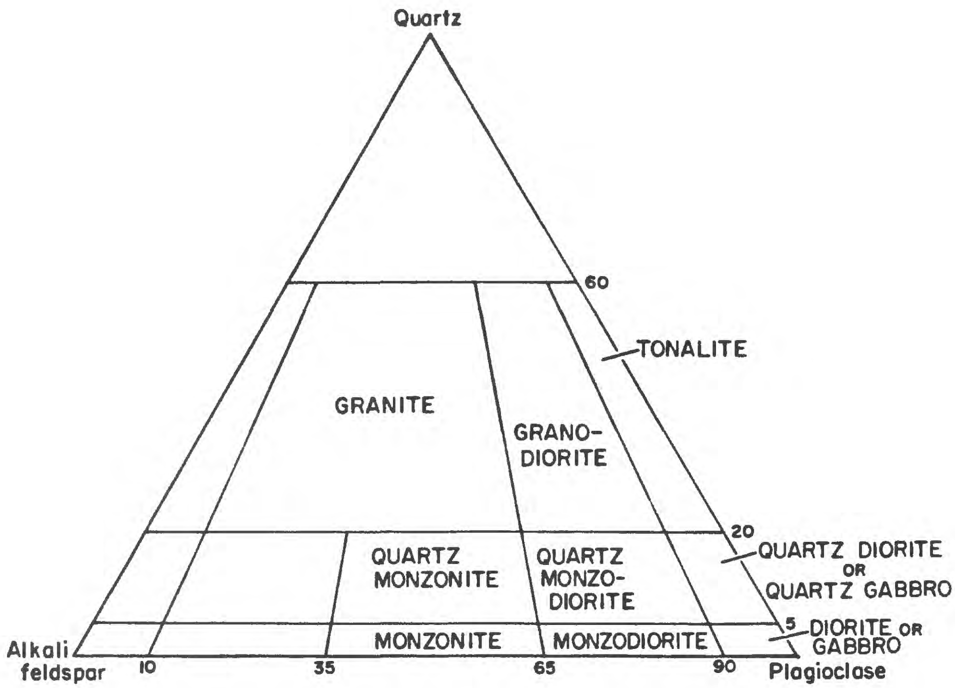


Figure 3.--Modal classification of plutonic rocks based on (volume percent) proportion of quartz, plagioclase, and K-feldspar. Classification of Streckeisen (1967).

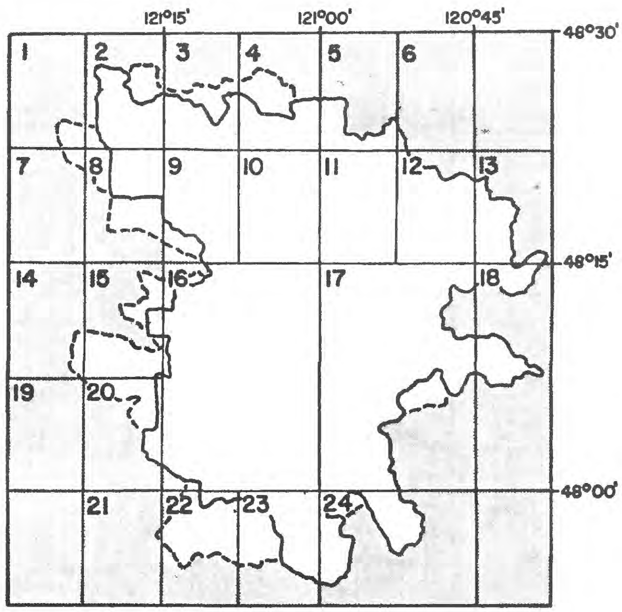


Figure 4.--Index to 1:24,000 and 1:62,500-scale USGS topographic map quadrangles of the Glacier Peak Wilderness and vicinity. Dotted lines show proposed additions to the Wilderness.

1. Illabot Peaks 1966
2. Snowking Mtn 1966
3. Sonny Boy Lakes 1982
4. Cascade Pass 1963
5. Goode Mtn 1963
6. McGregor Mtn 1963
7. Prairie Mtn 1966
8. Huckleberry Mtn 1982
9. Downey Mtn 1963
10. Dome Peak 1963
11. Agnes Mtn 1963
12. Mt Lyall 1963
13. Stehekin 1969
14. White Chuck Mtn 1966
15. Pugh Mtn 1966
16. Glacier Peak 1950
17. Holden 1944
18. Lucerne 1944
19. Bedal 1966
20. Sloan Peak 1966
21. Blanca Lake 1965
22. Bench Mark Mtn 1965
23. Poe Mtn 1965
24. Wenatchee Lake 1965

DATA SUMMARIES

Average modal compositions of tonalite greatly predominate in the area and vary widely from granodiorite for two of the largest bodies (Cloudy Pass batholith and Railroad Creek pluton) to quartz gabbro and gabbro (figs. 5, 6). The averages are based only on our data, and much additional modal data for many units are available in reports listed by Ford (1983a). Some units extend beyond the study area where they may have different modal averages, such as the Duncan Hill pluton which is a tonalite in this area (fig. 6, DH) but mostly granodiorite where chiefly exposed to the south (Cater, 1982, p. 62). Many of the smaller bodies (Cool, White Chuck Glacier, Sitkum, Downey Mountain, and Hidden Lake stocks, among others) were probably not representatively sampled due to sampling at only one or two sites generally selected on the basis of suitability for helicopter landings. For many units, our rock names differ from those given by others, probably owing to sampling of different areas as well as to usage of different classifications. The hornblende-"quartz-diorite" augen gneiss of the Dumbell Mountain plutons of Cater and Crowder (1967) and Cater (1982, p. 17), for example, is tonalite by our sampling and nomenclature (fig. 6, DUa).

Mineral occurrences of units are shown in figure 7. Garnet occurs only in plutons of dated or inferred pre-Tertiary age (fig. 7*B*), except for sparse occurrence in a contaminated contact zone of the Railroad Creek pluton. Among Tertiary plutons, the lower Eocene (Cater, 1982, p. 53) Clark Mountain stocks are unique in containing muscovite and coarse, well-formed epidote (fig. 7*A*) that otherwise occur only in older plutons (fig. 7*B*). Average amounts of biotite relative to hornblende generally increase with decreasing total content of mafic minerals (fig. 8). A close correspondence between specific gravity and mafic mineral content (fig. 9) is indicated by a correlation coefficient, r, of (+) 0.94.

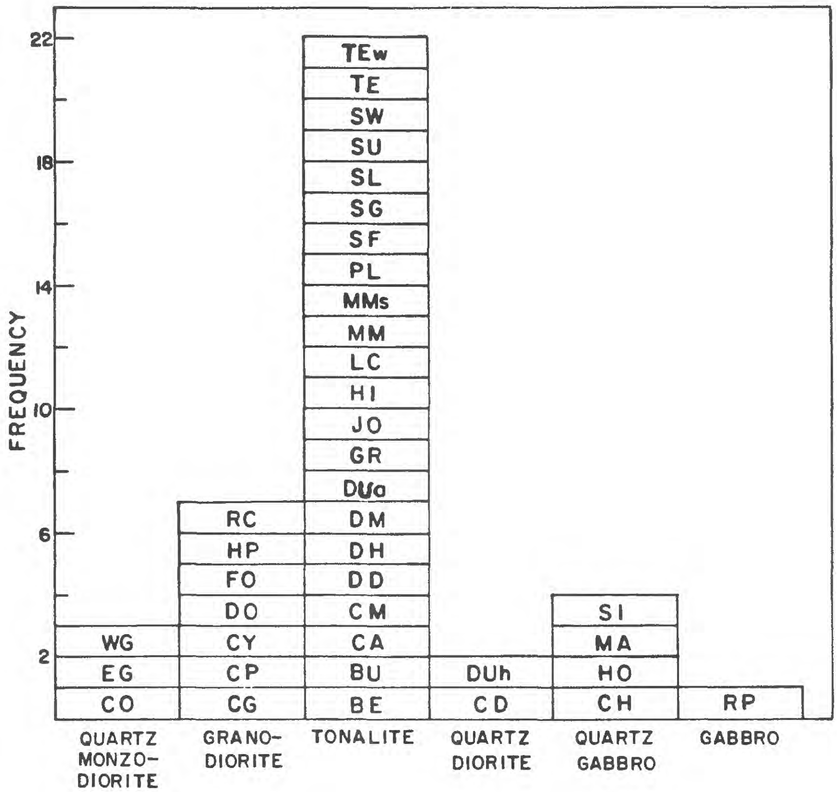


Figure 5.--Frequency distribution of average rock types of plutons and gneiss units of the Glacier Peak Wilderness area. Based on figure 6 and on chemical data on CIPW normative compositions of plagioclase (gabbroic rocks based on An >50). Symbols explained in figure 2 and text.

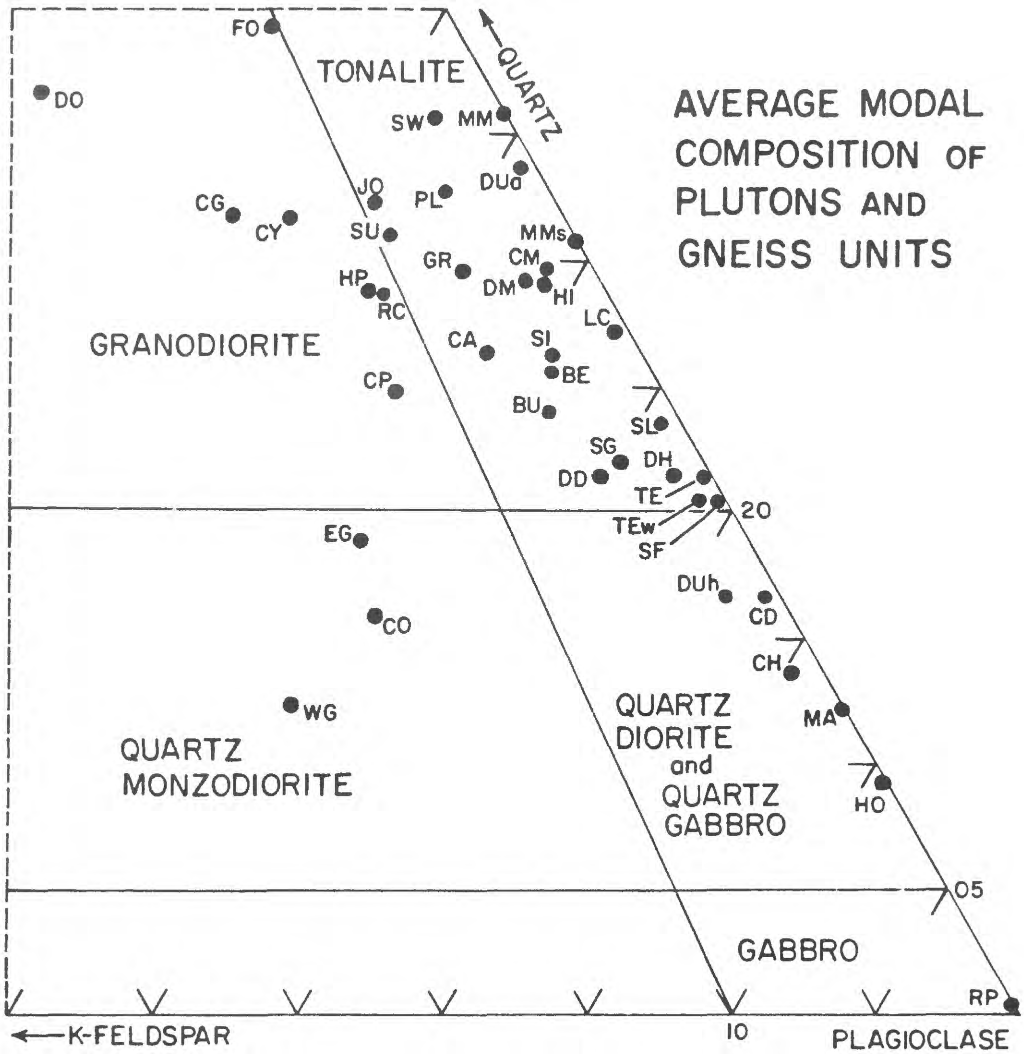
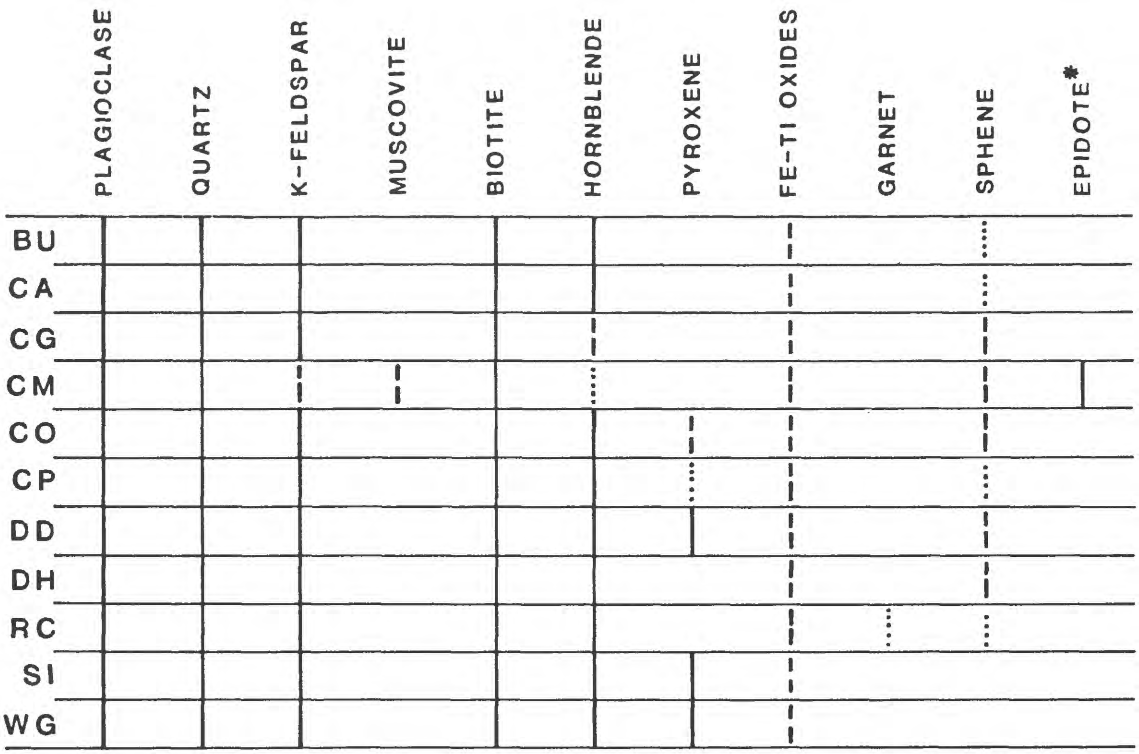
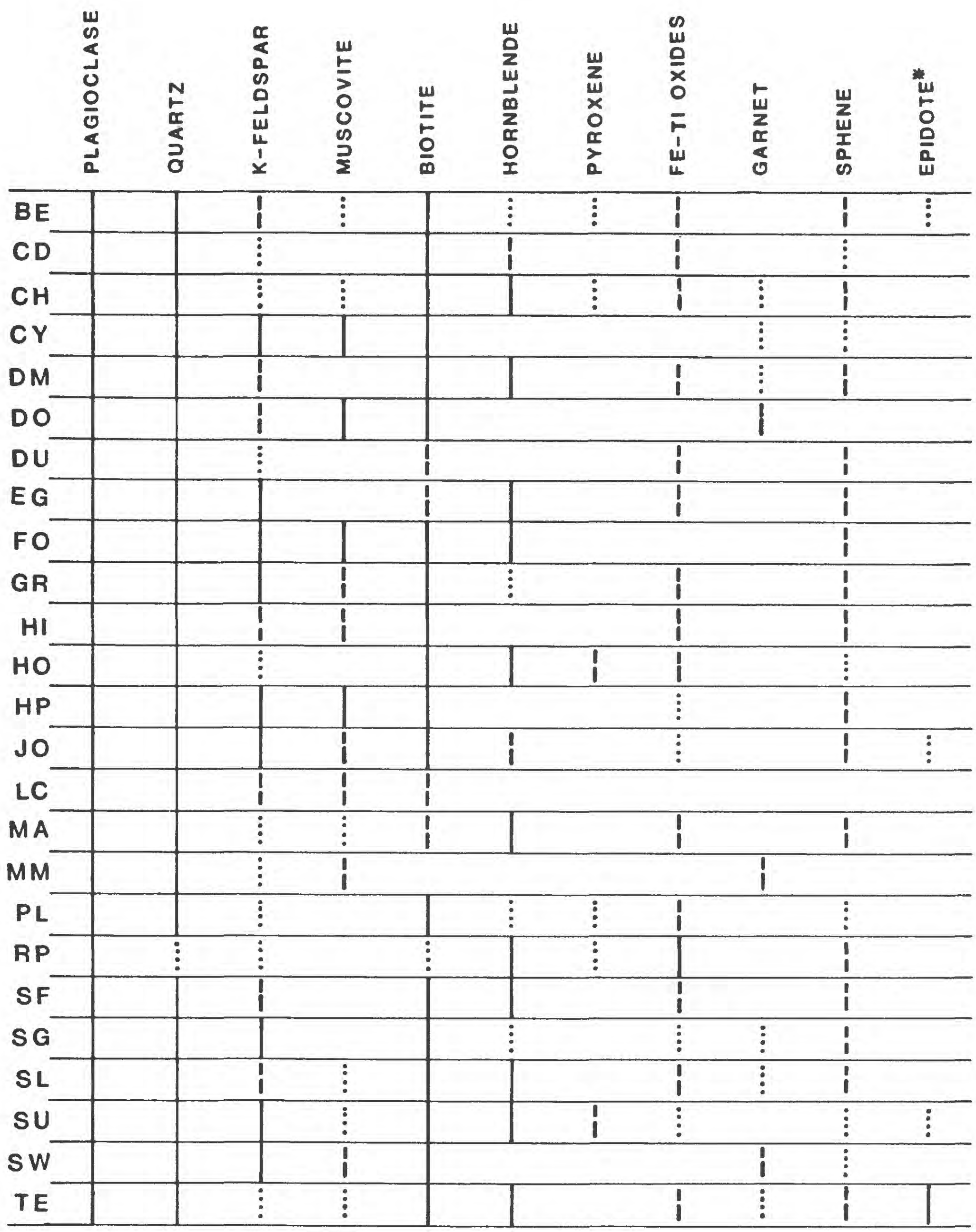


Figure 6.--Average proportions of quartz, K-feldspar, and plagioclase in plutons and gneisses of the Glacier Peak Wilderness area. Plot shows plagioclase corner of figure 3. See tables for number of samples averaged for each unit. Symbols explained in figure 2 and text.



A. TERTIARY PLUTONS

Figure 7.--Occurrence of minerals in plutons and gneiss units of the Glacier Peak Wilderness area. Solid lines, minerals generally present (thin sections) in a significant amount; dashed lines, generally present in trace or other minor amount; dotted lines, generally minor, sporadic occurrence. "Muscovite" includes all white micas; "hornblende" includes all primary and secondary green and brown colored amphiboles; "epidote*" is coarse, well formed and possibly similar to "magmatic epidote" described by Zen and Hammarstrom (1984). Variable amounts of secondary chlorite, colorless amphiboles, epidote, and other minerals are also commonly present. A, plutons of dated or inferred Tertiary age; B (following page), units of dated Cretaceous and older age and of undated age that may include early Tertiary. Symbols of units explained in figure 2.



B. PLUTONS AND GNEISS UNITS OF PRETERTIARY

OR UNKNOWN AGE

Figure 7.--Continued.

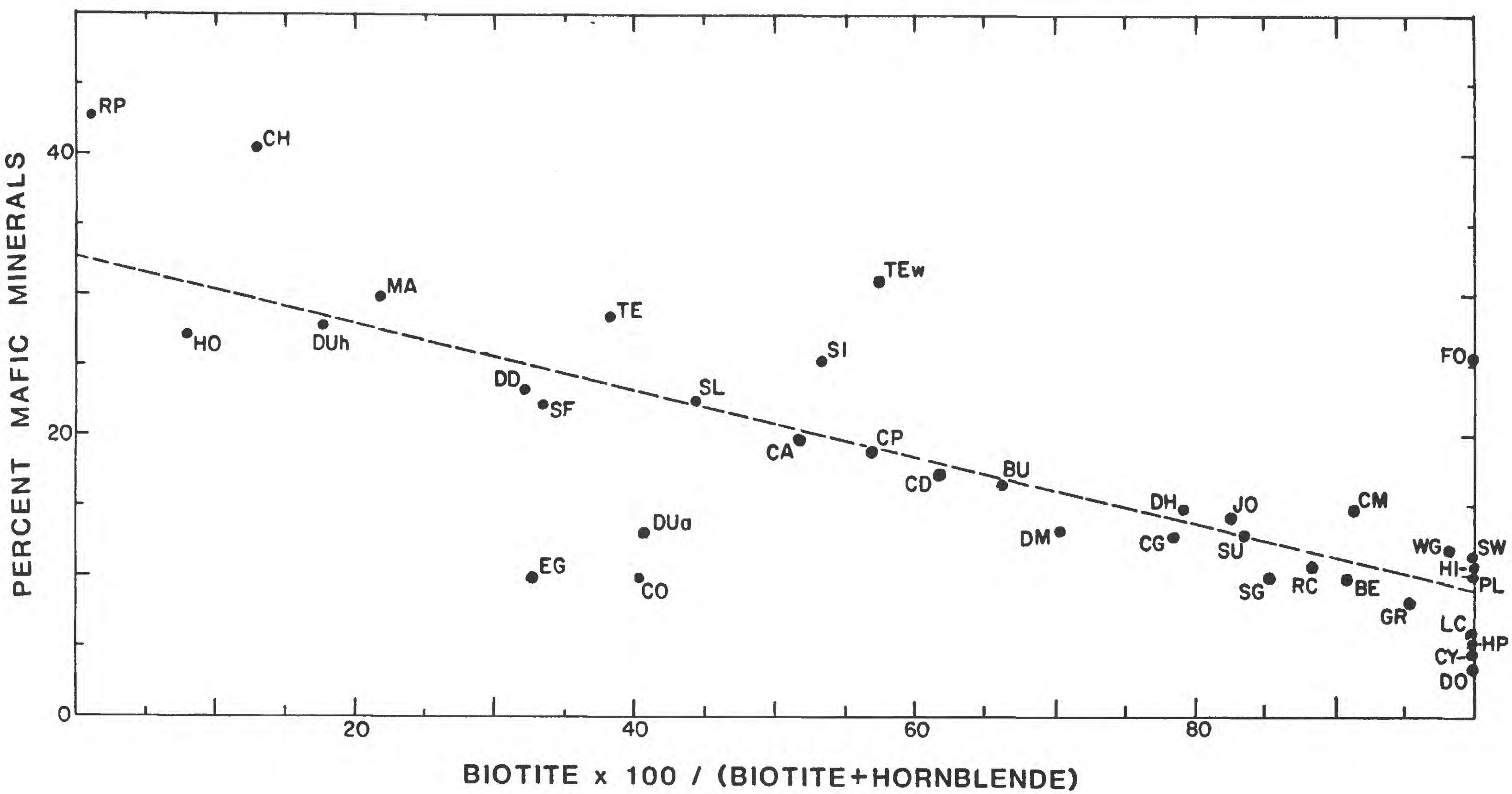


Figure 8.--Relation of average modal biotite and hornblende with total content of mafic minerals in plutons and gneisses of the Glacier Peak Wilderness area. Dashed line is line of linear regression calculated by least squares method. Correlation coefficient, $\underline{r}$, is (-).77. Symbols explained in figure 2 and text. Unit MM not shown due to lack of hornblende and biotite.

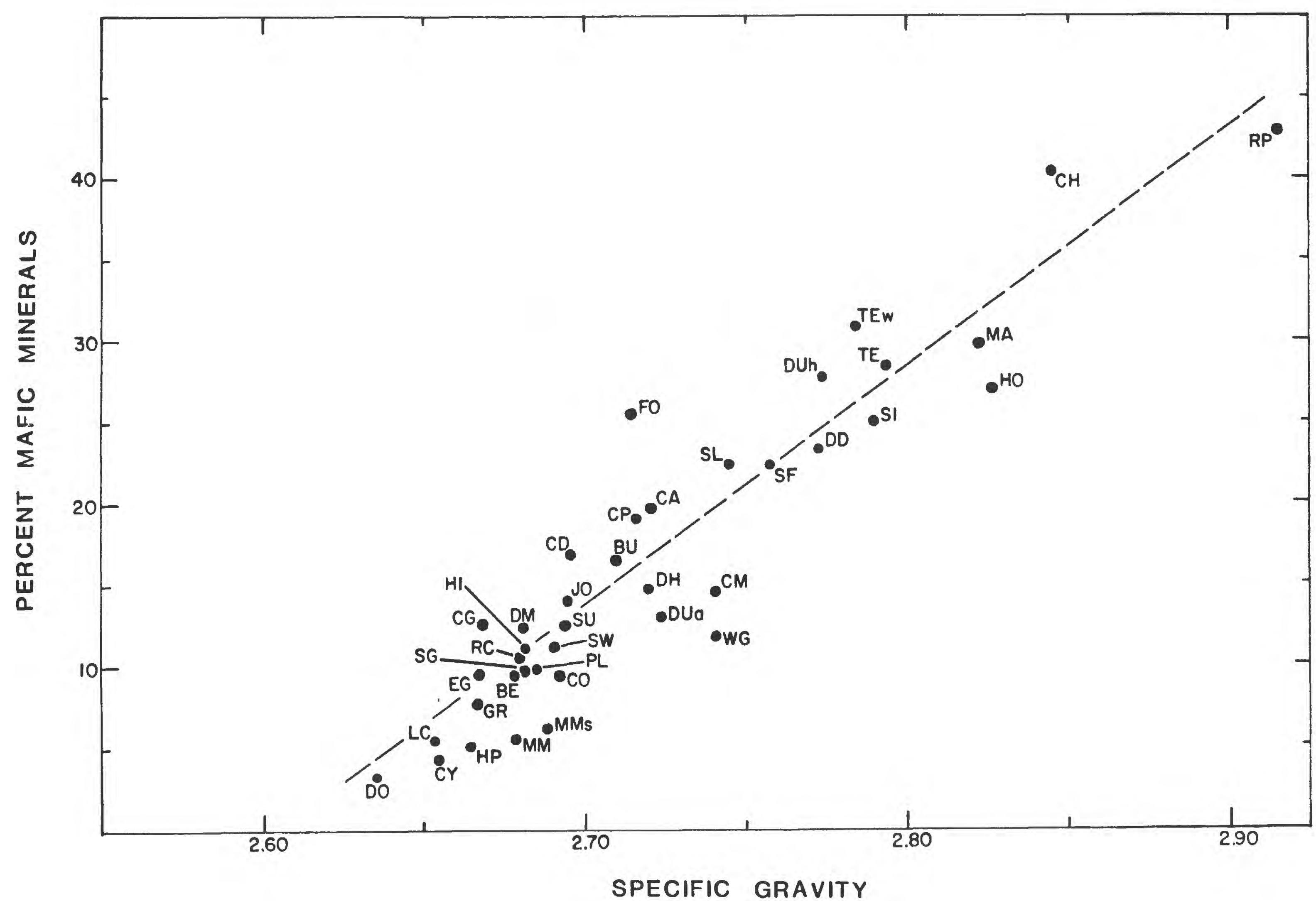


Figure 9.--Relation of average specific gravity with total content of mafic minerals in plutons and gneisses of the Glacier Peak Wilderness area. Dashed line is line of linear regression calculated by least squares method. Symbols explained in figure 2 and text.

Very little chemical data on rocks of the area have been published, except chiefly for the southeastern part of the Cloudy Pass batholith in the Holden quadrangle (Cater, 1969, p. 28-30); plutons and stocks that are part of the batholith or presumably related to it in the Glacier Peak quadrangle (Tabor and Crowder, 1969, p. 14); and many of the plutons of the Holden and Lucerne quadrangles (Cater, 1982). Chemical analyses of rocks from most of the plutons and major units of gneiss have also been made as part of our study of the area. Preliminary compilations of our (XRF) major-element chemistry are shown in diagrams for comparison of the chemical characteristics with modal data of units. The chemical data are also used to compute CIPW normative plagioclase compositions on which the rock classification and nomenclature are in part based. The CIPW norms and other chemical data represented in diagrams are from analyses normalized on a volatile-free (H_2O, CO_2) basis.

The variation of $Na_2O + K_2O$ with SiO_2 contents shows subalkalic characteristics of all units (fig. 10). A variety of other plots of the chemical data show a distinctly calcalkalic nature of the suite. In an AFM diagram, possible tholeiitic characteristics are shown by only two gabbroic intrusions: the Holden Lake pluton of hornblende-quartz gabbro and the Riddle Peaks pluton of layered and nonlayered (olivine-normative) hornblende gabbro (fig. 11; HO, RP). In an FeO^*/MgO and SiO_2 diagram, only the Riddle Peaks pluton shows tholeiitic characteristics, and the Holden Lake, Dead Duck, and Downey Creek plutons have iron-enriched compositions near the field of tholeiite and markedly apart from compositions of most units (fig. 12; RP, HO, DD, DO). Other chemical data suggest calcalkalic compositions of both the Holden Lake and Riddle Peaks plutons, in a diagram (fig. 13) showing CIPW-normative plagioclase compositions used for determining nomenclature of average rocks of the units. All units have molecular $Al_2O_3/(Na_2O + K_2O) > 1$, with none even closely approaching the field of peralkaline rocks (fig. 14). Approximately one half of the units are peraluminous (fig. 15), as defined chemically by a ratio (molecular proportions) $Al_2O_3/(CaO + Na_2O + K_2) > 1$ (Clarke, 1981, p. 3). Nearly one quarter of the units have average compositions lying within Gill's (1981, p. 6) field of medium-K, high silica orogenic andesite, but most have SiO_2 contents greater than the 53-63 percent range for andesite (fig. 16). Extrapolation of this field into more siliceous compositions suggests medium-K characteristics of most units, including all Tertiary plutons; a low-K nature of some pre-Tertiary units; and high-K nature of only the Eldorado Orthogneiss (fig. 16, EG).

Rock nomenclature based on modes (fig. 6) and chemical data (figs. 17-18) is similar for many units but there are discrepancies for some. For example, the Sulphur Mountain and Jordan Lakes plutons are tonalite in mode (fig. 6, SU and JO) but are granodiorite near the field of tonalite in chemical composition (fig. 17). The modal classification does not discriminate trondhjemite, which some units would be classed on the basis of chemical composition (fig. 17). Rocks classed as quartz diorite or more mafic by mode are not discriminated in the chemical classification of figure 17. Rock names given in this preliminary report are based on modes, supplemented by CIPW normative compositions of plagioclase (An = an x 100/(an + ab): in the modal classification of figure 3, units with an average plagioclase composition of An_{50} or greater (fig. 13) are gabbro or quartz gabbro (fig. 6).

Chemical characteristics of igneous rocks are used in many studies (for example, Martin and Piwinskii, 1972; Miyashiro, 1975; Petro and others, 1979; and Gill, 1981) to discriminate compressional, or orogenic, from extensional, or anorogenic, tectonic settings of magmatism. Calcalkalic suites, such as that of the Glacier Peak Wilderness area (fig. 11) characterize orogenic belts of island arcs and active continental margins (Miyashiro, 1975, p. 257). AFM diagrams of rocks from such a setting are characterized by little scatter paralleling the F-M join and much scatter normal to the join (Petro and others, 1979, p. 224 and fig. 4), as in the Glacier Peak suite (fig. 11). Patterns of frequency distributions of normative plagioclase composition and of the differentiation index of the Glacier Peak suite (fig. 19, A-B) are like those typical of compressional suites and markedly different from those of extensional suites showing multimodal patterns (Martin and Piwinskii, 1972, p. 4968; Petro and others, 1979, p. 223). The Mg numbers, namely, the molecular ratio Mg x 100/(Mg + Fe^{+2}), of many units (fig. 19, C) approximate an average value of 53 for orogenic andesite, a value considered too low to represent primary mantle melts that should have values of 67 or higher (Gill, 1981, p. 110). The Mg number depends in part on the oxidation state of iron: if recalculated so that $Fe_2O_3/FeO = 0.2$ (Hughes and Hussey, 1976), Mg values for only two units (fig. 19; CH, HO) would be nearly those of possible mantle characteristics.

The diagrams of figures 10 to 19 are given only to show chemical characterizations of the units. They imply neither genetic origins of units nor genetic relations between units. For example, the "calc-alkalic" trend of fig. 11 and "calc-alkalic" compositions of figs. 11-13 do not imply the commonly assumed presence of a differentiation sequence or even an igneous origin of all rocks, because the wide age range (Precambrian? to late Tertiary) of units argues against genetic relations and because some gneisses may be of sedimentary parentage.

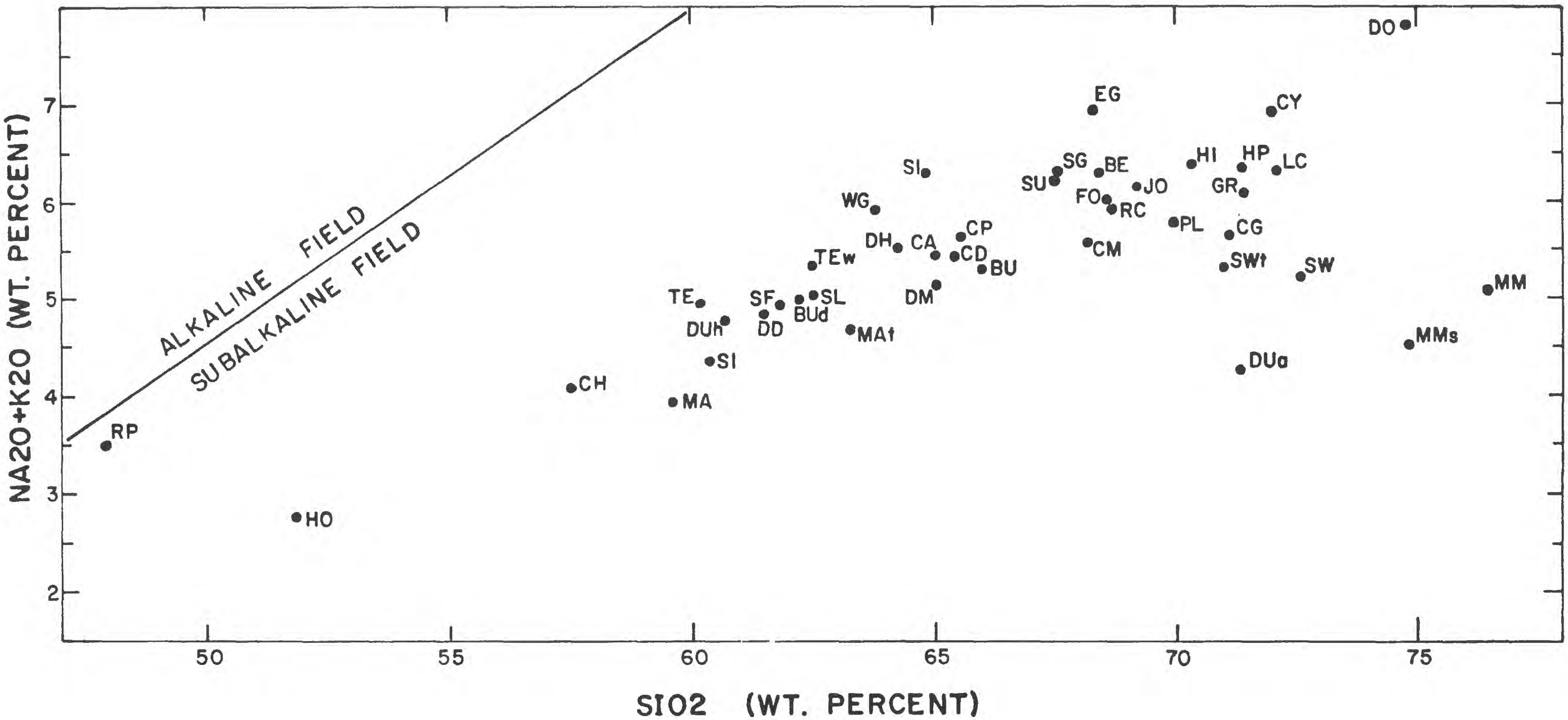


Figure 10.--Variation between total alkalies and SiO_2 contents in plutons and gneiss units of the Glacier Peak Wilderness area. Dividing line between alkaline and subalkaline rocks from Irvine and Baragar (1971, p. 532). Symbols explained in figure 2 and text.

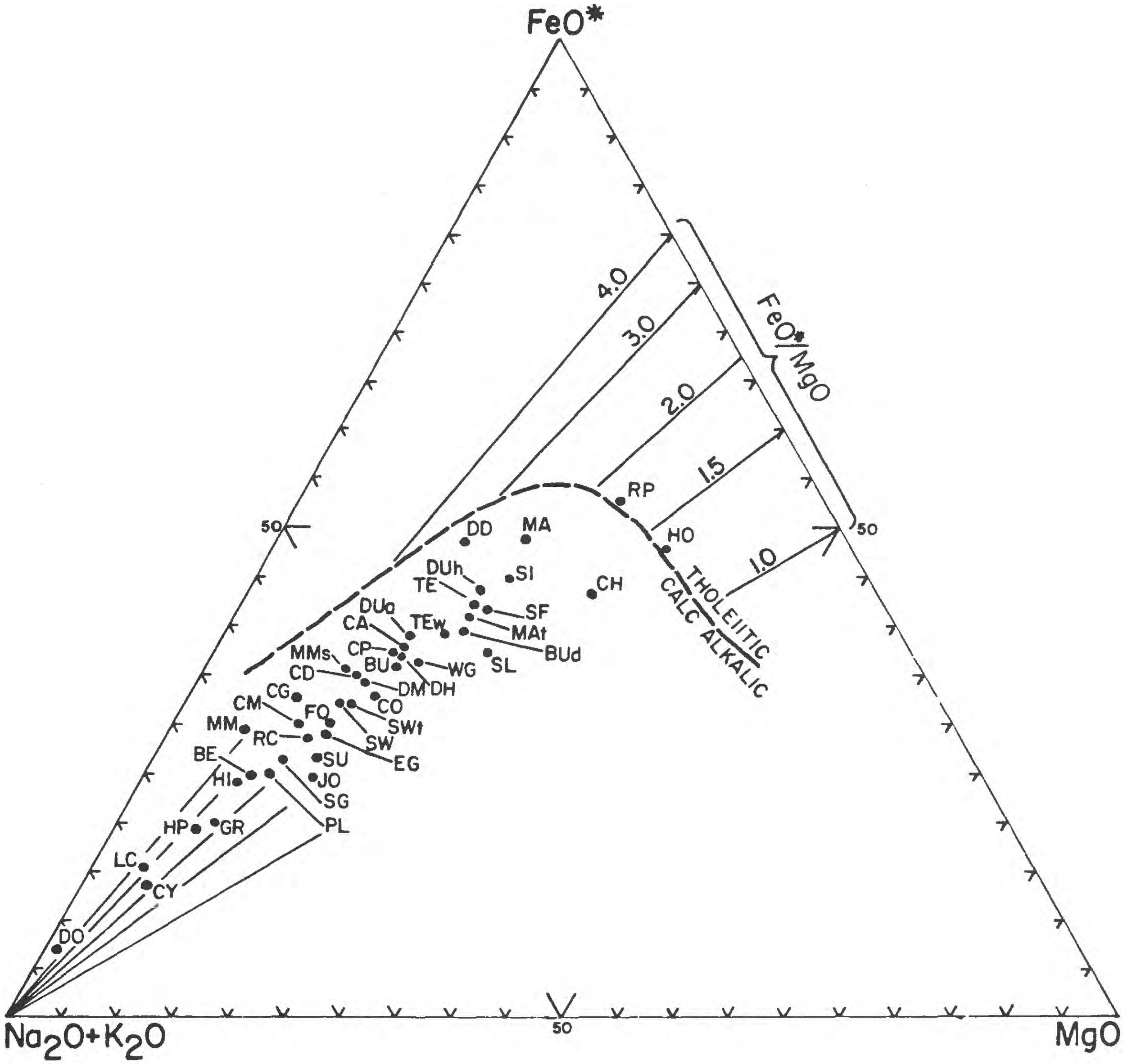


Figure 11.--AFM (A, $Na_2O + K_2O$; F, FeO^*; M, MgO) diagram of average compositions of plutons and gneisses of the Glacier Peak Wilderness area. $FeO^* = FeO + .8998 \times Fe_2O_3$. Isopleths of FeO^*/MgO, for comparisons with figure 12, are from Gill (1981, p. 9); dashed line separating tholeiitic and calcalkalic fields from Irvine and Baragar (1971). Symbols explained in figure 2 and text.

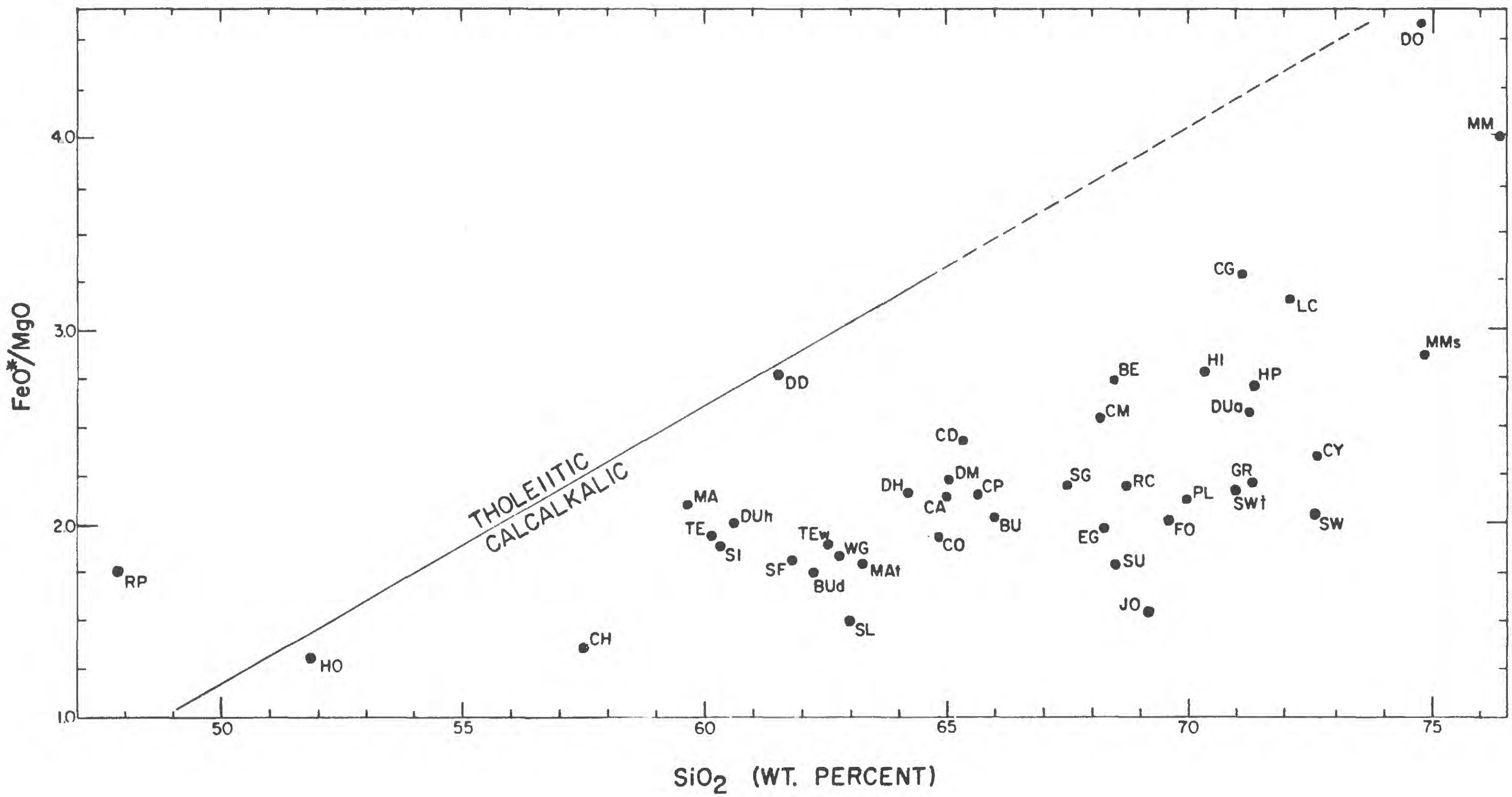


Figure 12.--Variation between FeO^*/MgO and SiO_2 in plutons and gneiss units of the Glacier Peak Wilderness area. Line separates tholeiitic and calcalkalic compositions: solid line from Gill (1981, p. 10); dashed line, projection into field of higher SiO_2 contents. Symbols explained in figure 2 and text.

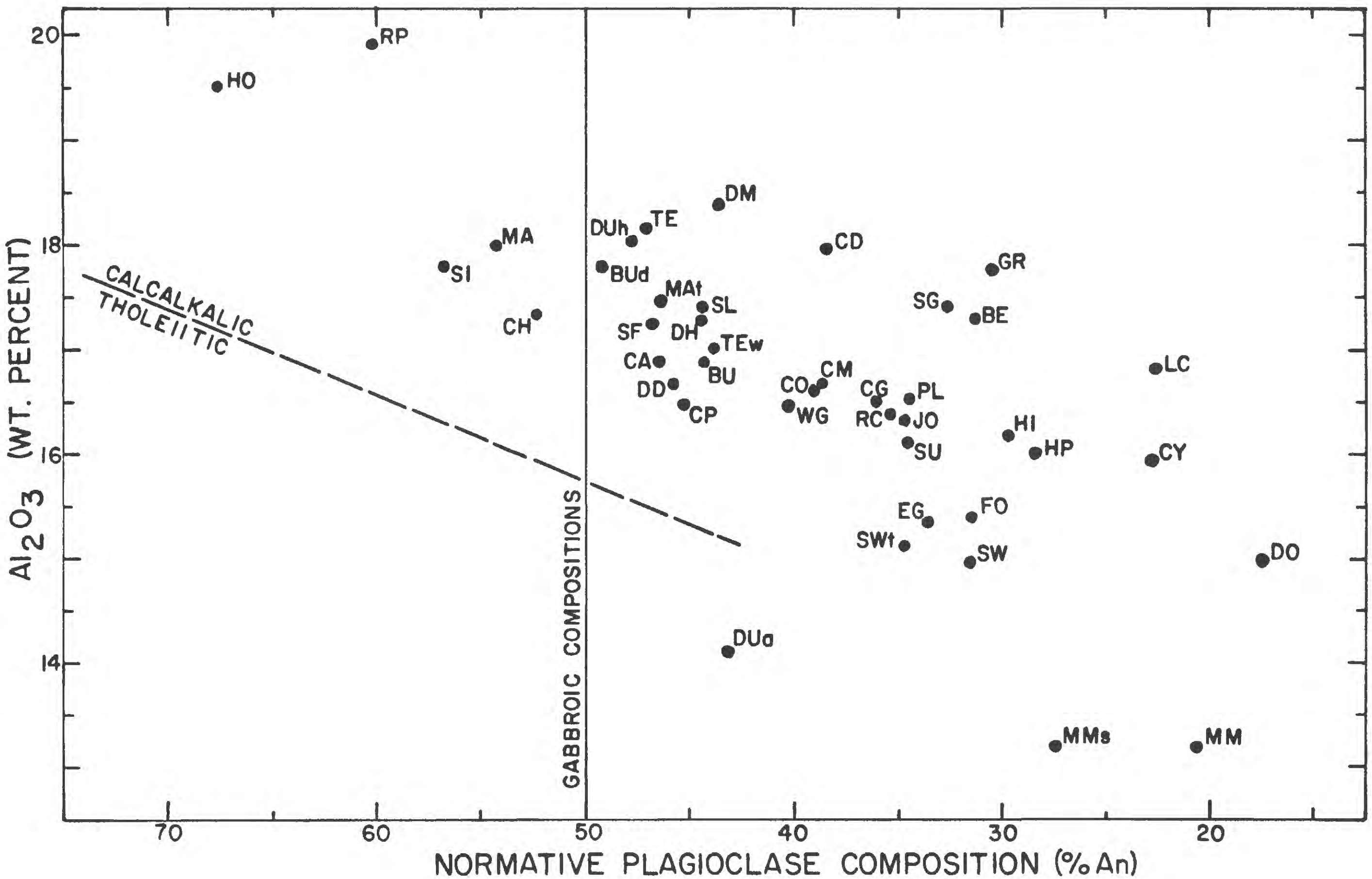


Figure 13.--Variation between normative plagioclase An composition (an x 100/(an + ab) and Al_2O_3 content of plutons and gneiss units of the Glacier Peak Wilderness area, in diagram of Irvine and Baragar (1971, p. 536). Symbols explained in figure 2 and text.

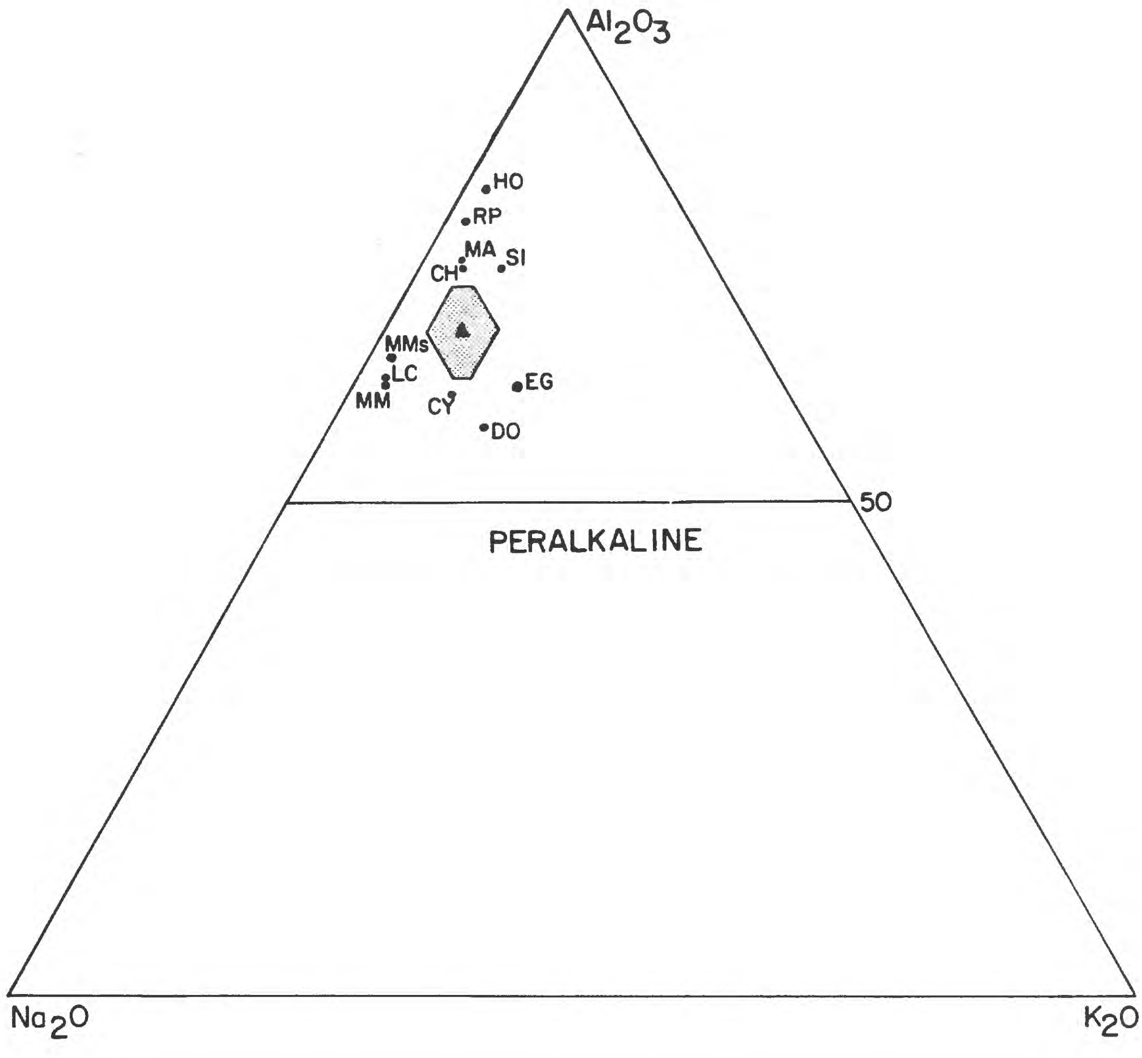


Figure 14.--Molecular proportions of Al_2O_3, Na_2O, and K_2O of plutons and gneiss units of the Glacier Peak Wilderness area. Shows only units lying outside the field (shaded area) of one standard deviation (+ and -) from the mean (solid triangle). Symbols explained in figure 2 and text.

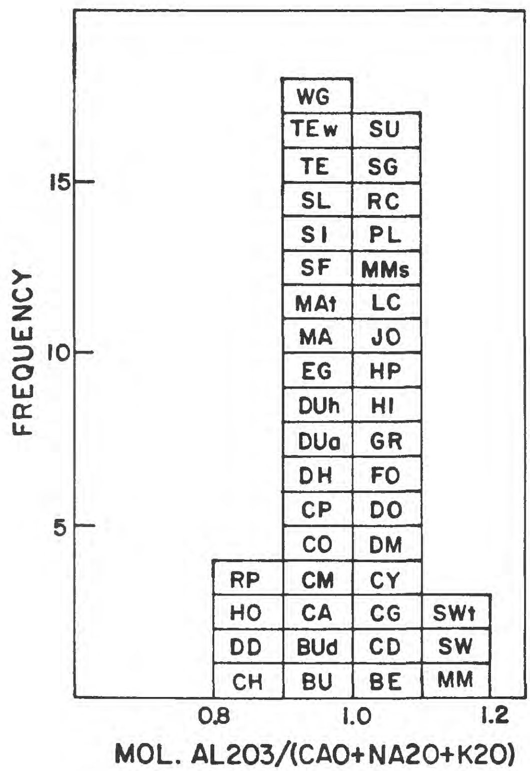


Figure 15.--Frequency distribution of the ratio (molecular proportions) $Al_2O_3/(CaO + Na_2O + K_2O)$ of plutons and gneiss units of the Glacier Peak Wilderness area. Symbols explained in figure 2 and text.

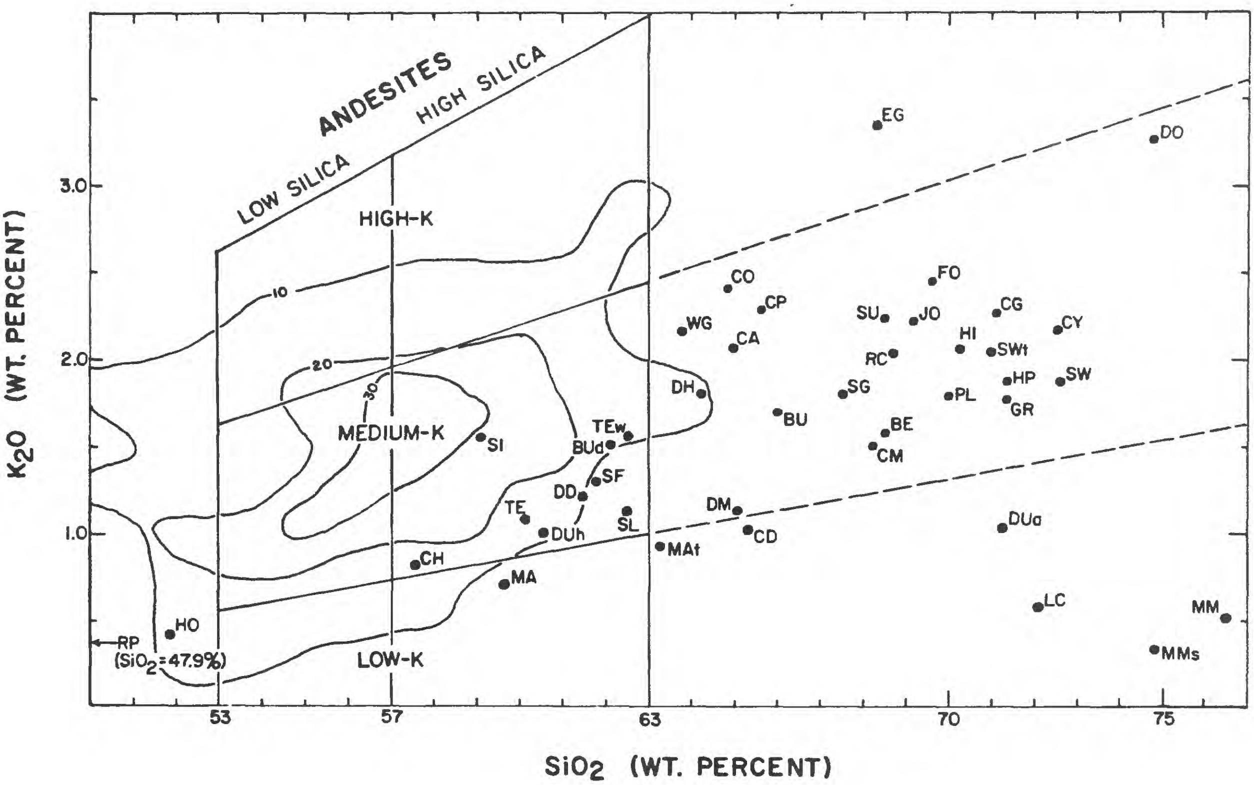


Figure 16.--Variation between average K_2O and SiO_2 contents of plutons and gneiss units of the Glacier Peak Wilderness area. Andesite subfields and contours of andesite analyses from Gill (1981, p. 6). Boundaries of subfields extended (dashed lines) into area of SiO_2 content greater than andesite. Symbols explained in figure 2 and text.

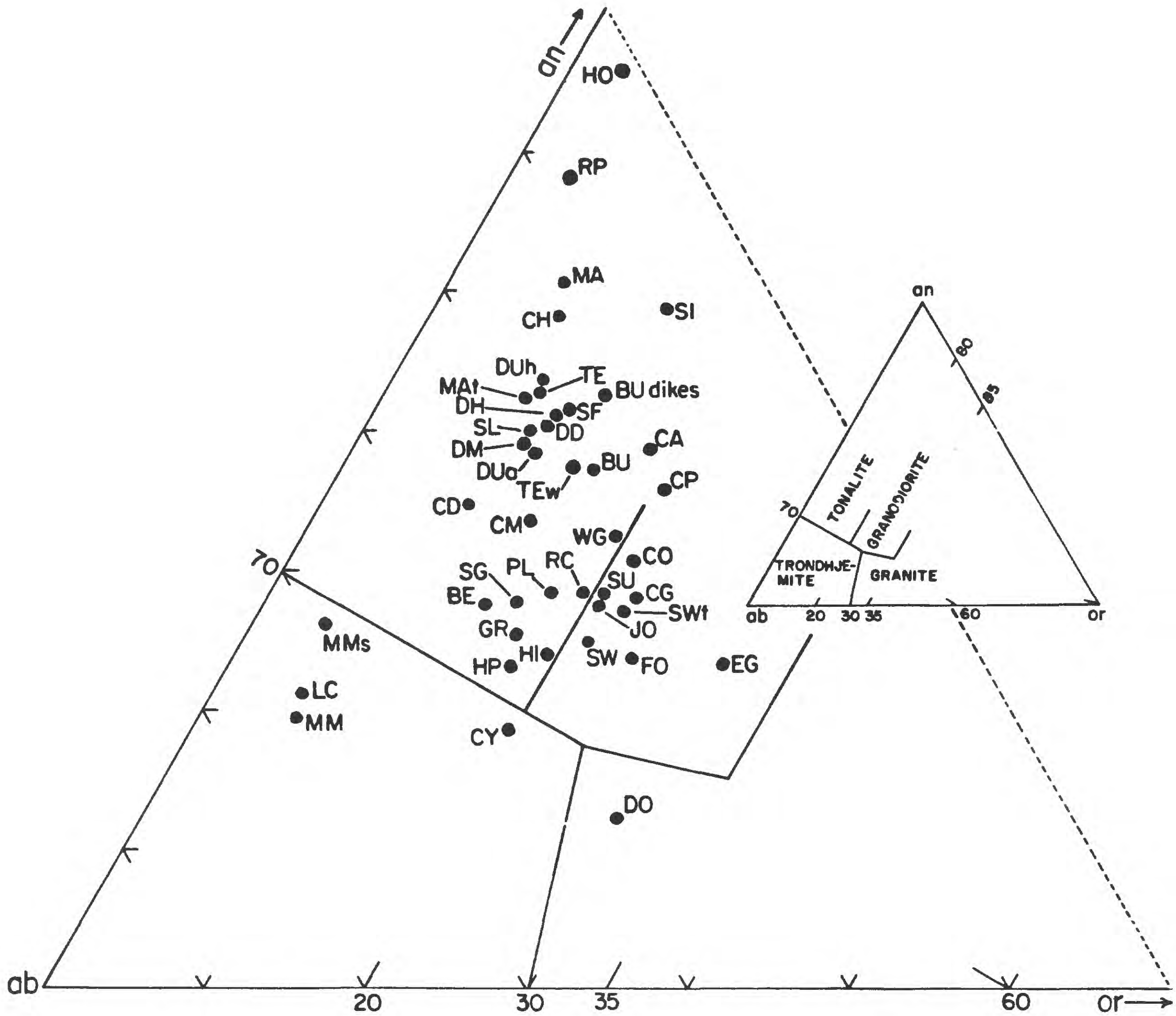


Figure 17.--Average proportions of CIPW normative ab, an, and or of plutons and gneisses of the Glacier Peak Wilderness area, in nomenclatural diagram of Barker (1979, p. 6). Symbols explained in figure 2 and text.

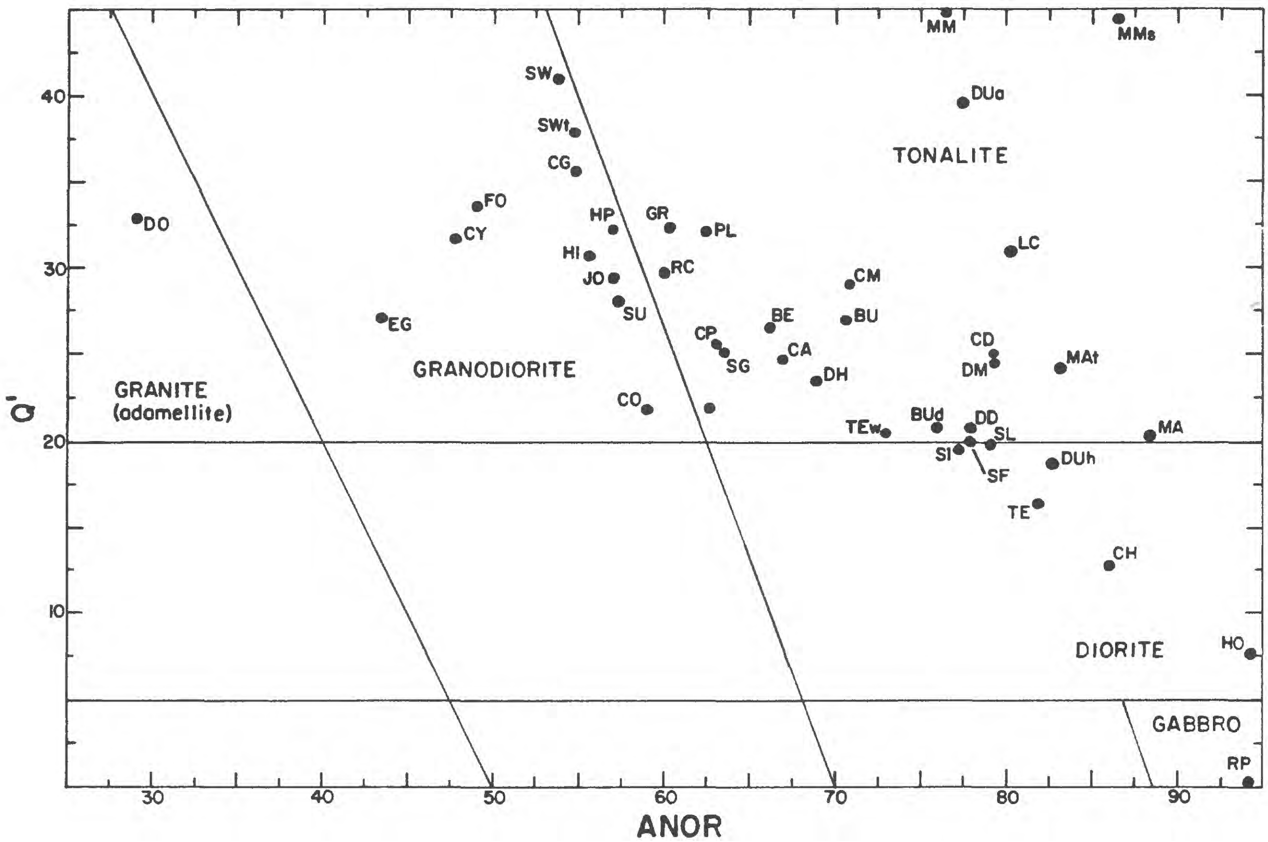


Figure 18.--Diagram showing CIPW normative approximation of nomenclature to modal classification of plutons and gneiss units of the Glacier Peak Wilderness area, by the method of Streckeisen and Le Maitre (1979). Rock names shown are from density distributions of analyses shown in diagrams of Streckeisen and Le Maitre (1979). Q' = normative q/(q + or + ab + an); ANOR = normative an x 100/(or + an). Symbols explained in figure 2 and text.

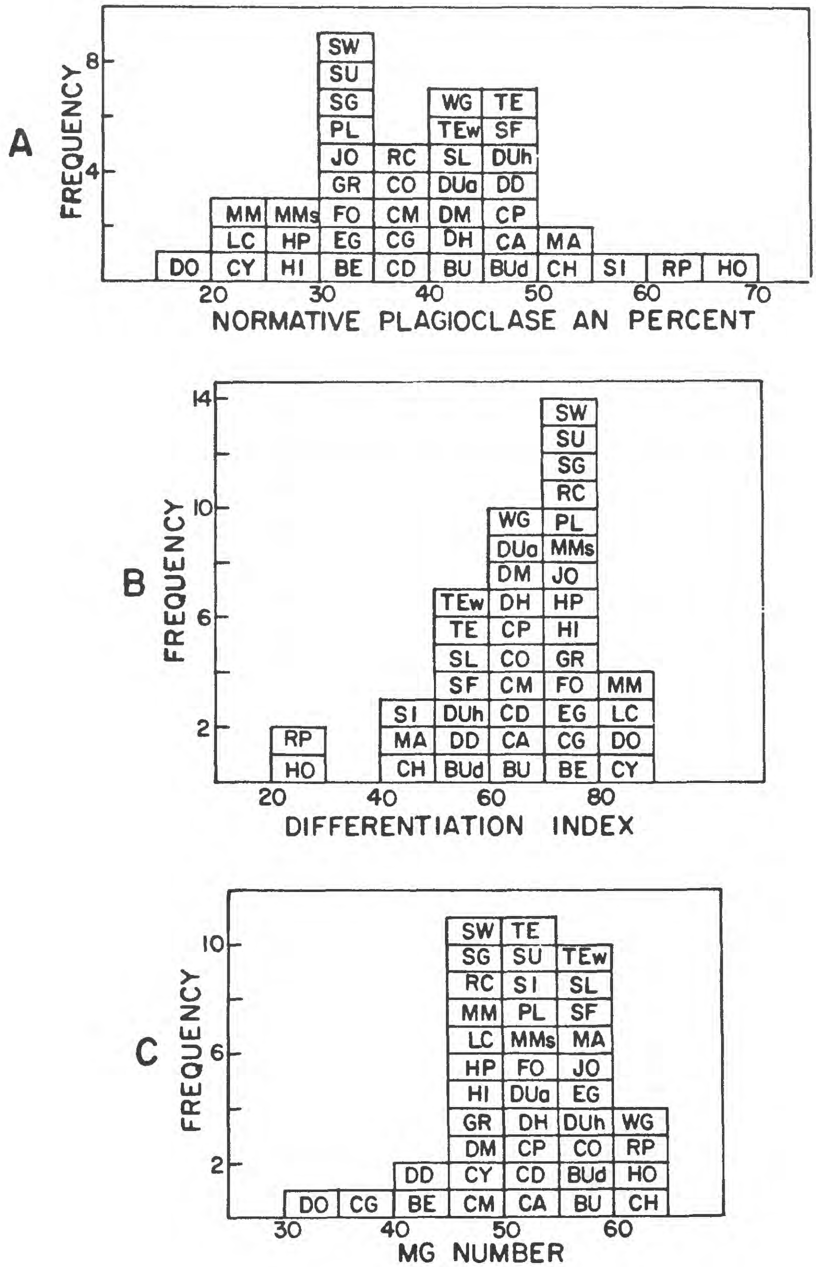


Figure 19.--Frequency distributions of (A) normative plagioclase compositions, (B) differentiation index (normative q + or + ab + an + ne), and (C) Mg number (see text) of plutons and gneiss units of the Glacier Peak Wilderness area. Symbols explained in figure 2 and text.

DATA REPORTS

Explanation of symbols

Field unit symbols that are used chiefly on summary diagrams of average compositions are explained in figure 2, except for those described below. BUd are dikes apparently related to the Mount Buckindy pluton (BU). DUa and DUh, respectively, are hornblende-quartz diorite augen gneiss and gneissic hornblende-quartz diorite of the Dumbell Mountain plutons (map units "dag" and "dhg" of Cater and Crowder (1967). MAt are samples of Misch's (1966) Marblemount Meta Quartz Diorite provided by Misch from his type area of the unit mapped (Misch, 1979) near the town of Marblemount just northwest of the Glacier Peak Wilderness (fig. 1). MMs are samples from southeast of Flat Creek (fig. 64) from one or more units possibly correlative with the Magic Mountain Gneiss as mapped in its type area by Tabor (1961). SWt are samples of Swakane Biotite Gneiss from its type area near Swakane Creek and the Columbia River, north of Wenatchee. TEw are samples from the Tenpeak pluton in the White Mountains area (White Mountain pluton of Cater and Crowder, 1967).

The following symbols are used for rock names in the data tables:

A	alaskite	GAM	melagabbro	QG	quartz gabbro
AP	aplite	GD	granodiorite	QM	quartz monzodiorite
DI	diorite	GR	granite	TO	tonalite
G	gneiss	HB	hornblendite	X	other
GA	gabbro	MQ	metaquartz diorite		
GAL	leucogabbro	QD	quartz diorite		

The symbols "p" and "f" used with those abbreviations indicate, respectively, a strong porphyritic texture or foliated structure, as in "TOf," a foliated tonalite. Modal compositions of some rocks are indicated in lower case, as in "Gto," a tonalitic gneiss.

The following symbols in the data tables show mineral occurrences seen but not counted in thin section: tr, trace amounts; s, small amount greater than trace but less than a few percent; and m, major amount.

Minerals of generally accessory type or of occurrence in only a few thin sections were not counted individually and are indicated by the following symbols in the last column of the tables:

al-	allanite	r-	rutile
ap-	apatite	sc-	scapolite
c-	calcite	sec-	secondary, undifferentiated
g-	garnet	sf-	sulfides
k-	kyanite	t-	tourmaline
m-	muscovite	z-	zircon
p-	prehnite		

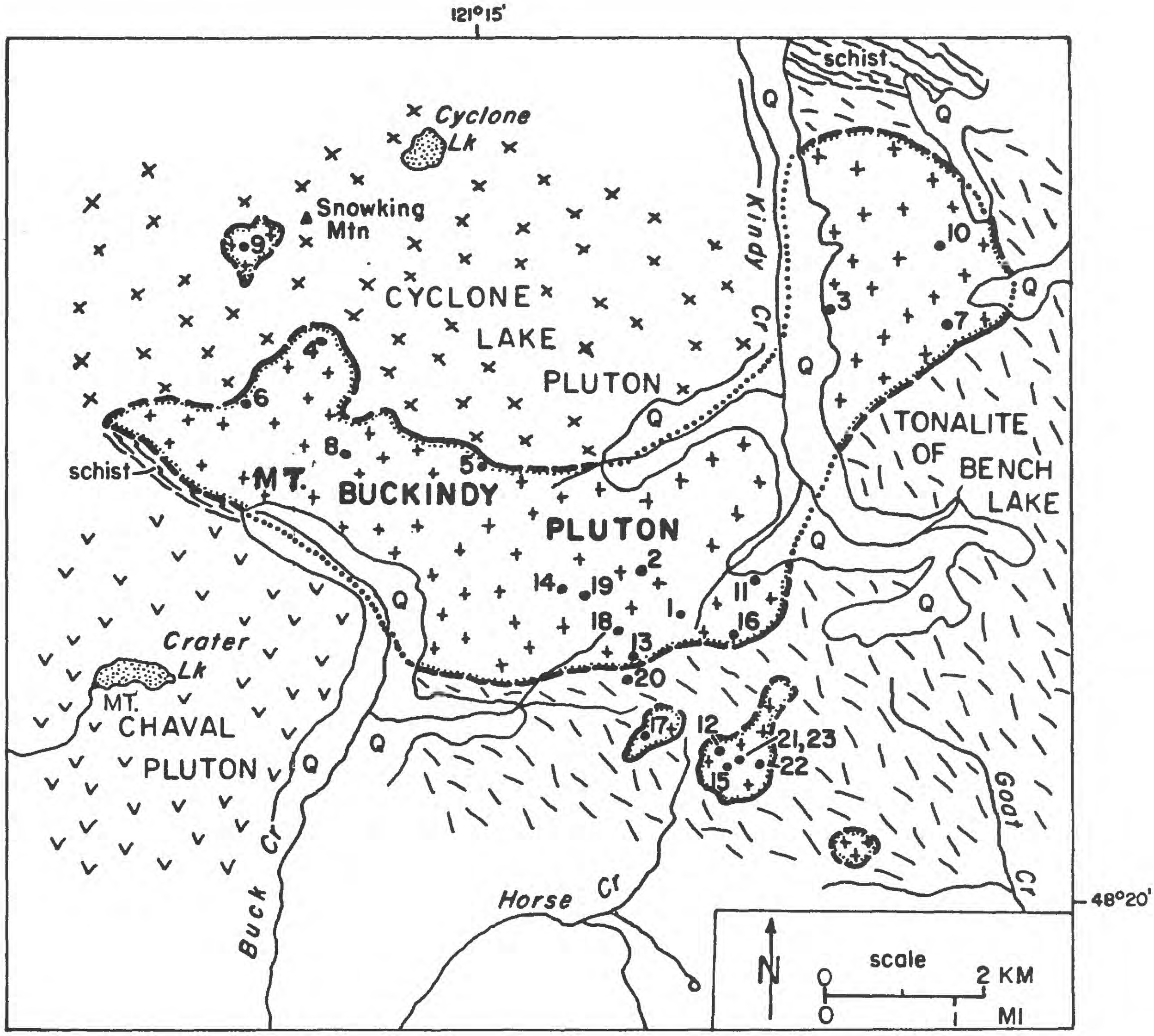


Figure 20.--Geologic sketch map of the Mount Buckindy pluton, showing approximate sample sites. Location in southern part of Snowking Mountain and west-central part of Sonny Boy Lakes quadrangles. Sites 16-20 are for dike samples and 21-23 for breccia-pipe samples from which modal data not obtained.

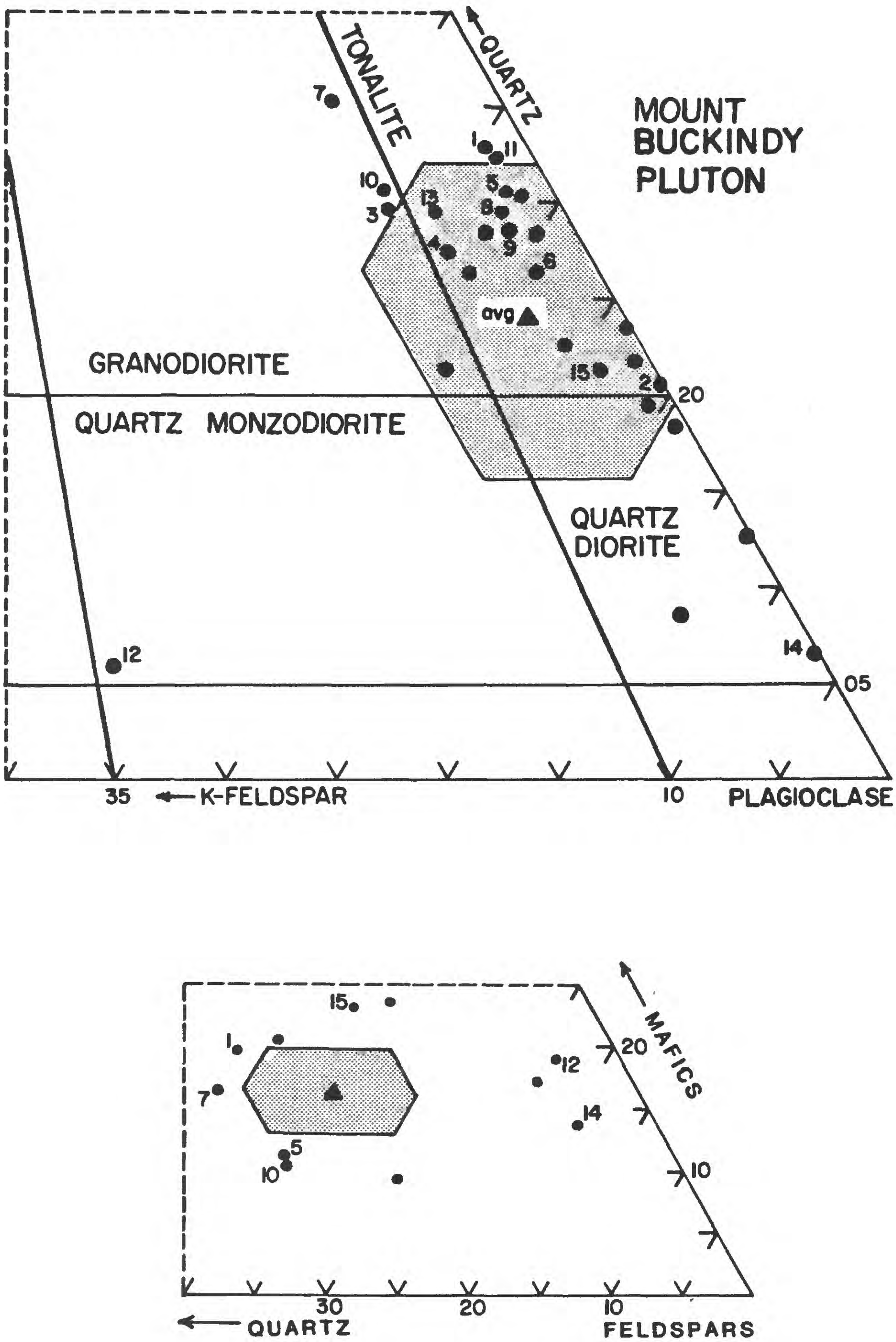


Figure 21.--Proportions of modal minerals of samples from the Mt Buckindy pluton, showing rock classification in upper diagram.

Table 1.--Modes (volume percent) and specific gravities of samples from the Mt Buckindy pluton. Averages exclude atypical samples 82S80A and 82S104A.

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
80F60A	1	TO	2.740	1.7	52.3	26.4	19.6	12.1	5.2	.1	.4	1.7	tr	.2 (ap,z)
80F61A	2	TOp	2.737	0	66.3	17.0	16.8	10.0	5.3	tr	.1	1.4	0	.1 (p)
80GX2189	3	GD	2.710	7.1	53.9	25.7	13.3	9.4	2.6	tr	.1	1.1	tr	0
80L19B	4	TO	2.705	5.4	56.0	23.7	14.9	8.0	5.7	0	.2	1.0	tr	tr (ap)
81F107A	5	TO	2.705	1.8	59.5	27.2	11.5	8.1	2.6	tr	.1	.7	0	tr (ap)
81F169B	6	TOp	2.708	2.5	58.1	21.8	17.6	10.4	5.9	tr	tr	1.2	.1	0
81F172A	7	GD	2.697	6.7	47.7	29.4	16.1	9.5	3.3	.1	1.9	1.2	0	.1 (al,ap)
81F251A	8	TO	2.720	2.4	55.3	24.3	18.0	10.7	4.8	.1	1.0	1.3	tr	.2 (al,p,z)
81N62A	9	TOp	2.713	2.7	57.5	24.1	15.7	6.0	3.4	.4	5.3	.4	.1	tr (c)
82F157A	10	GD	2.690	6.8	55.5	27.3	10.5	7.0	2.2	tr	.4	.8	.1	0
82F310A	11	TO	2.720	1.4	54.5	27.0	17.0	9.0	6.3	.1	.5	1.1	tr	tr (ap,z)
82S80A	12	QMp	2.691	26.1	50.1	4.8	19.0	s	m	--	--	--	--	--
82S97A	13	TO	2.711	4.6	55.2	25.3	14.9	8.8	5.0	.1	.1	.9	tr	tr (z)
82S102A	14	QDp	2.710	.1	80.5	5.5	13.9	2.3	10.4	tr	tr	1.0	0	.1 (al,ap)
82S112A	15	TOp	2.709	1.7	58.6	16.6	23.1	17.1	3.6	.3	1.5	.5	0	.1 (ap,p)
81F252A		TO	2.703	1.4	57.3	25.1	16.2	11.4	3.4	tr	tr	1.3	0	0
81N10A		TO	2.708	5.0	57.0	22.1	15.9	m	m	tr	tr	tr	0	tr (ap)
82F154A		QDp	2.708	1.1	66.1	16.3	16.6	m ≈	m	tr	tr	s	tr	tr (ap)
82F258A		TOp	2.682	.2	70.0	20.2	9.6	m	tr	tr	s	s	tr	0
82S83A		TOp	2.695	1.1	55.7	23.0	20.2	m	0	tr	m	s	tr	0
82S87A		TO	2.726	.5	63.4	18.0	18.0	m	m	tr	tr	s	0	tr (ap)
82S98A		TO	2.721	2.5	59.9	18.4	19.2	m	m	tr	tr	s	0	tr (ap)
82S99A		GD	2.709	7.7	56.7	17.3	18.2	m	m	tr	tr	s	0	0
82S100A		QD	2.741	.6	61.8	13.9	23.7	m	m	tr	tr	s	0	tr (ap)
82S101A		TO	2.691	3.5	56.9	24.0	15.6	m	s	tr	tr	s	0	0
82S103A		QDp	2.702	4.2	71.9	6.8	17.1	s	m	tr	tr	tr	0	0
82S104A		QDp	nd	0	59.5	8.7	31.8	--	--	--	--	--	--	--
Average			2.710	2.9	59.5	21.1	16.5	9.3	4.7	.1	.8	1.0	.1	tr
Standard dev.			.015	2.5	7.0	6.1	3.3	3.2	2.1	.1	1.4	.3	--	--
n			24 →					15 →						

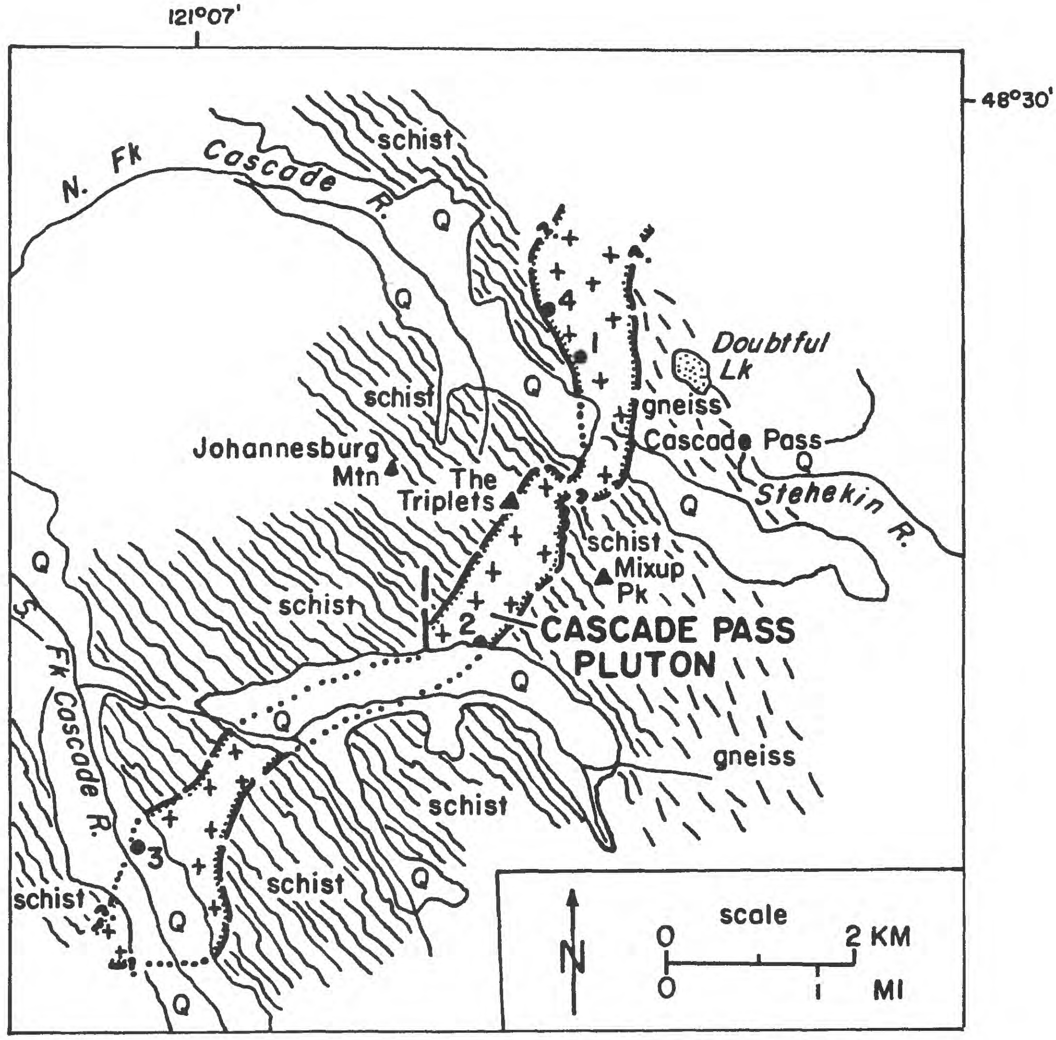


Figure 22.--Geologic sketch map of the Cascade Pass pluton, showing approximate sample sites. Location mostly in Cascade Pass quadrangle. Based largely on mapping by Tabor (1961).

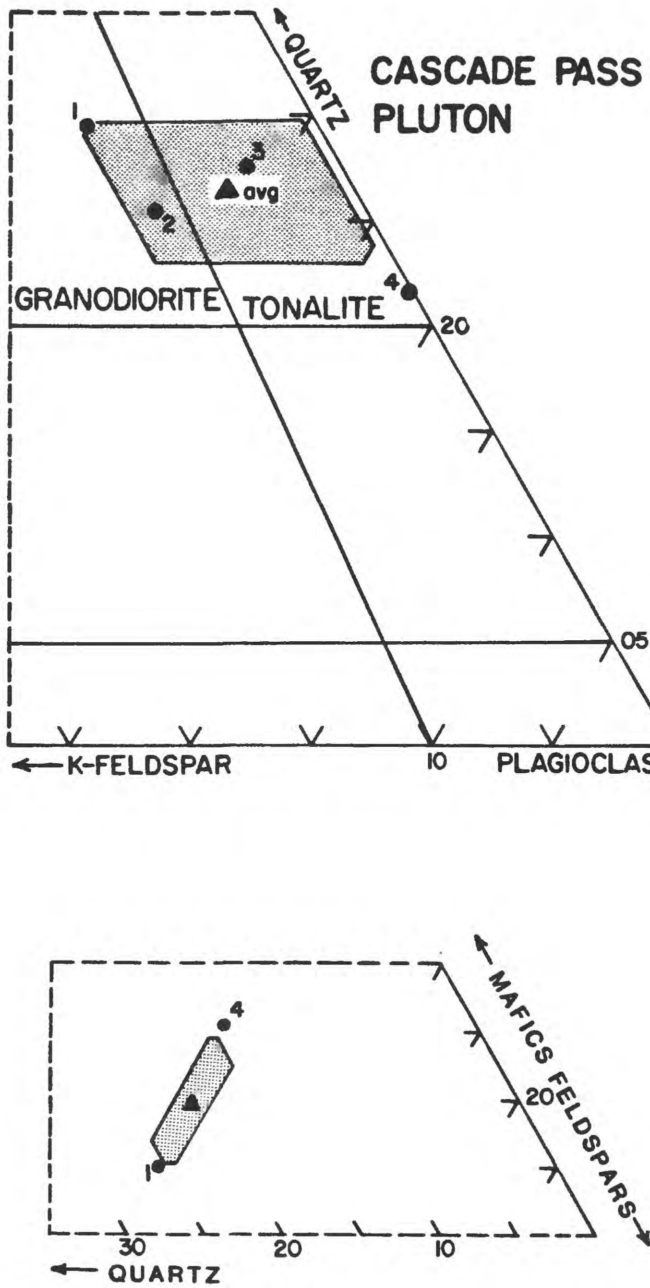


Figure 23.--Proportions of modal minerals of samples from the Cascade Pass pluton, showing rock classification in upper diagram.

Table 2.--Modes (volume percent) and specific gravities of samples from the Cascade Pass pluton

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
80S29A	1	GD	2.695	8.3	51.3	25.3	15.1	9.7	4.5	0	0	.8	0	tr (al)
81F218B	2	GD	2.711	7.2	53.1	20.6	19.1	9.0	4.3	.2	4.4	.1	.7	.3 (c)
81F221A	3	TO	2.728	3.0	55.2	22.4	19.3	9.1	8.2	0	.2	1.0	tr	.8 (sec)
82F151A	4	TOp	2.750	0	58.2	16.1	25.7	9.8	14.1	.6	0	1.0	tr	.2 (sf,ap)
Average			2.721	4.6	54.5	21.1	19.8	9.4	7.8	tr	tr	.7	tr	.3
Standard dev.			.024	3.8	3.0	3.9	4.4	.4	4.6	--	--	.4	--	--
n			4 →											

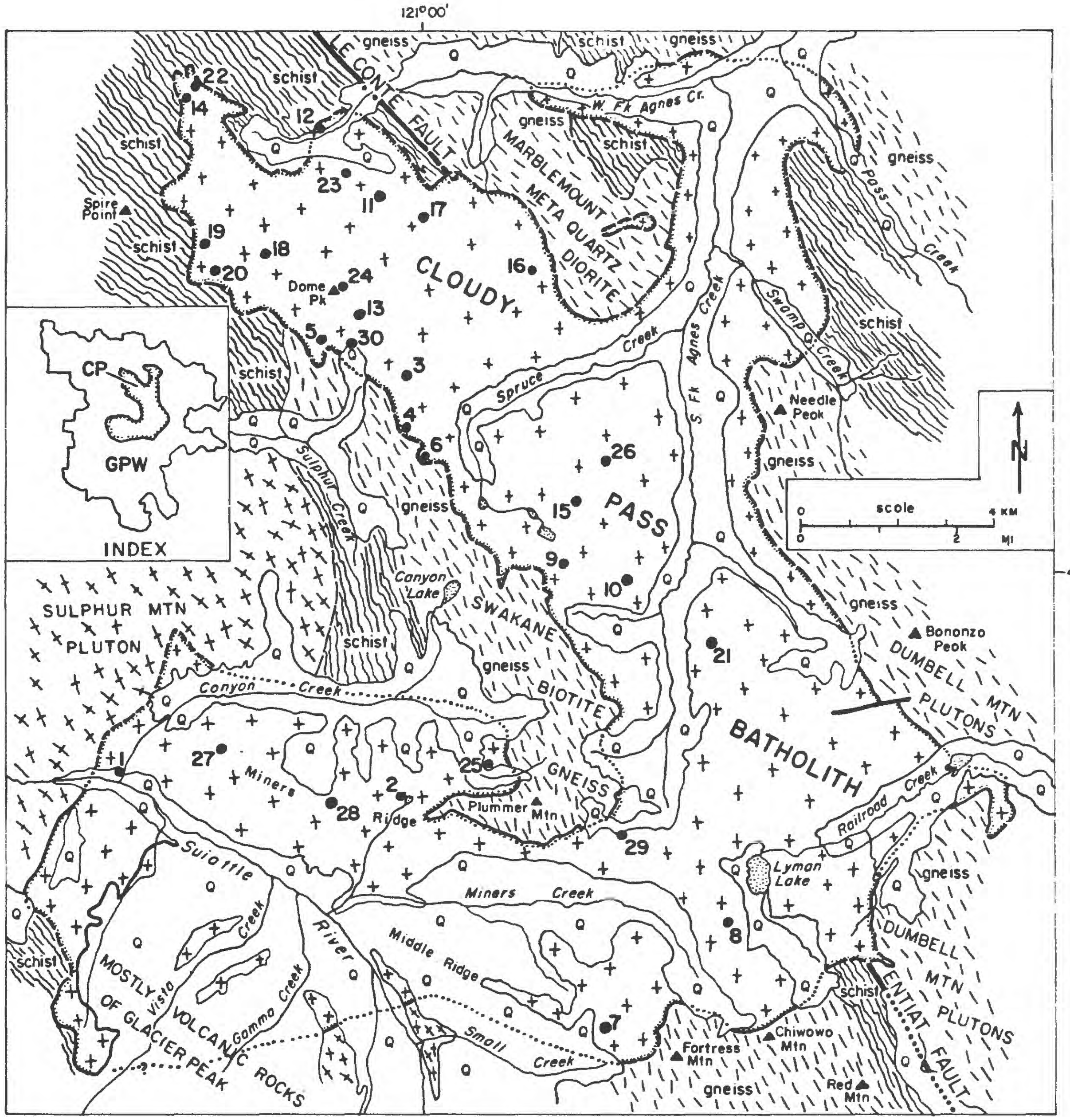
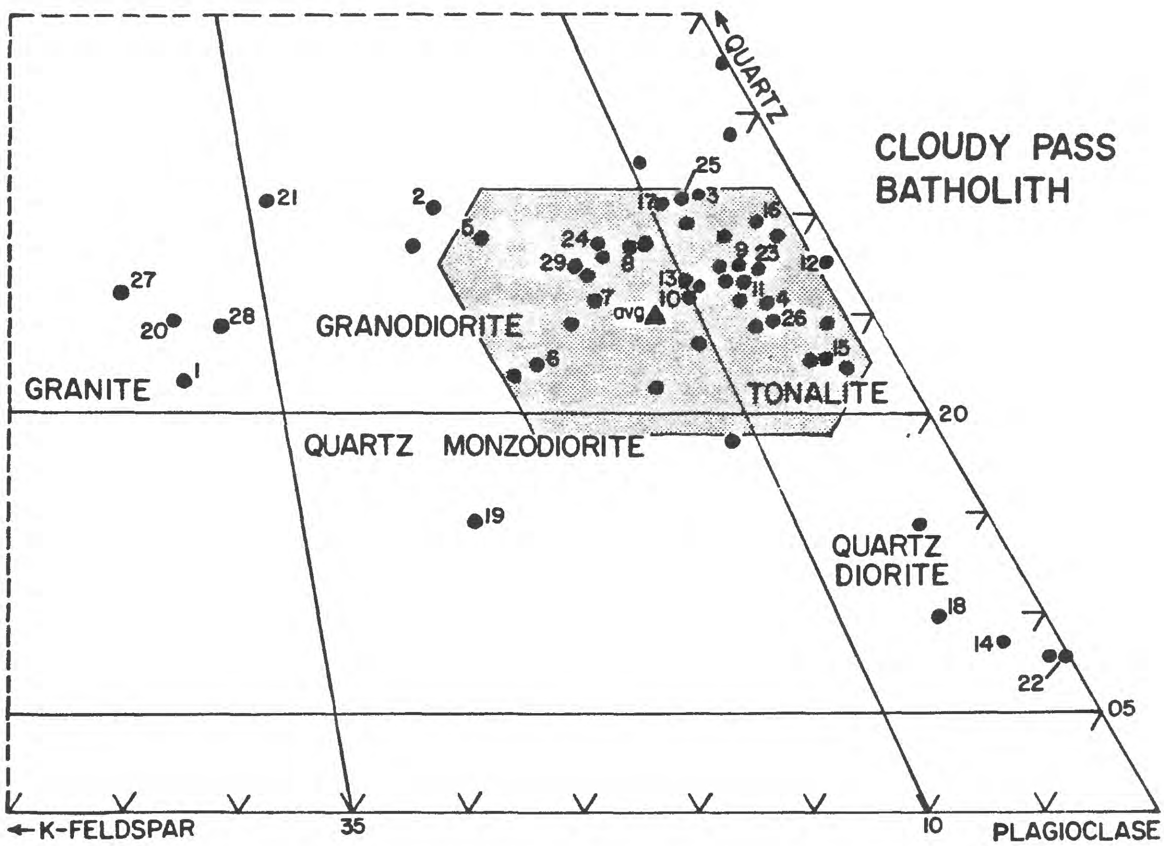


Figure 24.--Geologic sketch map of the Cloudy Pass batholith, showing approximate sample sites. Site 30 is for a chemically analyzed dike sample (not on table 3) with grain size too fine for modal determination.



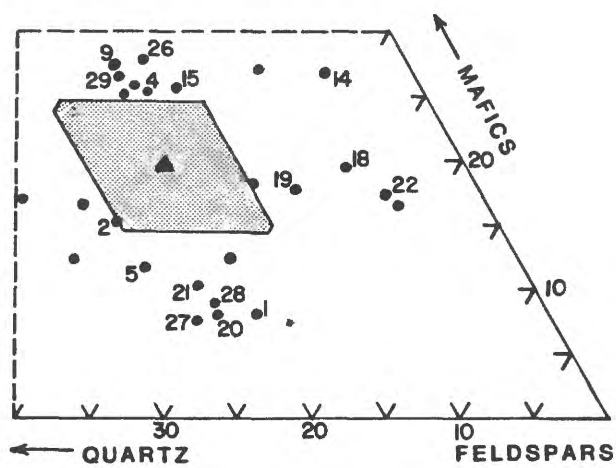


Figure 25.--Proportions of modal minerals of samples from the Cloudy Pass batholith, showing rock classification in upper diagram.

Table 3.--Modes (volume percent) and specific gravities of samples from the Cloudy Pass batholith

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Pyroxene	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
80R128A	1	GR	2.600	34.3	38.8	19.8	7.1	.8	.3	0	.6	4.5	.8	0	0
80S60A	2	GD	2.692	14.2	45.0	25.5	15.3	7.6	4.9	0	.6	2.0	.2	0	0
81F5A	3	TO	2.720	3.7	49.5	23.6	23.3	13.3	9.0	0	0	.4	.5	tr	tr (p)
81F8A	4	TOp	2.725	3.4	52.4	18.8	25.3	13.2	11.3	tr	0	.5	.2	0	.1 (p)
81F37A	5	GDp	2.677	13.4	49.5	25.3	11.8	6.1	3.8	tr	0	1.9	0	0	tr (z)
81F41B	6	GD	2.715	12.2	47.2	17.0	23.6	11.1	11.6	.2	0	.6	.2	0	tr (ap,p)
81F66A	7	GD	2.725	9.7	50.7	20.8	18.8	7.8	8.8	.5	.2	.8	.6	tr	tr (al)
81F68A	8	GD	2.720	6.8	49.4	22.3	21.4	9.1	9.2	0	.1	1.8	1.1	0	tr (al)
81F72A	9	TO	2.748	3.6	49.6	19.8	27.1	20.4	5.3	0	0	1.0	.4	0	tr (z)
81F73A	10	GD	2.743	6.1	52.8	20.3	20.8	12.2	5.3	2.0	.3	tr	.8	0	0
81F118A	11	TO	2.751	3.7	52.6	20.5	23.2	13.9	6.9	0	.1	1.6	.5	0	.2 (p)
81F119A	12	TO	2.729	.4	57.9	22.1	19.6	9.5	8.6	0	.1	1.3	0	.1	.1 (p)
81F148A	13	TO	2.753	5.7	50.8	20.4	23.1	12.6	7.9	0	.3	1.1	1.2	0	tr (p)
81F184C	14	QD	2.768	2.0	65.2	6.0	26.8	5.9	17.4	.1	.1	1.3	1.9	0	.1 (ap)
81F214A	15	TO	2.741	2.6	55.2	16.7	25.5	11.6	10.0	0	.4	3.0	.4	.1	.1 (ap,p)
81F217A	16	TO	2.730	2.3	54.4	23.6	19.7	13.2	5.2	0	.1	.7	.4	.1	tr (ap,p,z)
81L19A	17	TO	2.720	5.4	50.6	24.2	19.9	12.6	6.1	0	.1	.7	.2	.1	.1 (p)
81L35A	18	QDp	2.745	3.9	68.8	8.0	19.3	8.9	8.0	.9	.1	.6	.7	tr	0
81L36A	19	QMp	2.695	18.2	51.8	12.3	17.8	5.3	10.2	0	tr	.4	1.8	tr	tr (z)
81L38A	20	GR	2.610	28.1	41.2	22.6	8.1	0	3.4	0	.6	3.0	.8	tr	.2 (al,p,z)
81N42A	21	GDp	2.665	21.1	41.1	27.7	10.2	1.9	2.1	0	.8	5.0	.3	.1	.1 (sf,z)
81N67A	22	QDp	2.740	0	76.2	6.5	17.3	3.9	9.4	1.7	tr	.3	1.6	.1	.3 (sec)
81N69A	23	TO	2.725	3.0	55.9	21.9	19.3	7.6	7.9	0	.5	2.8	.3	.2	tr (p)
81N84A	24	GD	2.720	8.3	50.4	23.0	18.2	11.3	6.0	.7	0	.1	tr	0	tr (ap)
81N101A	25	TO	2.710	4.2	51.9	25.1	18.8	12.6	5.6	0	0	.4	.3	0	0
81N124A	26	TOp	2.750	3.5	51.1	17.7	27.7	12.9	10.1	0	.2	3.7	.5	.3	0
81S27A	27	GR	2.605	29.7	38.6	24.0	7.6	4.3	1.9	0	.1	.4	.8	.1	0
81S29A	28	GR	2.633	25.5	43.1	22.6	8.8	6.7	.7	0	0	.2	1.2	0	0
81S31A	29	GD	2.730	8.7	44.7	19.9	26.7	12.1	5.5	tr	.8	7.3	.8	.2	.1 (al)
81F9A		TO	2.750	1.7	55.4	18.3	24.5	m	< m	tr	0	tr	tr	tr	tr (ap)
81F65A		GDp	2.695	8.9	48.5	21.3	21.4	m	≈ m	0	tr	tr	s	tr	tr (ap,m)
81F67A		GD	2.710	8.4	51.2	23.1	17.2	m	≈ m	0	tr	s	tr	tr	tr (ap,z)
81F69A		GD	2.715	6.7	56.4	19.3	17.7	m	≈ m	tr	tr	s	s	tr	tr (ap,z,m)
81F70A		TOp	2.723	4.5	51.2	23.4	20.8	m	> m	0	tr	tr	tr	0	tr (ap)
81F149A		TO	2.734	3.9	51.2	19.1	25.8	m	> m	0	0	tr	tr	tr	tr (ap)
81F215A		TO	2.726	2.9	58.8	18.1	20.1	m	≈ m	tr	tr	tr	s	0	tr(ap,al,z)
81L35B		TO	2.730	2.1	56.8	23.5	17.6	m	< m	tr	tr	s	tr	tr	tr (ap)
81L41A		QD	2.777	2.2	60.5	10.3	27.0	m	≈ m	tr	tr	tr	s	0	tr (ap)
81N36A		GD	2.725	9.0	53.9	16.9	20.1	m	< m	0	0	tr	s	0	tr (ap)
81N36B		QDp	2.775	.6	68.9	6.0	24.5	s	m	tr	tr	m	tr	0	0

Table 3.--Continued

Sample No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite		Hornblende	Pyroxene	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
81N38A	QMp	2.713	7.7	59.0	15.0	18.3	s		m	0	tr	m	s	tr	tr (sf)
81N68A	TO	2.765	1.8	57.5	17.1	23.6	m	<	m	0	tr	m	s	tr	0
81N100A	TO	2.713	5.4	50.7	27.1	16.8	m	≈	m	0	tr	s	tr	0	tr (ap)
81N108A	GD	2.728	7.2	53.6	24.2	14.9	m	>	m	0	tr	tr	tr	0	tr (ap,z)
81N153,	TO	2.702	4.5	56.4	22.9	16.2	m	<	m	0	tr	tr	s	tr	tr (ap,z)
81N158A	TO	2.718	3.3	51.1	22.0	23.5	m	<	m	0	tr	m	tr	s	tr (ap)
81S33A	GD	2.715	11.0	51.6	20.2	17.2	m	>	m	0	tr	s	tr	tr	0
81S38A	TO	2.745	4.1	50.7	20.2	25.0	m	≈	m	0	0	tr	tr	0	tr (ap,sf)
81S40A	TO	2.678	1.7	56.1	29.9	12.3	m		s	0	tr	tr	tr	0	tr (ap)
81S40B	TO	2.730	4.7	57.2	19.8	18.2	m	≈	m	tr	tr	tr	tr	0	tr (ap,al)
81S43A	TO	2.722	.1	51.6	31.4	16.9	m	>	m	0	tr	tr	tr	tr	tr (ap)
82G52A	GD	2.660	15.4	45.0	23.9	15.7	m		tr	0	s	s	tr	0	tr (sf)
82S19A	TO	2.755	5.8	53.9	21.2	19.1	m		s	m	tr	tr	s	0	tr (ap)
82S20A	GD	2.683	15.6	52.8	19.1	12.5	m		0	0	tr	s	tr	tr	0
Average		2.716	7.8	52.7	20.2	19.2	9.3		7.0	0.2	.2	1.6	.6	tr	tr
Standard dev.		.039	7.8	7.0	5.4	5.3	4.6		3.7	0.5	.3	1.7	.5	--	--.
n		54 →					29 →								

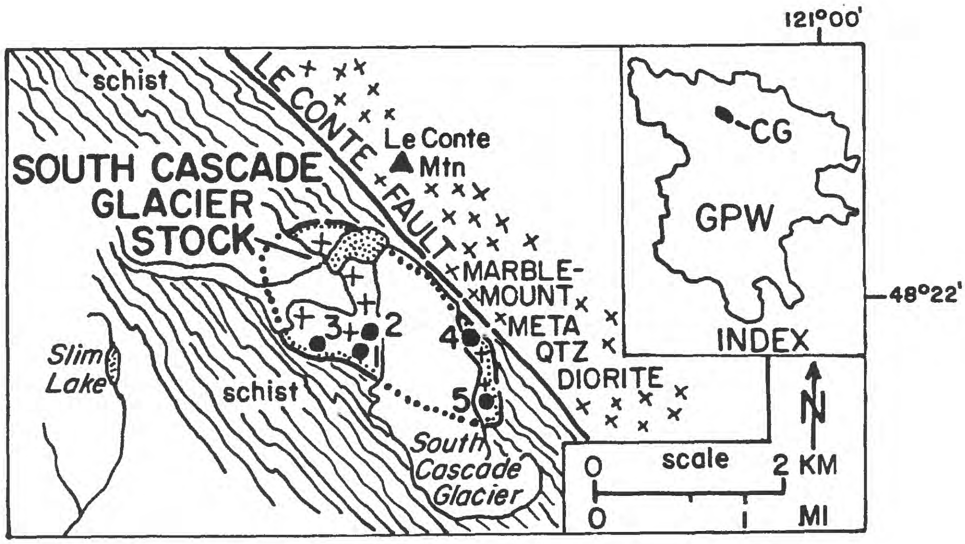


Figure 26.--Geologic sketch map of the South Cascade Glacier stock, showing approximate sample sites. Chiefly from mapping of Tabor (1961).

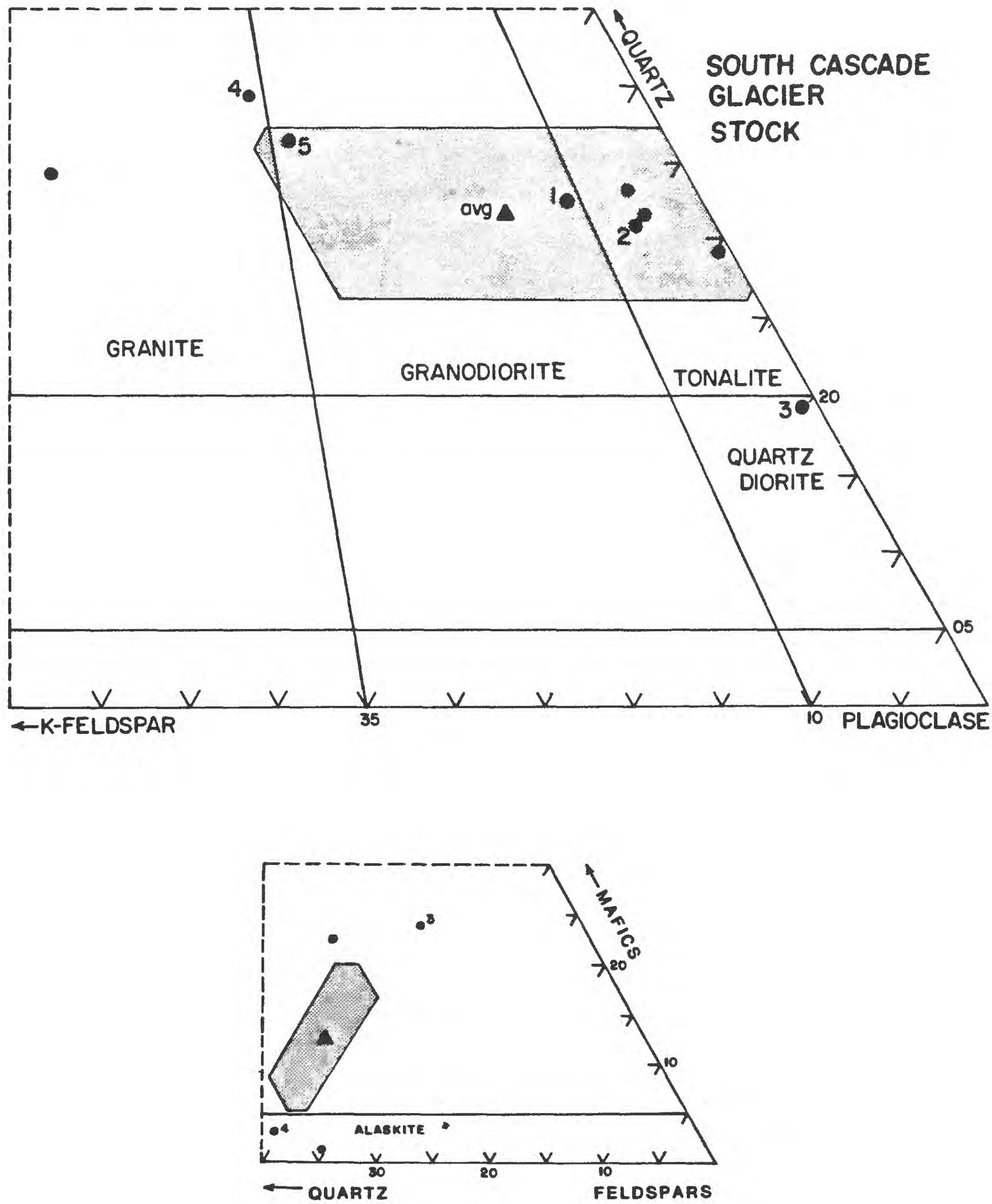


Figure 27.--Proportions of modal minerals of samples from the South Cascade Glacier stock, showing rock classification in upper diagram.

Table 4.--Modes (volume percent) and specific gravities of samples from the South Cascade Glacier stock

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
81F112A	1	GD	2.677	6.4	51.6	28.2	13.8	7.4	tr	.2	5.6	.2	.4	tr (al)
81F113A	2	TO	2.710	3.6	55.2	26.4	14.8	8.4	1.5	tr	4.2	.2	.4	tr (p)
81F134A	3	QD	2.727	.7	60.7	14.7	23.9	11.6	6.0	tr	5.6	.5	.2	tr (ap,c)
81F135A	4	Agr	2.628	21.4	37.5	37.9	3.2	.2	0	.1	2.7	.2	tr	tr (c)
81F136A	5	GD	2.624	20.0	39.6	33.9	6.4	.3	0	tr	5.7	.4	.1	tr (c,z)
81F84A		TO	2.650	3.3	54.1	28.7	13.9	tr	0	tr	m	tr	tr	tr (m)
81F114A		TO	2.705	3.7	54.5	27.1	14.7	m	s	tr	s	tr	tr	tr (ap)
81F115A		TO	2.716	.6	54.2	22.7	22.6	m >	m	tr	tr	tr	0	tr (ap,z)
81F137D		Agr	2.579	35.2	29.5	34.0	1.2	0	0	0	tr	tr	0	s (m)
Average			2.668	10.5	48.5	28.2	12.7	5.6	1.5	tr	4.8	.3	.2	tr
Standard			.051	12.1	10.4	6.9	7.9	5.1	2.6	--	1.3	.1	.2	--
n			9					5						

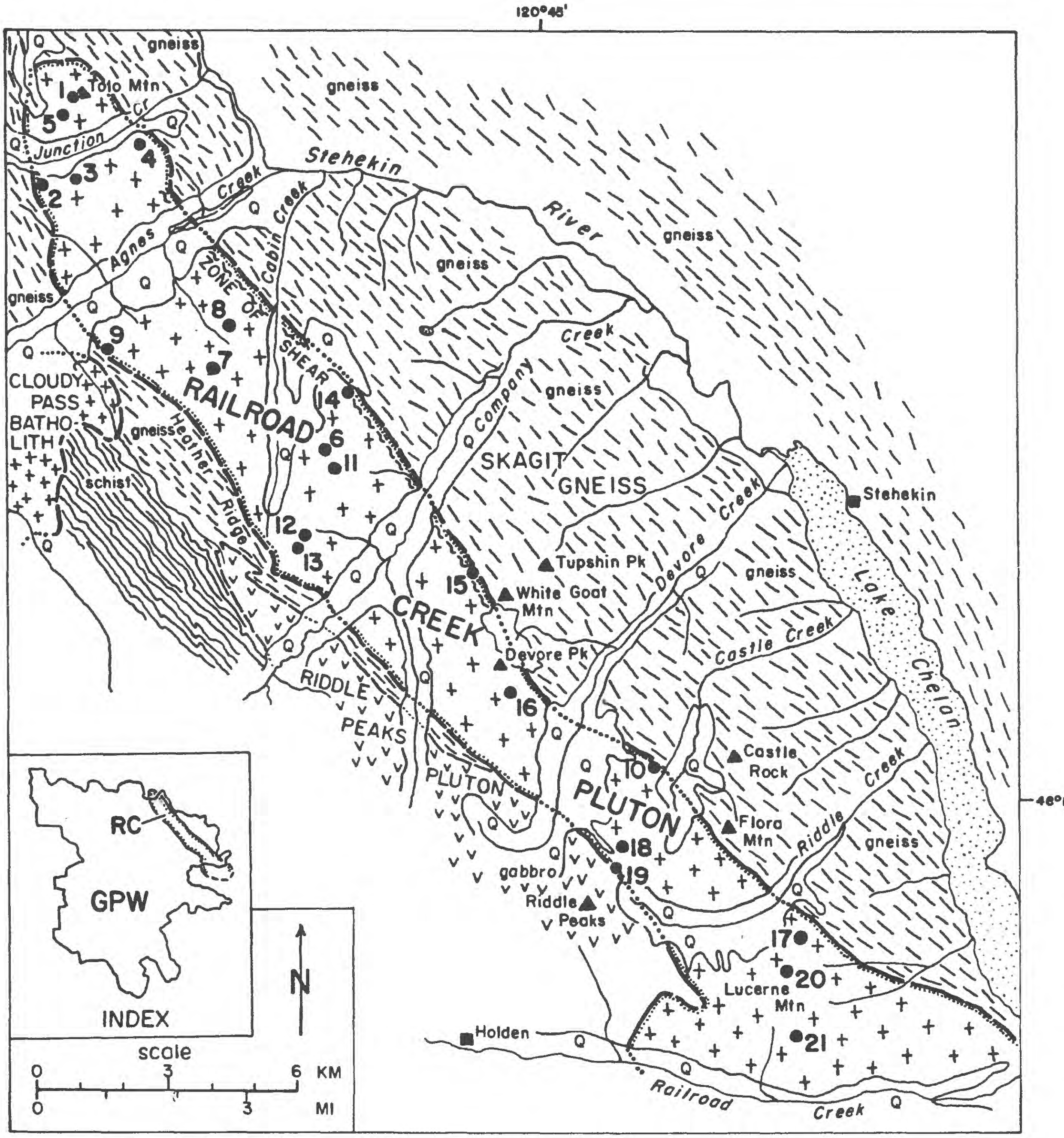


Figure 28.--Geologic sketch map of the Railroad Creek pluton, showing approximate sample sites. From mapping of Cater and Wright (1967) south of Flora Mountain, Tabor (1961) north of Agnes Creek, and Libby (1964) in intervening area..

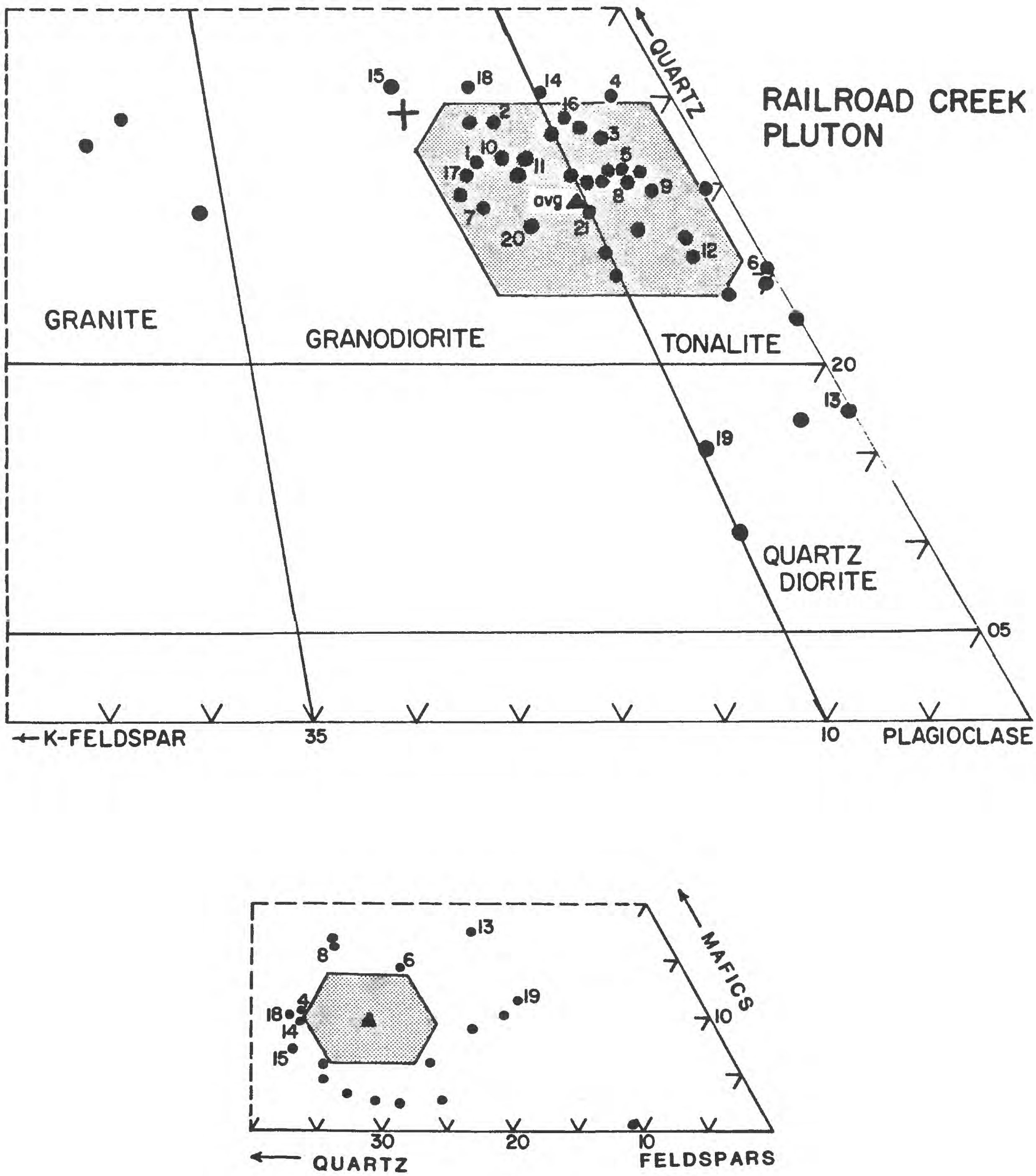


Figure 29.--Proportions of modal minerals of samples from the Railroad Creek pluton, showing rock classification in upper diagram. Cater's (1982, p. 80) average (upper diagram) for southern end of body (Lucerne quadrangle) marked by "+."

Table 5.--Modes (volume percent) and specific gravities of samples from the Railroad Creek pluton

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
81F45A	1	GDf	2.665	10.3	53.0	28.6	8.1	6.6	.6	.1	.6	.2	0	tr (ap)
81F48A	2	GDf	2.667	8.7	51.6	30.1	9.6	8.8	0	.1	0	.6	0	tr (al,ap)
81F49A	3	TOf	2.690	4.3	56.3	29.2	10.2	7.5	.9	tr	1.4	.2	tr	.1 (al,ap,z)
81F51A	4	TOf	2.680	2.7	55.6	31.3	10.4	7.4	1.4	.1	1.2	.3	0	tr (ap)
81F52A	5	TOf	2.692	3.9	56.6	26.9	12.5	8.9	1.9	.1	1.3	.2	0	tr (al,ap)
81F176A	6	TO	2.726	0	64.0	21.7	14.3	9.7	3.2	tr	1.1	.3	tr	tr (al,ap)
81F245A	7	GD	2.659	11.0	51.4	25.4	12.2	11.7	tr	0	.3	.1	0	tr (ap)
81F246A	8	TOf	2.720	3.9	54.1	25.6	16.4	14.0	1.1	.1	1.0	.2	0	tr (ap)
81F248A	9	TOf	2.680	3.3	59.7	26.8	10.2	9.2	.5	.1	.2	.2	tr	tr (ap,al)
81F295A	10	GDf	2.679	9.1	53.1	28.7	9.1	6.6	1.1	.2	1.0	.1	tr	.1 (ap,z,al)
81N30A	11	GD	2.670	8.1	54.2	28.9	8.8	6.8	1.2	.3	.4	.1	0	tr (ap,al)
81N34A	12	TOf	2.718	2.9	61.3	22.5	13.4	9.9	2.6	tr	.7	.2	tr	.1 (ap,al,z)
81N149A	13	QDf	2.748	0	67.9	14.6	17.6	13.2	2.5	.1	1.3	.4	tr	tr (ap)
81S16A	14	TO	2.670	5.7	53.0	31.5	9.8	7.4	0	tr	2.2	.2	.1	tr (ap,al)
81S24A	15	GD	nd	12.3	47.1	33.3	7.3	5.9	.7	tr	.4	tr	tr	.1 (sec)
81S25A	16	TO	2.687	5.2	53.9	30.3	10.6	6.8	1.2	.7	1.8	.1	tr	tr (ap)
82F50A	17	GD	2.657	11.2	52.5	28.2	8.1	6.9	.6	tr	.4	.1	0	.1 (al,ap,z)
82F54A	18	GD	2.675	8.6	49.4	32.1	10.0	7.9	.7	0	1.1	.2	tr	tr (ap,al)
82F83B	19	QDf	2.688	7.5	67.0	14.0	11.5	3.9	.2	.6	5.7	.4	tr	.6 (sec,ap)
82G43A	20	GD	2.667	9.3	56.5	25.2	9.0	5.0	.6	tr	2.5	.1	tr	.9 (sec,ap,z)
82S12A	21	GD	2.659	6.3	56.2	25.2	12.3	10.5	1.3	tr	.4	.1	tr	tr (ap)
80H105A		TO	nd	4.9	56.7	30.6	7.8	--	--	--	--	--	--	--
80H106B		TO	nd	0	63.7	18.5	17.9	m	m	tr	s	tr	tr	tr (z)
81F53A		TOf	2.660	6.1	55.9	26.6	11.5	0	0	tr	m	tr	tr	0
81F58A		QD	2.698	2.0	72.2	15.6	10.2	--	--	--	--	--	--	--
81F177A		Agr	2.627	26.2	36.9	32.3	4.6	s	0	0	tr	tr	tr	tr (ap,z)
81F247A		TOf	2.681	5.0	62.2	25.5	7.2	m	tr	0	tr	tr	tr	tr (z)
81F267B		TOf	2.665	1.1	65.1	28.0	5.9	m	tr	tr	tr	tr	0	tr (ap,z)
81F268A		TO	2.694	3.4	63.2	24.7	8.7	m	s	tr	tr	tr	tr	tr (ap,z)
81F294A		GD	2.670	6.9	57.5	23.0	12.6	m	s	0	tr	tr	0	tr (ap)
81N22A		TO	nd	3.8	56.6	26.5	13.1	m	s	tr	s	tr	tr	tr (ap,z)
81N27A		TO	nd	2.3	63.8	21.6	12.2	m	s	tr	s	tr	tr	tr (ap,z)
81N29A		Agd	2.645	12.3	56.0	29.0	2.7	s	0	0	s	tr	0	tr (ap)
81N103A		TO	2.632	5.3	56.7	26.8	11.2	tr	0	tr	m	s	tr	tr (al,z)
81S15A		Ato	2.660	.2	72.9	24.0	2.8	s	0	0	s	tr	0	s (g)
81S15F		Aqm	2.660	8.9	79.1	10.5	1.5	tr	tr	tr	s	tr	0	tr (ap)
81S18A		Agr	nd	25.7	44.1	27.5	2.6	0	tr	0	s	s	0	0
82F67A		Agr	2.617	29.1	36.5	31.0	3.3	0	0	0	s	s	tr	s (g,m)
82F82A		TO	2.638	4.4	56.4	26.9	12.2	0	tr	tr	m	s	0	tr (ap,c)
82G44A		GD	2.660	6.2	55.0	30.0	8.8	m	tr	tr	s	tr	tr	tr (ap,z)

Table 5.--Continued

Sample No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
82G45A	GD	2.690	5.8	51.8	25.5	16.9	tr	m	tr	s	tr	tr	0
82G47A	GD	2.642	9.9	52.5	31.7	5.9	s	tr	0	m	tr	tr	tr (ap)
82G54A	GD	2.610	6.9	56.6	29.4	7.1	m	tr	tr	m	s	0	tr (ap,z)
82G55A	GD	2.650	7.4	63.1	23.5	6.0	m	s	tr	s	tr	tr	tr (ap)
82S14A	GD	2.654	8.8	53.1	27.1	11.0	0	tr	s	m	s	tr	0
Average		2.671	7.3	56.9	26.1	10.7	8.3	1.0	.1	1.2	.2	tr	tr
Standard dev.		.03	6.2	8.1	5.1	3.9	2.5	.9	.2	1.2	.1	--	--
n		39 →	45 →				21 →						

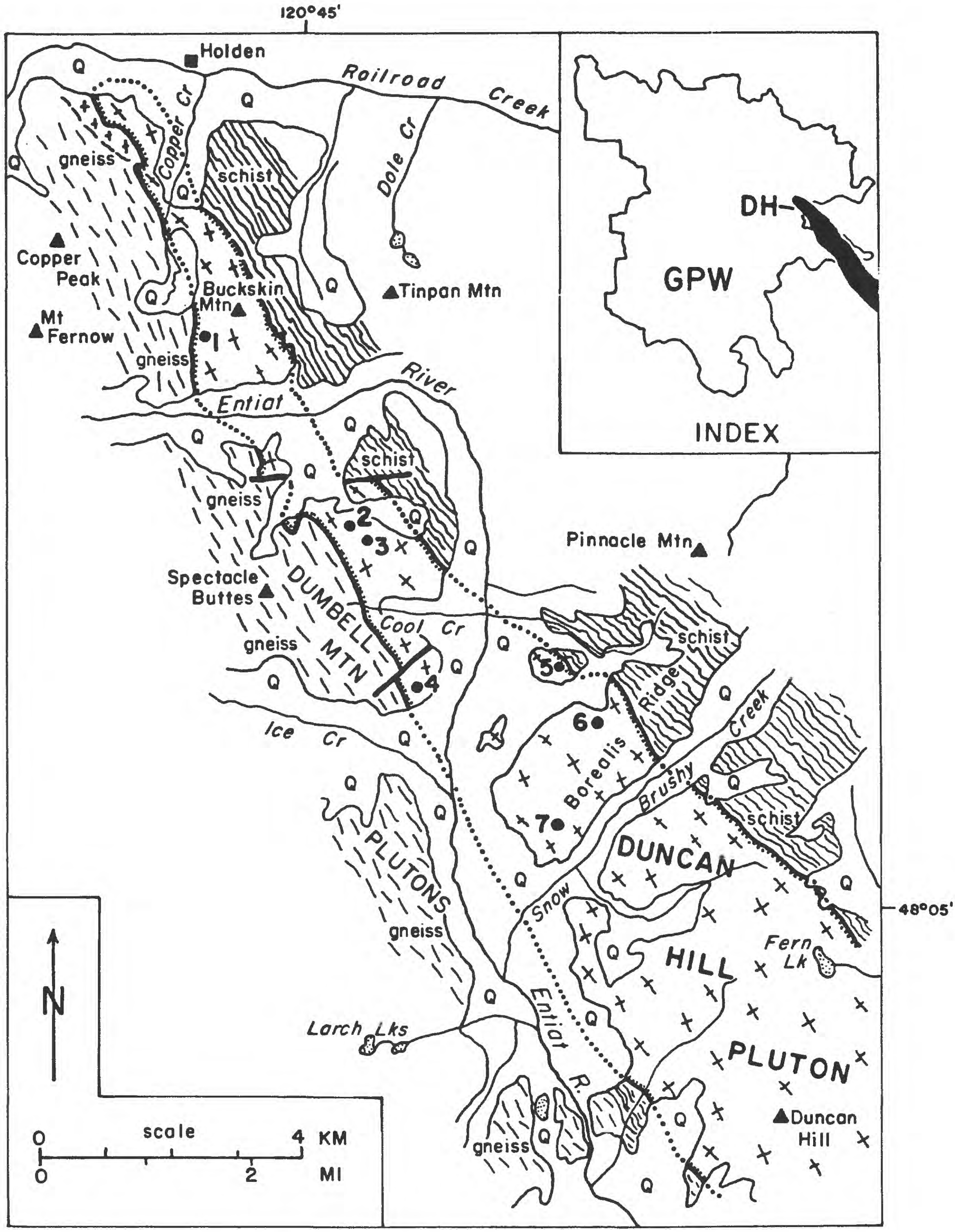


Figure 30.--Geologic sketch map of northern part of the Duncan Hill pluton, showing approximate sample sites. From mapping of Cater and Crowder (1967) and Cater and Wright (1967). As shown, includes contact complexes mapped separately.

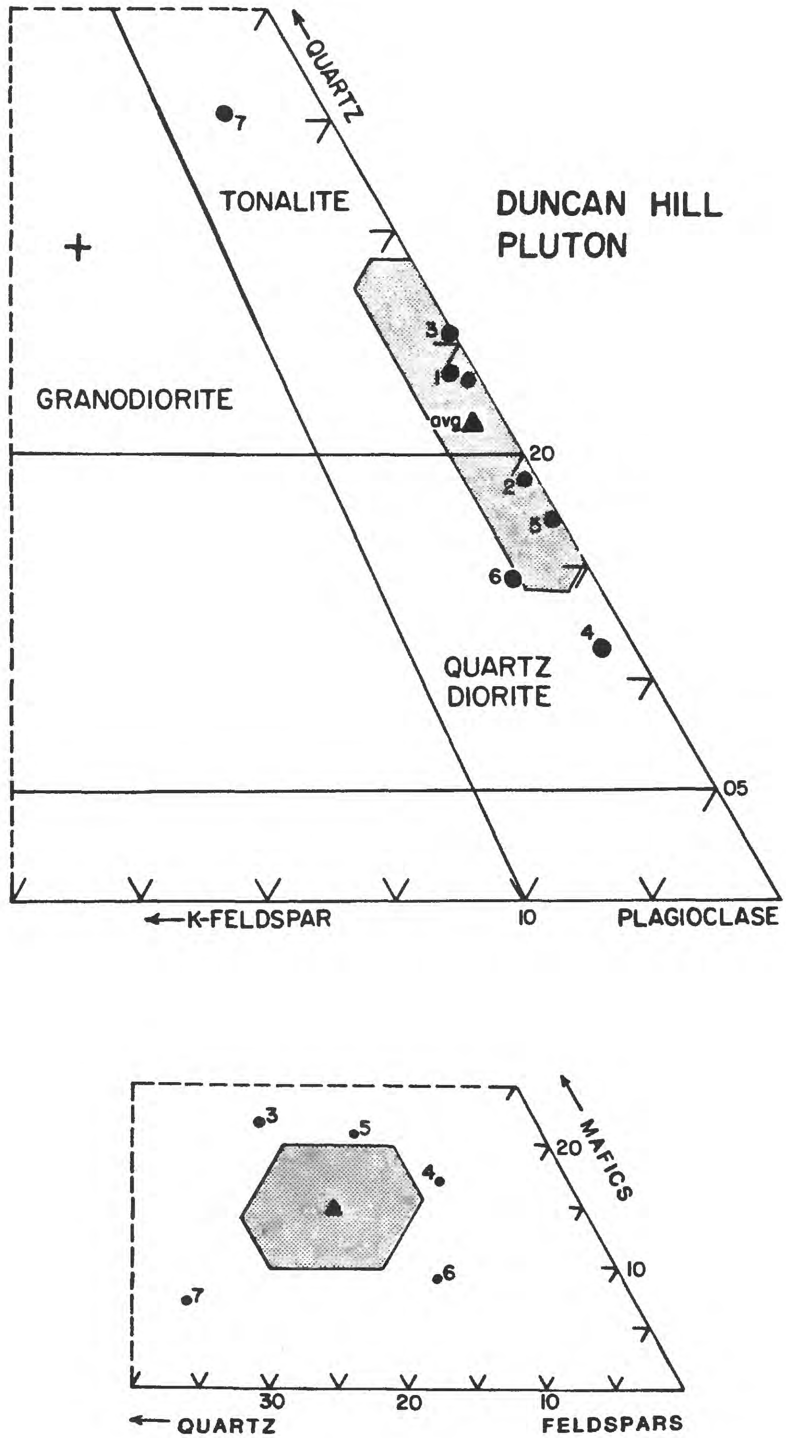


Figure 31.--Proportions of modal minerals of samples from the northern end of the Duncan Hill pluton, showing rock classification in upper diagram. Average of Cater's (1982, p. 63) modes for entire body marked by "+" in upper diagram.

Table 6.--Modes (volume percent) and specific gravities of samples from the Duncan Hill pluton

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others	
82F41A	1	TOf	2.718	.9	66.9	21.3	10.9	10.1	.1	tr	.1	.4	.2	.1	(ap,z,sec)
82G34A	2	QDf	2.724	.5	66.2	15.5	17.7	4.8	4.8	tr	4.3	1.8	.9	1.1	(sec,z,ap)
82S3A	3	TOf	2.742	0	58.3	19.9	21.9	17.5	3.3	0	.5	.4	.3	tr	(ap,p,z)
82S4A	4	QDf	2.750	1.4	72.2	9.3	17.1	13.7	1.8	tr	.4	.2	1.0	.1	(p,ap)
82S6A	5	QDf	2.723	.2	65.1	13.7	21.0	7.4	5.5	tr	6.1	.6	1.1	.4	(sec,p,ap)
82S7B	6	QDf	2.677	2.8	74.7	13.4	9.1	7.0	1.5	0	.3	tr	.2	tr	(ap)
82S8A	7	TOf	2.683	3.7	56.4	32.7	7.2	5.1	0	0	1.2	.5	.2	.1	(sec,al)
82S2A		TOf	2.746	.3	65.5	20.5	13.6	m >	m	tr	tr	tr	tr	tr	(ap)
Average			2.720	1.2	65.7	18.3	14.8	9.4	2.4	tr	1.8	.6	.6	.3	
Standard dev.			.028	1.3	6.2	7.2	5.5	4.7	2.2	--	2.4	.6	.4	.4	
n			8 →					7 →							

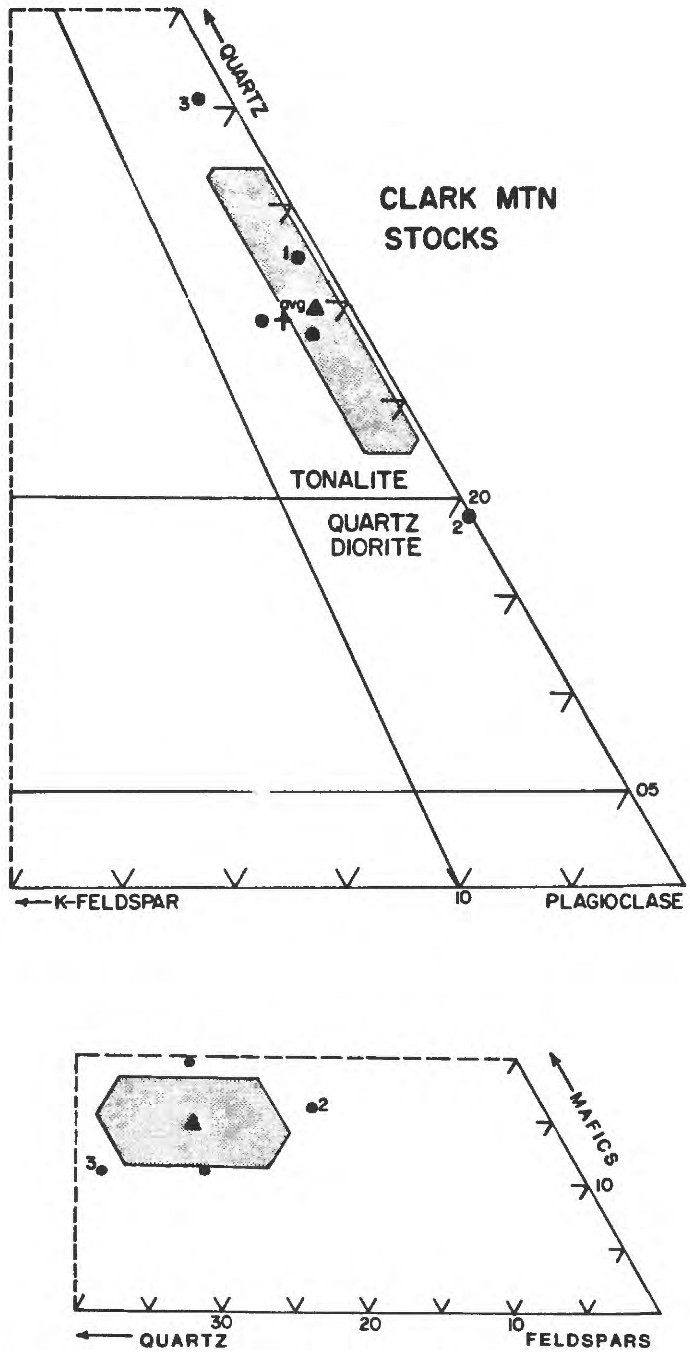


Figure 32.--Proportions of modal minerals in samples from the Clark Mountain stocks, showing rock classification in upper diagram. Geologic sketch map of stocks shown in figure 47. "+" in upper diagram shows average of Cater's (1982, p. 54) modes.

Table 7.--Modes (volume percent) and specific gravities of samples from the Clark Mountain stocks

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Muscovite	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
82F101A	1	TO	2.750	0.8	54.9	26.5	15.2	10.2	0	2.6	4.1	0	.2	.7	tr(ap,al,z)
82F103A	2	QD	2.742	0	68.0	15.9	16.1	8.5	2.2	tr	4.4	.2	.1	.7	tr (al)
82G56A	3	TO	2.723	1.2	47.8	32.9	11.0	4.6	0	7.1	5.5	.2	.1	.5	tr (al)
82F18A		TO	2.791	2.0	55.6	22.7	19.7	m	0	tr	s	0	tr	s	tr (ap)
82F102A		TO	2.692	3.8	59.4	25.8	11.0	m	0	s	s	tr	tr	s	s (al)
Average			2.740	1.6	57.1	24.8	14.6	7.8	.7	3.2	4.7	.1	.1	.6	tr
Standard dev.			.036	1.4	7.4	6.2	3.7	2.9	1.3	3.6	.7	.1	.1	.1	--
n			5 →					3 →							

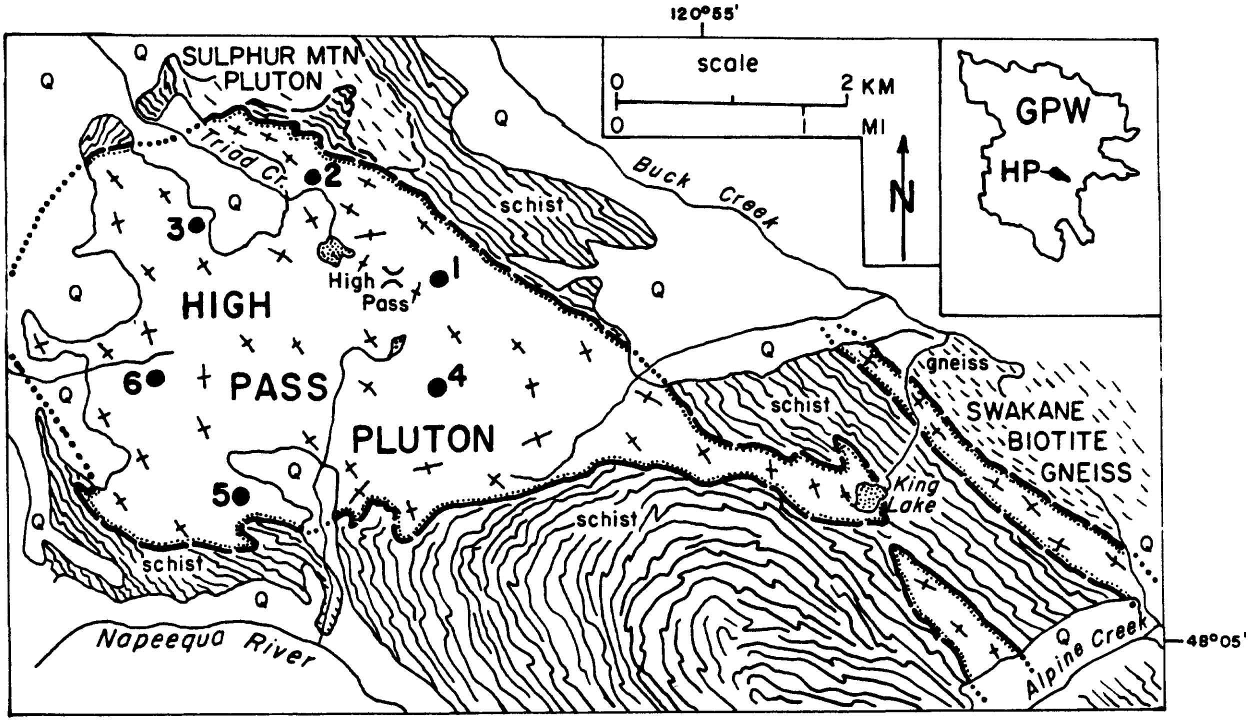


Figure 33.--Geologic sketch map of the High Pass pluton, showing approximate sample sites. From mapping by Cater and Crowder (1967).

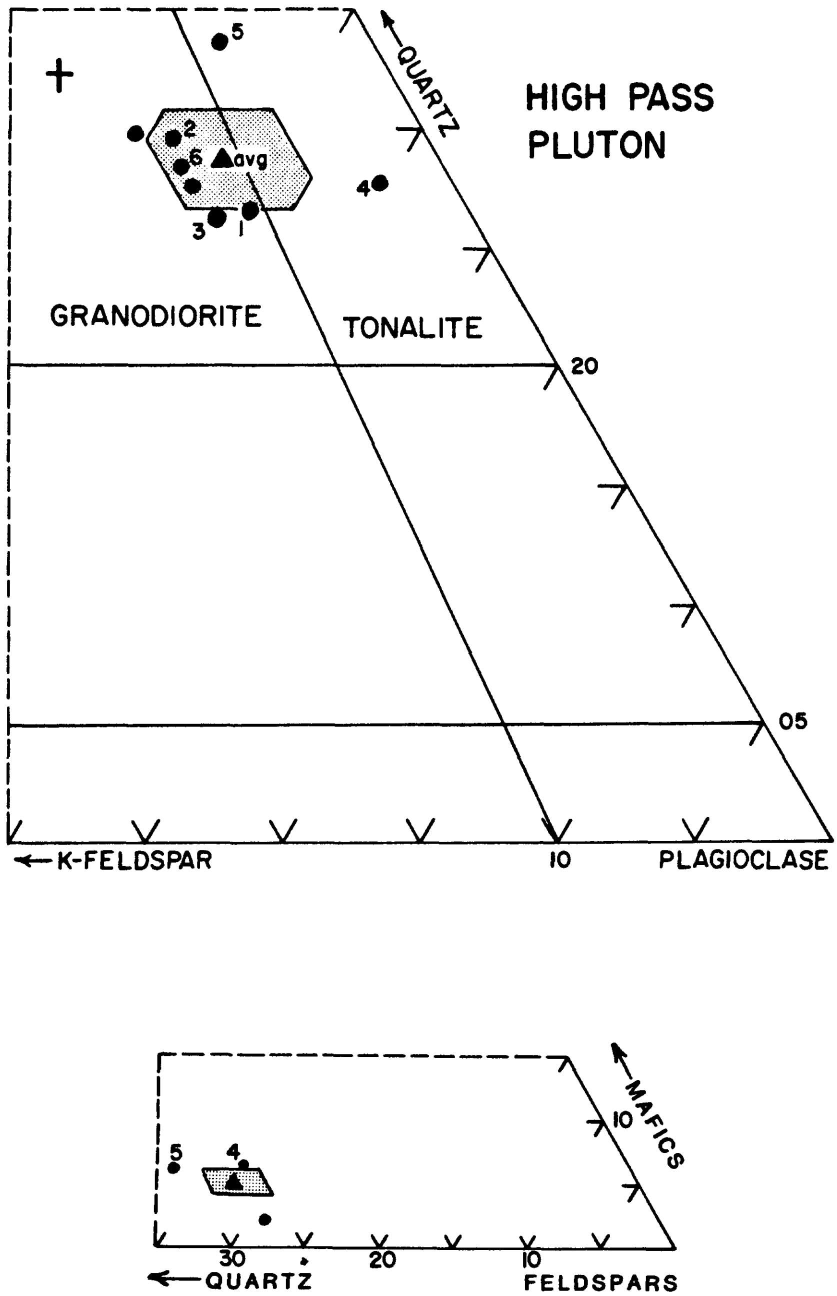


Figure 34.--Proportions of modal minerals of samples from the High Pass pluton, showing rock classification in upper diagram. Average of Cater's (1982, p. 40) modes marked by "+" in upper diagram.

Table 8.--Modes (volume percent) and specific gravities of samples from the High Pass pluton

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Muscovite	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
82F10A	1	GDf	2.673	7.1	61.7	25.3	5.9	3.8	tr	1.8	.1	0	.1	tr (p,al,ap)
82F11A	2	GD	2.657	8.6	55.9	28.1	5.7	4.7	1.7	.6	tr	tr	.2	.2 (sec,p)
82F23A	3	Agd	2.671	8.8	60.2	25.3	4.7	4.1	1.0	.3	.1	0	.2	tr (sec,ap)
82G4A	4	TOf	2.691	2.3	62.5	26.0	6.5	4.6	2.6	1.2	0	.1	.5	tr (z,ap)
82G58A	5	TO	2.661	5.1	55.8	30.8	6.0	4.9	2.3	.6	.1	0	.4	s (al)
82S40A	6	Agd	2.663	9.2	57.6	27.0	4.8	4.1	1.4	.4	tr	tr	.3	s (al,ap,z)
82G5A		Agd	2.645	10.0	56.8	28.3	4.9	m	s	s	tr	tr	s	tr (ap,z)
82G59A		Agd	2.648	9.2	60.8	26.7	3.2	s	s	s	s	s	s	tr (z)
Average			2.664	7.5	58.9	27.2	5.2	4.4	1.5	.8	tr	tr	.3	--
Standard dev.			.015	2.6	2.7	1.9	1.0	.4	.9	.6	--	--	.1	--
n			8 →					6 →						

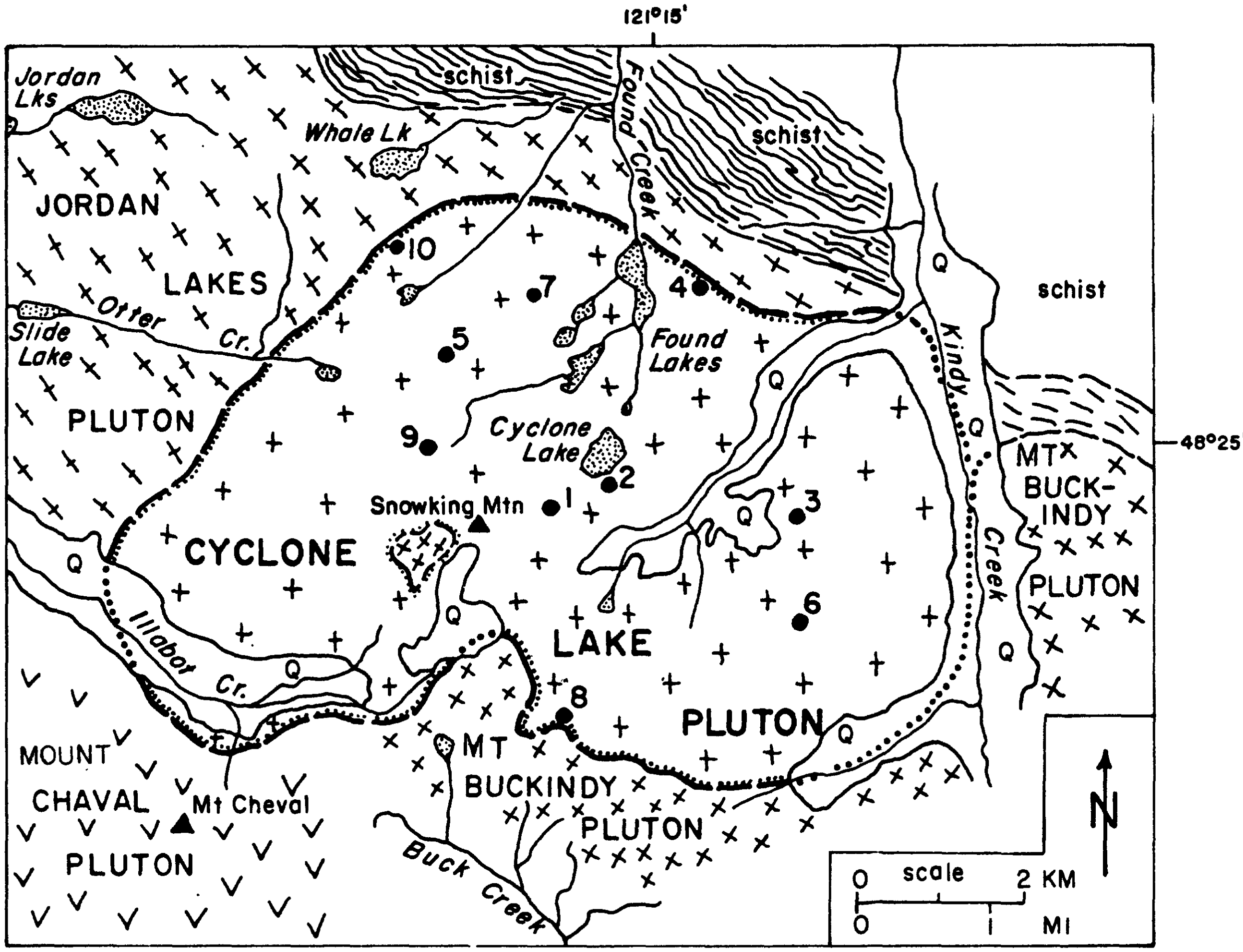
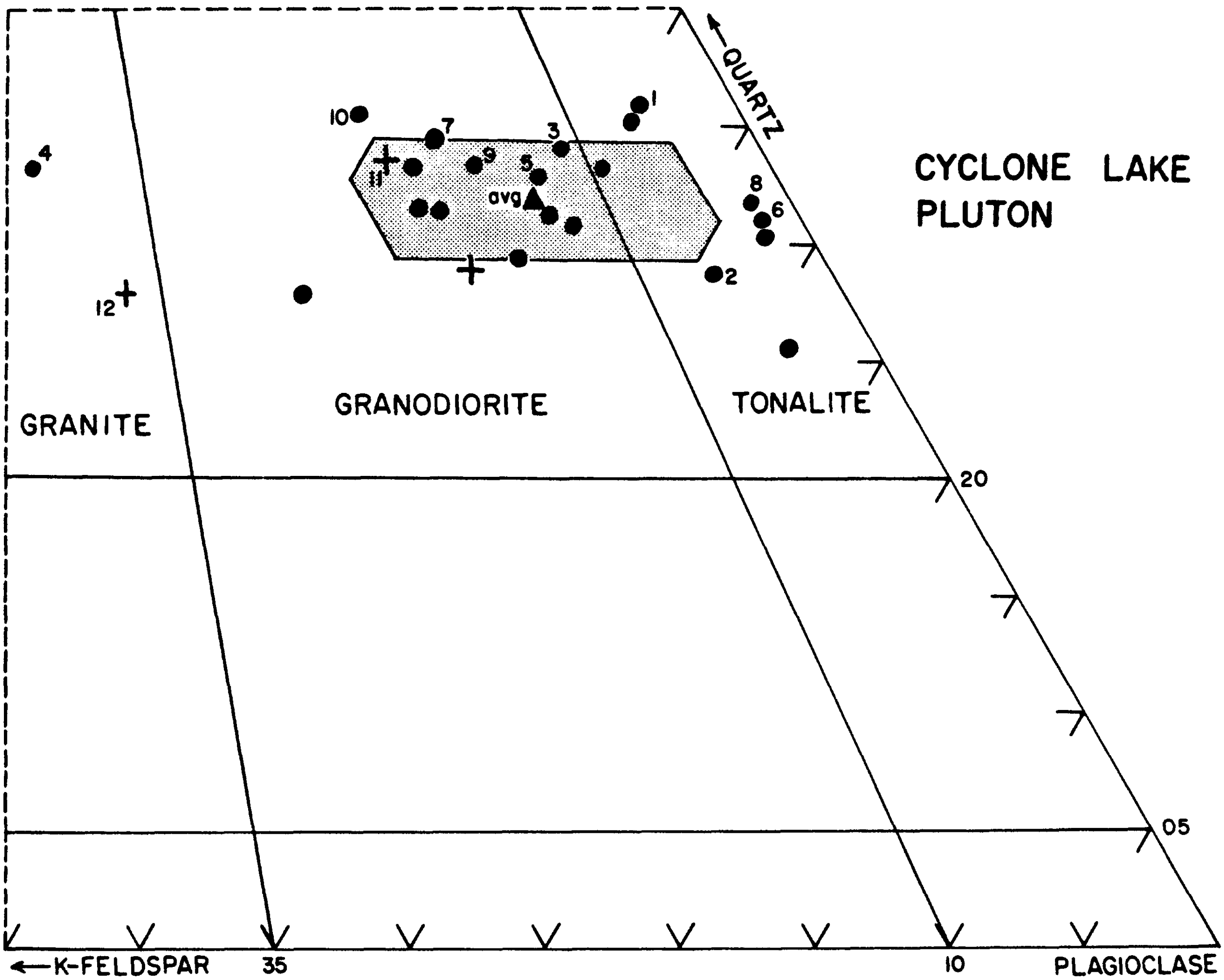


Figure 35.--Geologic sketch map of the Cyclone Lake pluton, showing approximate sample sites. In part, from mapping by Bryant (1955).



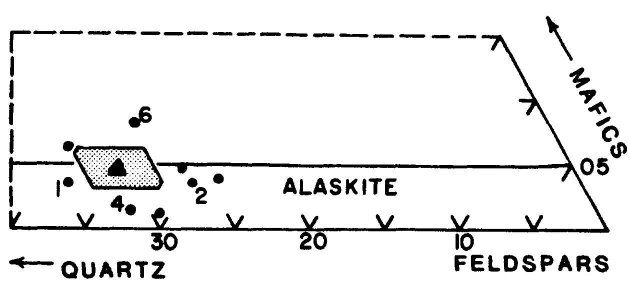


Figure 36.--Proportions of modal minerals of samples from the Cyclone Lake pluton, showing rock classification in upper diagram. Dike or other small body possibly related to pluton marked by "+" (upper diagram).

Table 9A.--Modes (volume percent) and specific gravities of samples from the Cyclone Lake pluton

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Muscovite	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
81F17A	1	Atof	2.650	3.8	58.5	34.6	3.2	2.5	tr	.2	.3	.1	.2	tr (ap,z)
81F18A	2	Atof	2.663	4.1	62.0	26.7	3.6	3.2	3.5	.1	tr	.1	.2	tr (ap,z)
81F19A	3	Agdf	2.655	7.0	54.4	31.7	4.2	4.0	2.7	.1	tr	0	tr	tr (ap)
81F20A	4	Agrf	2.620	26.2	37.3	31.4	1.4	.4	3.7	.6	.3	tr	.1	tr (al,ap)
81F21A	5	GD	2.655	8.2	52.8	29.9	5.2	4.1	3.9	.8	.1	.1	.1	tr (ap)
81F28A	6	TOf	2.675	1.5	59.8	27.6	8.2	7.7	2.9	.1	.3	.1	0	tr (ap,z)
81F32A	7	Agdf	2.660	11.1	49.2	31.9	4.1	2.8	3.7	.9	tr	.1	.1	.2 (p,ap)
81F106A	8	Atof	2.655	1.4	63.6	30.1	4.9	4.4	tr	tr	.2	.2	0	tr (r)
81F170A	9	GDf	2.658	10.2	51.4	30.8	5.1	4.9	2.5	.2	tr	tr	tr	tr (ap)
81N64A	10	Agdf	2.650	13.1	45.7	32.4	3.6	1.1	5.2	1.2	1.0	.3	0	.2 (g)
80L38A		TOf	2.664	3.9	56.8	33.0	6.2	m	m	tr	tr	tr	0	tr (ap)
81F22A		Agdf	2.660	13.4	52.1	30.0	4.5	m	m	tr	tr	tr	tr	tr (ap)
81F23A		Agdf	nd	19.3	49.3	26.4	4.9	s	m	s	tr	tr	tr	tr (ap)
81F29A		Agdf	2.637	11.2	58.5	29.2	1.1	s	s	s	s	tr	tr	tr (ap)
81F108A		Agdf	2.663	12.7	52.8	29.9	4.6	s	s	tr	s	tr	tr	tr (ap)
81L13A		Agd	2.632	9.0	56.9	29.8	4.3	m	tr	tr	s	tr	0	tr (ap)
81L14A		Ato	2.665	1.6	63.8	29.1	5.5	m	m	tr	tr	tr	0	tr (ap)
81N9A		Ato	nd	3.5	68.3	24.2	4.0	s	0	tr	s	tr	0	tr (ap)
81N11A		GD	nd	8.4	57.2	29.0	5.4	s	m	0	s	s	0	tr (ap)
81N12A		Agd	nd	12.7	51.1	31.8	4.5	m	m	tr	tr	tr	0	tr (z)
81N63A		Ato	2.666	6.4	57.3	31.4	4.9	s	s	s	s	tr	tr	0
Average			2.655	9.0	55.2	30.0	4.5	3.5	2.8	.4	.2	.1	.1	tr
Standard dev.			.014	6.2	6.9	2.4	1.5	2.1	1.7	.4	.3	.1	.1	--
n			17→	21 →				10 →						

Table 9B.--Modes (volume percent) and specific gravities of samples from small bodies probably related to the Cyclone Lake pluton (Headings as in table 9A)

Sample No.														
81N106B	11	Agd	2.642	13.9	52.5	32.3	1.3	s	s	tr	tr	tr	0	tr (ap)
81F181A	12	Agrf	2.617	26.0	44.5	27.0	2.6	s	s	tr	s	tr	0	tr (ap)
80N44A		Agr	2.648	12.9	56.5	28.1	2.6	s	tr	tr	tr	tr	0	tr (ap)

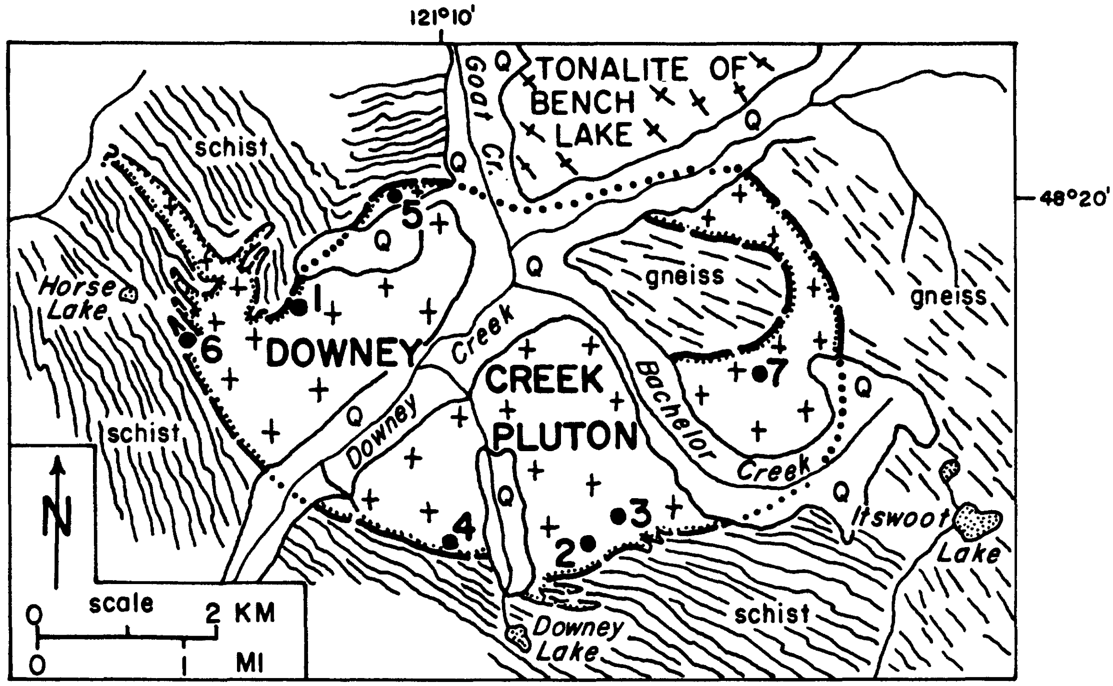


Figure 37.--Geologic sketch map of the Downey Creek pluton, showing approximate sample sites.

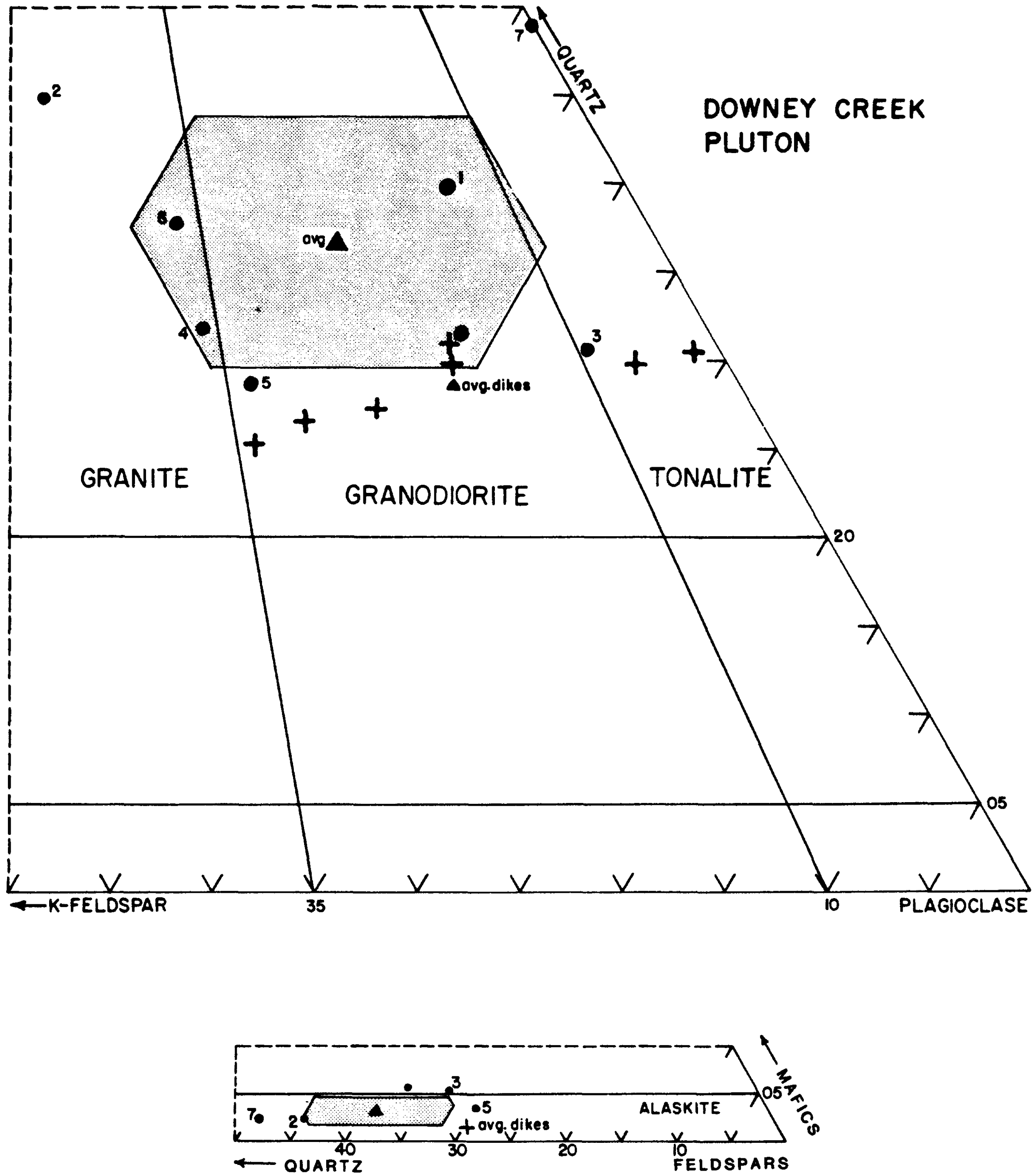


Figure 38.--Proportions of modal minerals of samples from the Downey Creek pluton, showing rock classification in upper diagram. Dike or other small body possibly related to pluton, or to Cyclone Lake pluton, marked by "+" (upper diagram.

Table 10A.--Modes (volume percent) and specific gravities of samples from the Downey Creek pluton

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Muscovite	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
80F91B	1	Agdf	2.643	8.5	49.2	38.3	2.8	2.1	1.1	.3	tr	.1	0	.3 (g)
80F93A	2	Agrf	2.643	24.0	26.7	41.2	2.6	1.2	5.5	.6	.3	.1	0	.4 (g)
80F106A	3	TOf	2.657	5.9	57.4	27.6	5.4	4.8	3.7	.2	.2	.2	.1	tr (p,ap,z)
80F137A	4	Agrf	2.627	23.8	41.7	30.3	2.3	2.1	1.9	.1	.1	tr	0	tr (p)
81F125A	5	Agdf	2.622	22.0	43.4	26.4	3.7	2.9	4.5	.3	tr	tr	0	.4 (g)
81N74A	6	Agrf	2.637	21.9	37.1	36.0	2.1	.6	2.9	tr	tr	0	0	1.5 (g)
81N89A	7	Atof	2.610	0	48.6	46.8	2.7	.1	1.9	.2	.2	.2	0	2.0 (g)
80F105A		Agdf	2.648	11.6	53.0	29.6	5.8	m	s	tr	tr	tr	tr	tr (ap,al)
Average			2.636	14.7	44.6	34.5	3.4	2.0	3.1	.2	.1	.1	tr	.7
Standard dev.			.015	9.4	9.7	7.3	1.4	1.6	1.6	.2	.1	.1	--	.8
n			8 →					7 →						

Table 10B.--Modes (volume percent) and specific gravities of samples from dikes related to the Downey Creek pluton (Headings as in table 10A)

Sample No.														
80F53A		Agdf	2.642	12.4	54.8	30.5	2.3	tr	s	tr	s	s	tr	tr (ap)
80F100A		Agd	2.615	21.8	50.2	26.4	1.6	s	0	tr	tr	tr	0	tr (g)
80F101A		Agdf	2.635	13.2	55.2	28.6	3.0	s	s	tr	s	tr	0	0
81F76A		Ato	2.640	4.5	65.0	29.7	.8	s	s	0	s	tr	0	tr (ap)
81F78A		Agd	2.592	25.0	49.2	24.8	.9	s	0	tr	s	s	0	tr (ap)
81F124A		Agd	2.619	18.2	53.1	26.8	2.0	s	tr	tr	s	tr	tr	tr (z,ap)
81N97A		Ato	2.615	1.3	66.7	30.4	1.6	tr	s	s	s	s	tr	s (g,ap)
Average			2.623	13.8	56.3	28.2	1.7							
Standard dev.			.018	8.7	6.9	2.2	.8							
n			7 →											

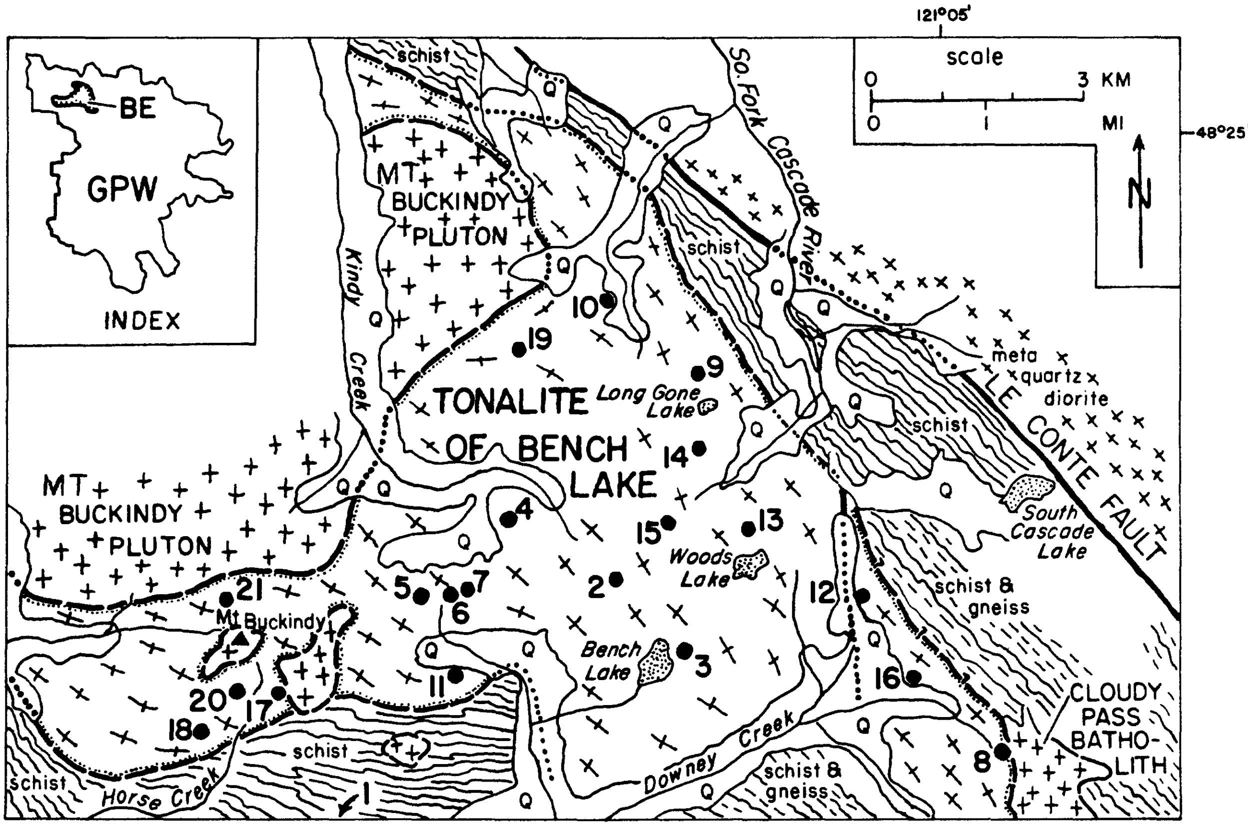
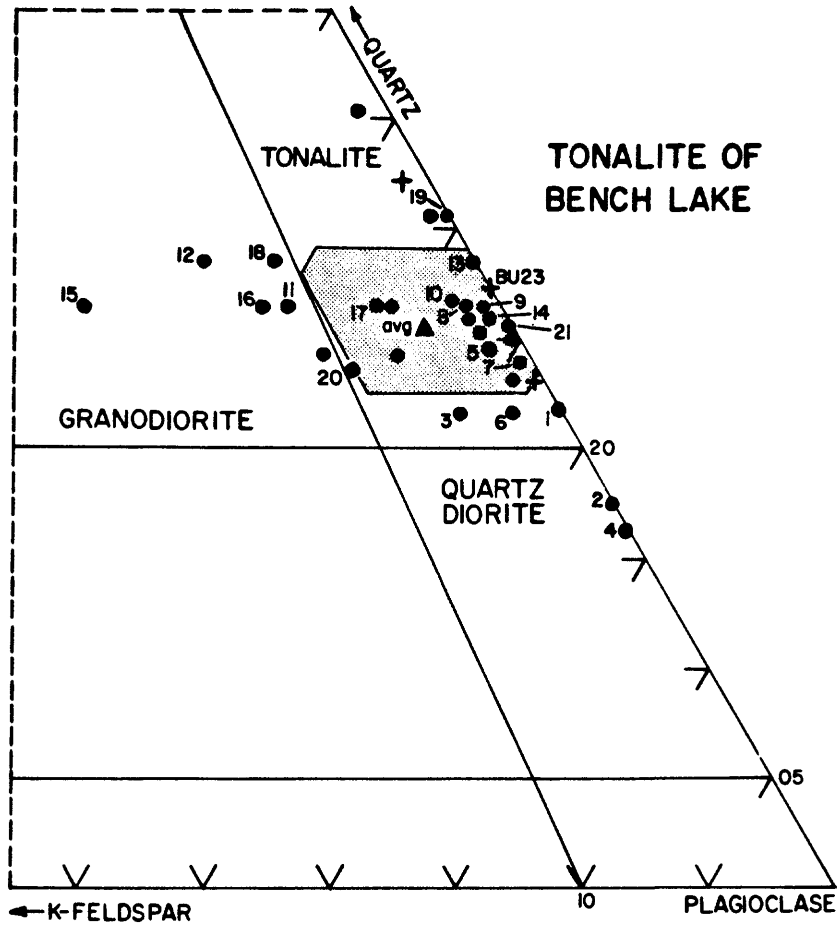


Figure 39.--Geologic sketch map of the tonalite of Bench Lake, showing approximate sample sites. Correlation of area east of Downey Creek with main unit uncertain.



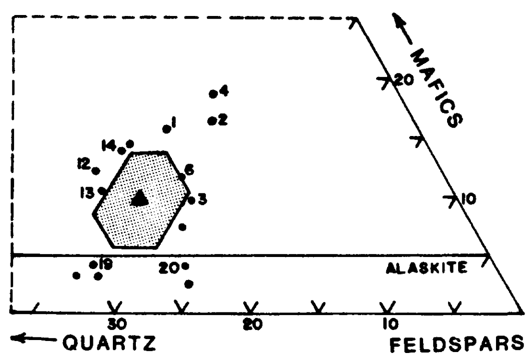


Figure 40.--Proportions of modal minerals in samples from the tonalite of Bench Lake, showing rock classification. "+," clasts possibly of unit present in breccia pipes associated with the Buckindy pluton.

Table 11.--Modes (volume percent) and specific gravities of samples from the tonalite of Bench Lake

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Pyroxene	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
80F36A	1	TOf	2.698	0	65.7	18.4	15.9	13.5	0	0	1.8	.1	.1	.4	tr (ap,z)
80F65A	2	QDf	2.763	0	69.0	14.9	16.1	9.2	5.5	0	.7	tr	.1	.7	tr (ap.z)
80F68A	3	TOf	2.693	3.7	66.8	19.6	9.9	8.5	.2	0	.8	.2	0	.2	tr(ap,z,al)
80N33D	4	QDf	2.750	0	68.0	13.3	18.7	11.0	5.4	0	1.5	tr	tr	.8	tr (ap,z)
81F26A	5	TOf	2.685	1.3	64.0	21.1	13.5	10.1	1.3	0	.8	.3	.3	.7	tr (ap)
81F27A	6	TOf	2.695	1.8	67.1	19.3	11.8	8.1	2.5	0	.4	.1	tr	.7	tr (ap)
81F171A	7	TOf	2.698	.5	66.4	21.1	12.0	9.7	0	0	.7	1.0	.1	.5	tr (ap,m)
81F184A	8	TOf	2.647	1.3	65.2	24.1	9.4	7.8	0	0	0	1.1	.5	0	tr (ap,z)
81F222A	9	TOf	2.677	.7	65.7	23.9	9.7	8.2	0	0	.4	.5	.1	.6	tr (ap,z)
81F224A	10	TOf	2.679	1.6	63.5	23.7	11.2	10.0	.1	0	.3	.2	tr	.6	tr (ap)
81L25A	11	GDf	2.665	7.6	59.4	24.4	8.7	6.9	0	0	.1	.9	.4	.4	tr (m,ap)
81L26A	12	GDf	2.673	9.3	53.3	25.3	12.1	9.3	0	1.2	.9	.3	tr	.5	tr (ap)
81L27A	13	TOf	2.690	0	63.9	25.6	10.5	9.5	0	0	.4	.2	.1	.3	s (m)
81L30C	14	TOf	2.695	.8	62.7	22.5	14.0	12.8	0	tr	.3	.1	.1	.7	s (m)
81L51A	15	GDf	2.652	15.4	52.9	24.5	7.2	4.4	0	0	.6	1.9	.3	0	tr(ap,al,m)
81N72A	16	GDf	2.658	8.8	57.5	23.5	10.3	8.7	0	0	.5	.7	.2	.2	s(m,ap,al,z)
81N90C	17	TOf	2.675	4.4	60.3	23.4	11.9	10.5	0	0	.1	.9	.2	.2	.1 (al)
81N95A	18	GDf	2.640	7.4	59.4	26.7	6.5	5.6	0	0	.3	.3	tr	.3	s (m,al,ap)
82F320A	19	TOf	2.657	0	66.1	29.4	4.4	4.1	0	0	.1	.1	.1	.1	s (m,al,ap)
82S81A	20	TOf	2.650	7.1	66.2	22.7	4.1	1.6	0	0	.1	1.8	.4	.1	.3 (sec,al)
82S89A	21	TOf	2.702	.1	67.4	23.3	9.2	7.6	.7	0	tr	.2	.4	.2	.2 (sec,al)
81L28A		TO	2.678	1.3	69.7	21.3	7.7	m	0	0	s	s	tr	s	tr (ap,m)
8131A		TOf	2.680	1.5	66.8	24.0	7.7	m	0	0	s	tr	tr	s	tr (ap,z)
81N75A		TOf	2.665	1.3	58.0	32.1	8.6	m	0	0	s	tr	tr	s	s (m)
81N76A		TOf	2.685	1.5	67.4	23.5	7.6	m	0	0	s	tr	tr	s	s (m)
81N80A		Atof	2.663	.9	66.4	29.8	2.9	s	0	0	s	tr	tr	tr	s (m)
81N106A		TOf	2.704	.1	63.6	21.9	14.4	m	0	0	s	tr	tr	s	tr (ap)
82S79B		TO	2.609	5.0	68.9	23.6	2.5	s	0	0	tr	s	s	tr	tr (m)
82S79C		GDf	2.660	7.4	61.2	21.8	9.5	m	s	0	s	s	tr	s	tr (ap)
82S84A		TOf	2.658	4.6	62.3	23.9	9.2	m	tr	0	s	s	tr	s	tr (al)
82S85D		TO	nd	1.0	64.7	31.1	3.2	s	0	0	tr	s	tr	tr	tr (al,ap)
Average			2.678	3.1	63.9	23.4	9.7	8.4	.8	tr	.5	.5	.2	.4	tr
Standard dev.			.030	3.7	4.3	4.0	4.0	2.8	1.7	--	.5	.6	.2	.3	--
n			30 →	31 →	→	→	→	21 →	→	→	→	→	→	→	→

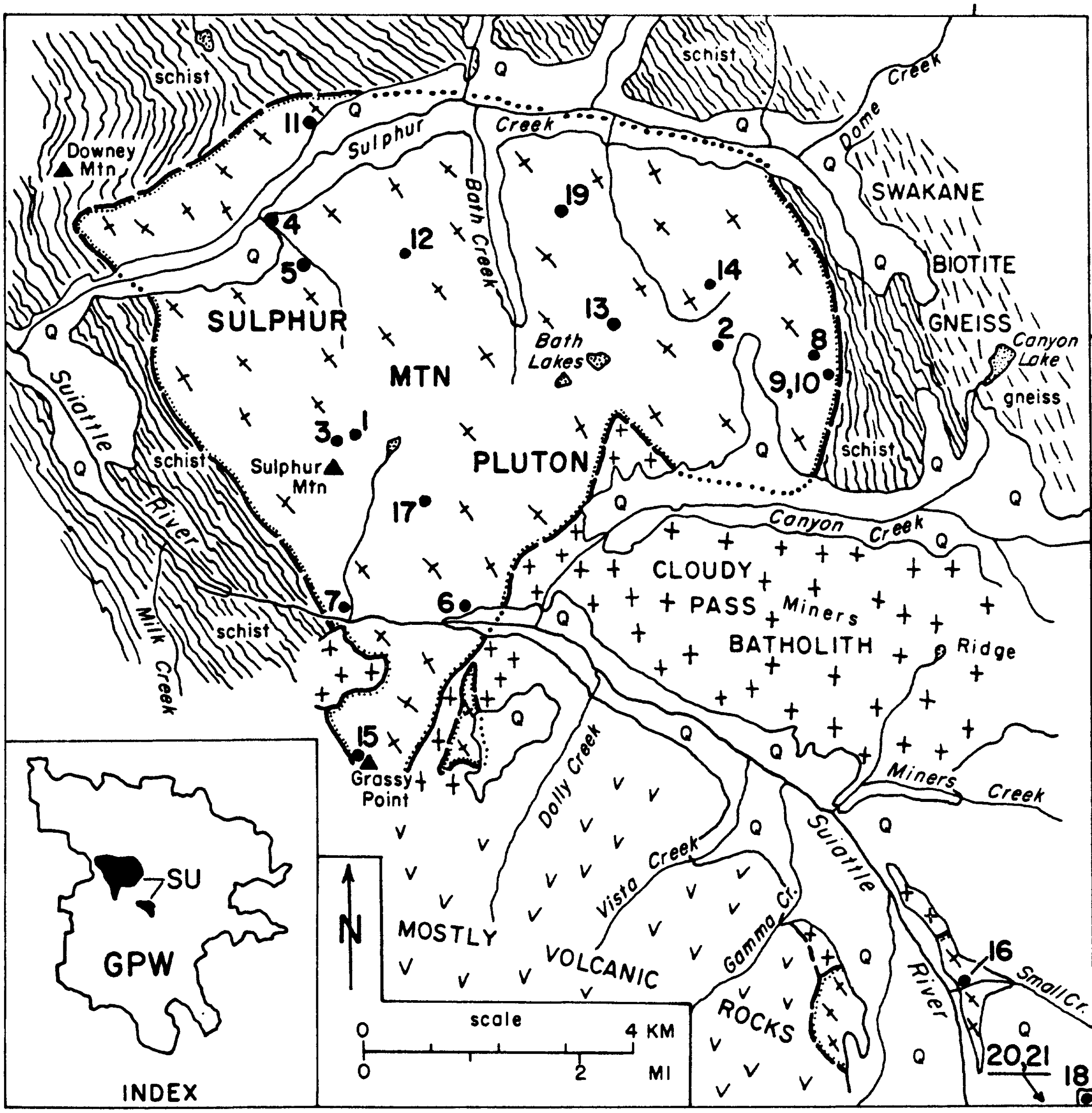
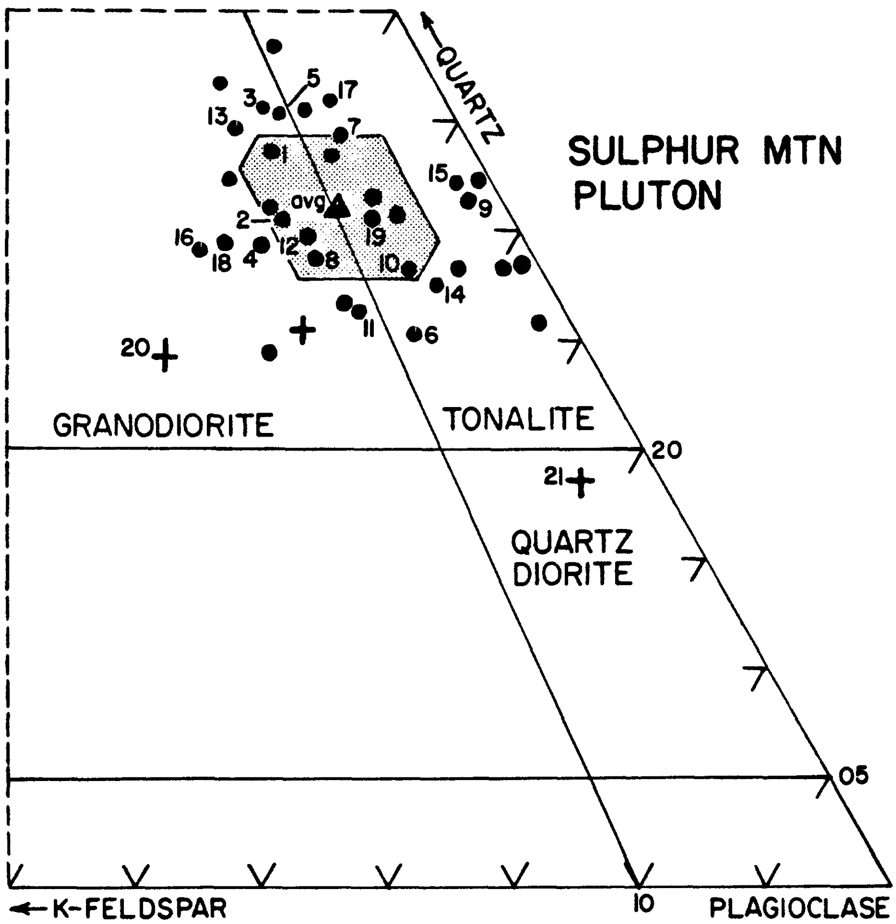


Figure 41.--Geologic sketch map of the Sulphur Mountain pluton, except for small areas in Holden quadrangle to southeast (Cater and Crowder, 1967), showing approximate sample sites.



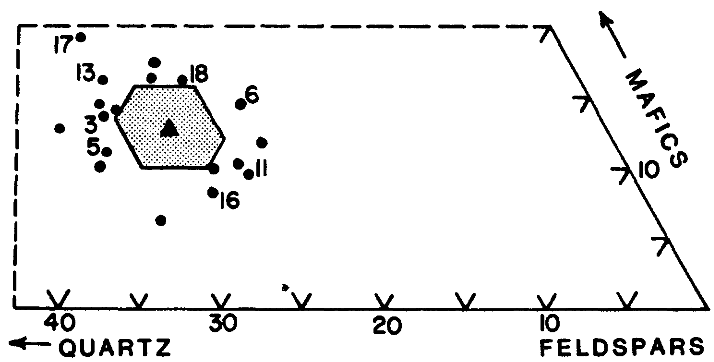


Figure 42.--Proportions of modal minerals of samples from the Sulphur Mountain pluton, showing rock classification in upper diagram. Samples from small separate areas in Holden quadrangle to southeast of main mass are marked by "+" in upper diagram.

Table 12.--Modes (volume percent) and specific gravities of samples from the Sulphur Mountain pluton. Samples 80F112A, 81N150A, 82F211A, and 82F212A are atypical and not included in averages

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Pyroxene	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
80H133A	1	GD	2.678	7.0	50.5	29.4	13.1	7.8	.2	.3	3.0	.8	0	.9	tr (m)
80H146A	2	GDf	2.694	8.0	52.8	27.1	12.2	9.2	1.6	0	.8	.1	.1	.3	.1 (ap,m,z)
80R117A1	3	GD	2.700	6.5	49.3	30.5	13.7	9.0	0	1.4	2.3	.1	.1	.7	.1 (ap,m)
80R124A	4	GDf	2.698	8.9	51.1	25.0	15.0	11.4	0	.9	.7	.9	0	.9	.1 (al)
80R125A	5	GDf	2.680	6.0	51.1	31.7	11.2	7.0	.7	0	.3	2.1	.1	1.0	.1 (m)
80R129A	6	TOf	2.710	5.3	58.4	21.7	14.6	6.8	7.1	0	0	.1	.1	.4	0
80R131A	7	TOf	2.745	4.3	52.2	29.4	14.1	9.8	1.4	.2	1.4	.3	0	.9	tr (al)
81F2A	8	GDf	2.678	7.4	54.5	24.8	13.3	9.8	1.6	tr	.3	.2	tr	1.3	tr (al)
81F4A	9	TOf	2.680	1.3	60.1	28.2	10.5	7.7	tr	1.0	1.2	tr	.1	.4	.1 (al)
81F4B	10	TOf	2.690	4.4	57.1	24.1	14.4	11.5	1.8	tr	.3	.3	tr	.6	0
81F74A	11	GDf	2.670	7.5	59.1	23.6	9.7	6.2	.8	tr	.5	.8	.3	.5	.6 (sec,al)
81F143A	12	GDf	2.685	7.3	54.2	26.2	12.3	1.7	.9	1.1	1.4	6.6	tr	.6	.1 (al)
81F144A	13	GDf	2.718	7.5	47.2	29.3	16.1	10.1	4.5	0	.3	.2	0	1.0	0
81F145A	14	TOf	2.688	3.7	60.2	24.7	11.3	9.4	.2	0	.2	.4	.4	.4	.3 (al,p)
81F163A	15	TOf	2.685	1.3	58.7	28.4	11.6	6.7	.1	0	.8	3.3	0	.7	tr (al)
81F164A	16	GDf	2.658	12.1	53.0	26.7	8.2	5.9	.7	0	.1	.8	0	.7	0
81F165A	17	TOf	2.761	3.7	48.0	29.1	19.2	9.6	4.8	.7	3.4	.1	0	.7	tr (p,al,m)
81F270A	18	GDf	2.670	10.0	49.2	24.6	16.2	9.2	1.6	1.1	.8	2.1	0	1.3	.1 (al,p)
81N83A	19	TOf	2.698	5.0	56.1	26.7	12.2	7.4	1.7	2.2	.5	.1	0	.3	tr (ap)
82F211A	20	GDf	2.665	15.2	53.7	22.3	8.9	m	0	0	tr	s	0	tr	0
82F212A	21	QDf	2.693	2.5	63.4	14.9	19.2	m	0	s	s	0	tr	s	tr (ap,al)
80F112A		TO	2.705	1.0	65.5	23.2	10.3	m	tr	tr	s	s	tr	s	s (p,ap)
80H136A		TOf	2.712	4.2	53.2	26.2	16.4	m >	m	tr	s	0	tr	s	tr (al,ap)
80H138A		TOf	2.713	3.1	59.8	24.5	12.6	m >	m	0	s	s	tr	s	tr (al,ap)
80H153A		GDf	2.696	7.8	58.0	23.9	10.3	m	s	tr	s	0	0	s	tr (ap)
80R117A2		TO	2.680	4.8	48.8	33.5	12.9	m	s	tr	s	tr	tr	s	s (m)
80R118A		TO	2.710	5.4	49.7	30.3	14.5	m	s	s	s	tr	0	s	tr (m)
80R120A		GD	2.706	8.2	52.2	27.1	12.5	m	tr	s	s	tr	tr	s	tr (al)
80R126A		GD	2.658	10.4	56.0	21.7	12.0	m	0	0	s	s	0	tr	tr (al)
80R130A		TO	2.700	4.0	53.0	25.5	17.5	m	s	tr	s	tr	0	s	tr(p,al,ap)
81F1A		TOf	2.655	1.7	62.6	25.2	10.6	m	0	0	s	tr	tr	s	s (al)
81F142A		GDf	2.679	10.6	48.9	28.3	12.1	m	s	tr	s	s	0	s	s (p,al)
81F146A		TOf	2.659	.5	63.3	30.9	5.3	s	0	0	s	s	tr	s	0
81F166A		GD	2.688	7.6	48.7	32.5	11.1	s	0	0	m	m	s	s	0
81F173A		TO	2.722	5.3	53.4	29.0	12.3	m	tr	0	s	tr	0	s	tr (ap)
81N43A		TOf	2.690	.4	63.8	25.5	10.3	m	s	0	s	tr	tr	s	0
81N150A		GDf	2.698	9.2	54.8	22.0	14.1	11.6	0	1.9	.2	0	0	.4	tr (z)
Average			2.693	5.8	54.4	27.1	12.7	8.2	1.6	.5	1.0	1.0	tr	.7	.1
Standard dev.			.024	3.0	4.8	3.0	2.7	2.3	1.9	.6	1.0	1.6	--	.3	.2
n			33 →					19 →							

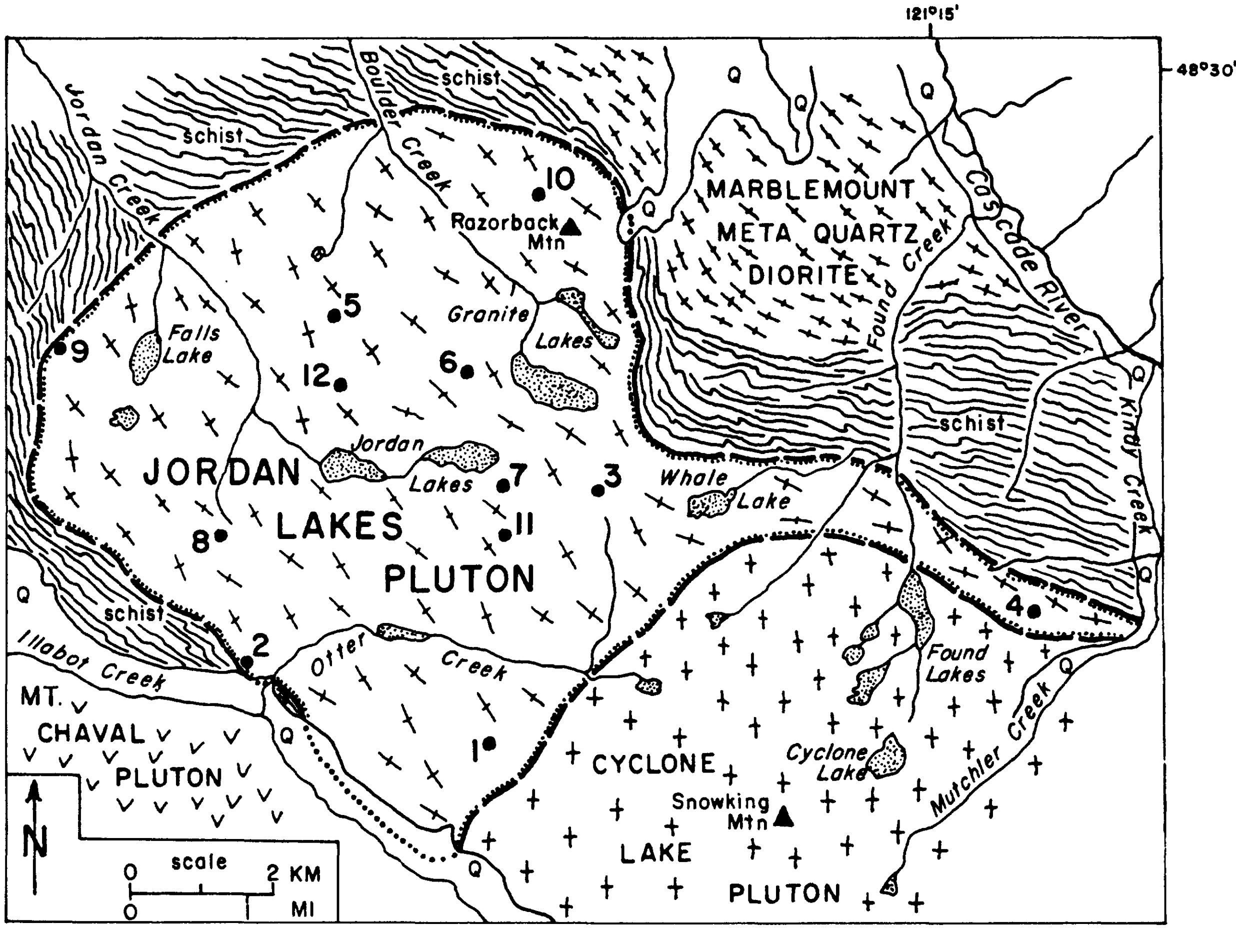
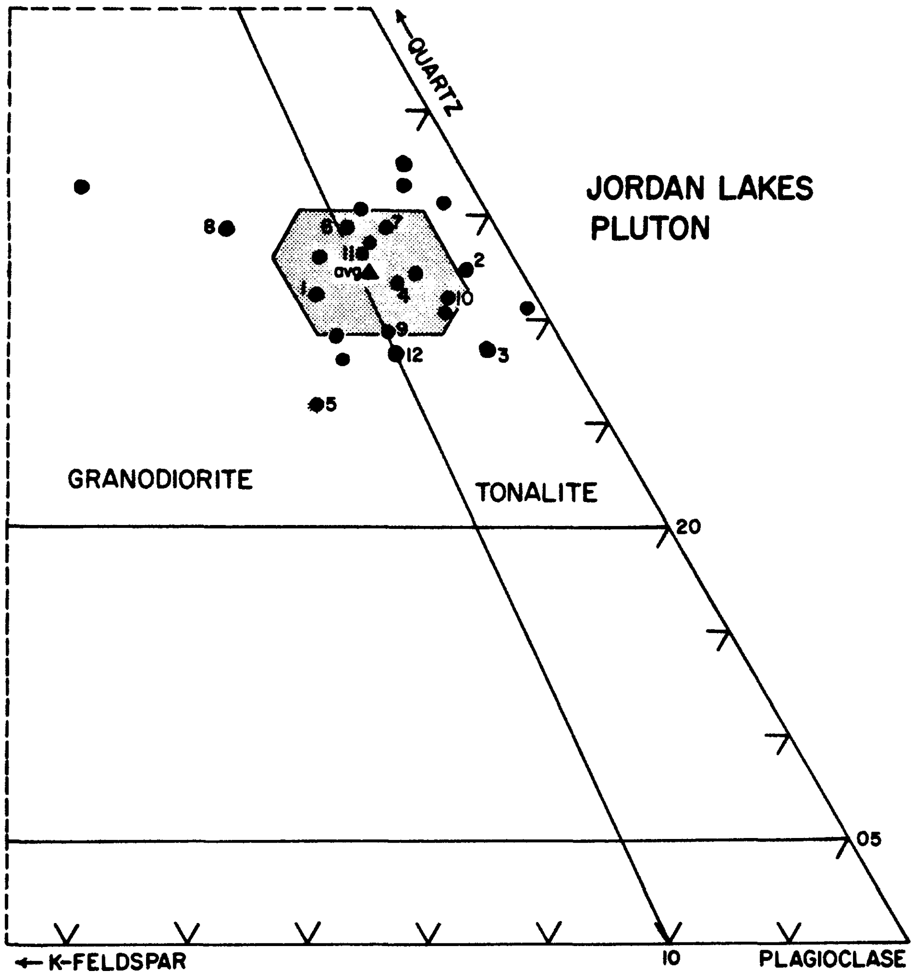


Figure 43.--Geologic sketch map of the Jordan Lakes pluton, showing approximate sample sites. In part, from mapping of Bryant (1955).



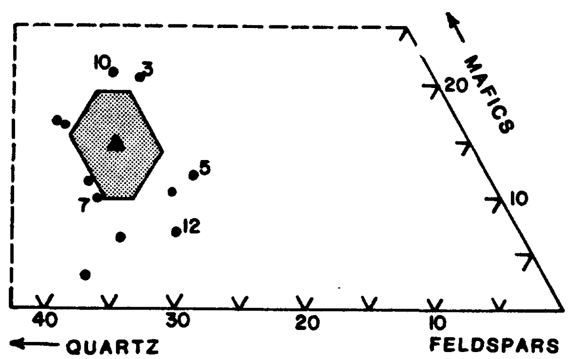


Figure 44.--Proportions of modal minerals of samples from the Jordan Lakes pluton, showing rock classification in upper diagram.

Table 13.--Modes (volume percent) and specific gravities of samples from the Jordan Lakes pluton

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Pyroxene	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
80L4A	1	GD	2.675	7.8	51.1	26.5	14.6	2.3	2.9	0	4.9	2.6	.3	.5	1.1 (m)
80S26E	2	TO	2.710	1.8	53.9	26.8	17.5	13.7	2.0	0	1.6	.1	0	tr	tr (m)
81F24A	3	TO	2.690	2.7	54.2	22.7	20.3	1.3	7.5	0	2.1	9.1	0	.3	tr (m)
81F30A	4	TOf	2.705	4.5	54.2	27.5	13.7	12.1	.4	tr	.9	0	0	.3	tr (m)
81F36A	5	GD	2.688	10.4	54.8	22.8	11.9	6.4	.5	tr	3.6	1.1	0	.2	tr (m,z)
81F110A	6	TOf	2.715	5.3	49.4	28.7	16.6	13.8	.6	0	1.9	tr	0	.3	tr (m,al)
81F111A	7	TOf	2.698	4.3	54.9	30.9	9.9	8.3	tr	0	1.2	tr	0	.3	tr (m,al)
81N1A	8	GD	2.698	9.4	45.9	29.0	15.7	11.7	1.8	0	1.6	.2	0	.4	.1 (ap,z)
81N3A	9	TO	2.688	5.8	52.2	24.2	17.8	10.4	4.9	0	1.7	.7	0	.1	tr (m)
81N15A	10	TO	2.729	3.1	51.5	24.5	20.9	14.4	3.3	0	2.5	tr	0	.6	.1 (al,m, ap,z)
82F152A	11	TO	2.686	5.5	54.6	29.7	10.2	9.3	.1	0	.5	0	0	.4	tr (m,z)
82F153A	12	GD	2.692	6.6	60.1	26.5	6.8	5.9	0	0	.7	0	0	.2	tr (m,z)
80N18A		TO	2.664	4.5	53.0	31.2	11.3	m	0	0	s	s	tr	tr	s (m)
81F20B		TOf	nd	.4	57.0	25.4	17.2	14.0	1.3	0	1.3	0	.5	.1	tr (m)
81F23B		TOf	2.708	1.3	54.5	30.9	13.3	m	0	0	s	tr	tr	s	s (m)
81F25A		GD	2.673	7.3	49.6	23.4	19.6	m ≈	m	0	s	tr	tr	s	s (p,m)
81F33A		TO	2.667	4.7	50.6	27.9	16.8	m	tr	0	s	tr	tr	s	s (m,al,ap)
81F34A		GD	2.640	15.8	45.8	35.3	3.0	0	0	0	s	s	s	tr	m (m)
81F35A		GDf	2.680	7.5	55.8	31.2	5.4	s	0	0	s	tr	tr	s	s (m)
81F109A		TO	2.730	2.1	50.1	30.9	16.9	m >	m	0	s	0	tr	s	s (m)
81L17A		TO	2.700	3.7	51.4	26.0	18.9	m >	m	0	s	s	tr	s	s (m,p,ap)
81N13A		GD	2.678	8.7	55.9	25.1	10.3	m	0	0	s	tr	tr	s	s (m)
81N14A		TO	2.718	3.4	55.0	25.3	16.3	m	s	0	s	0	tr	s	s (m)
81N66A		TO	2.720	2.2	50.9	30.5	16.4	m	s	0	s	tr	s	s	tr (m)
Average			2.694	5.4	52.8	27.6	14.2	9.5	2.0	tr	1.9	1.1	tr	.3	tr
Standard dev.			.022	3.5	3.3	3.2	4.8	4.4	2.2	--	1.2	2.5	--	.2	--
n			23 →	24 →				13 →							

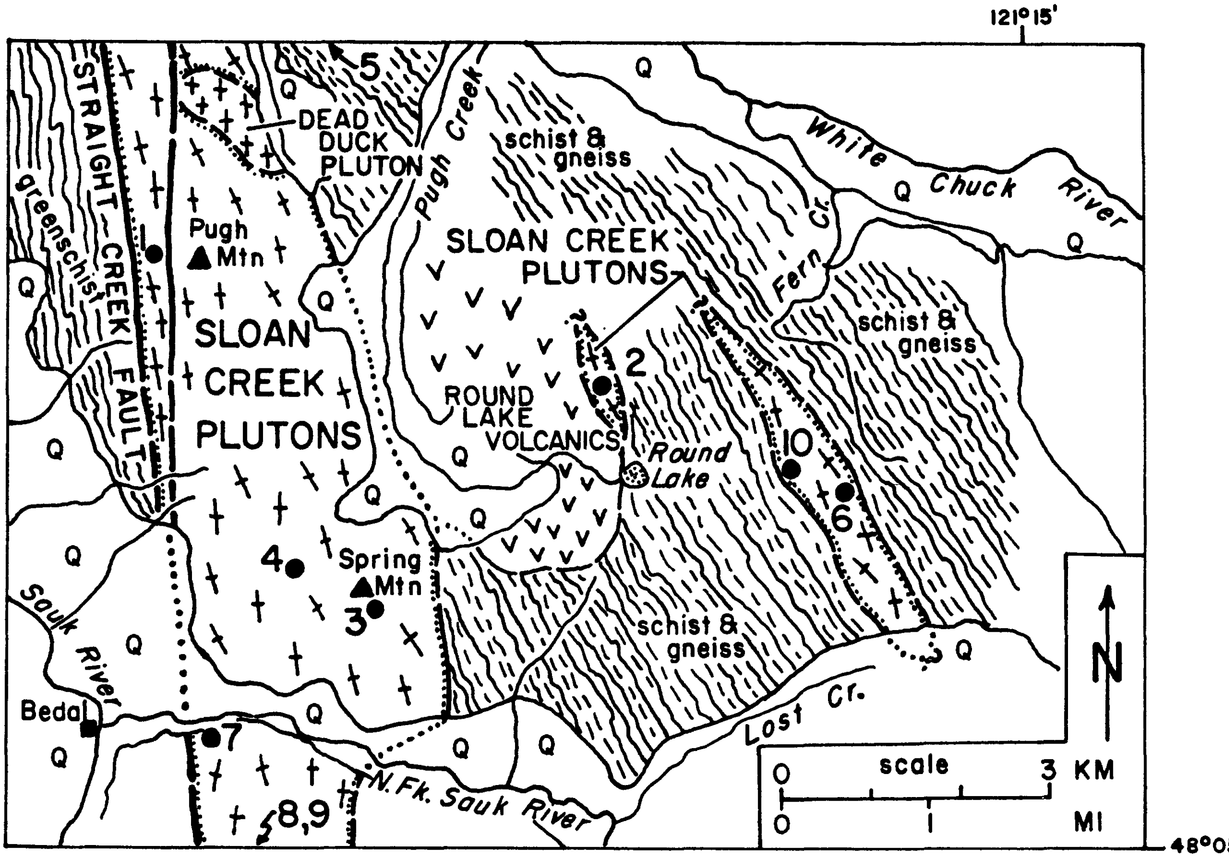


Figure 45.--Geologic sketch map of part of the Sloan Creek plutons, showing approximate sample sites. In part, from mapping of Vance (1957). Country rock schist and gneiss probably contains additional members of unit.

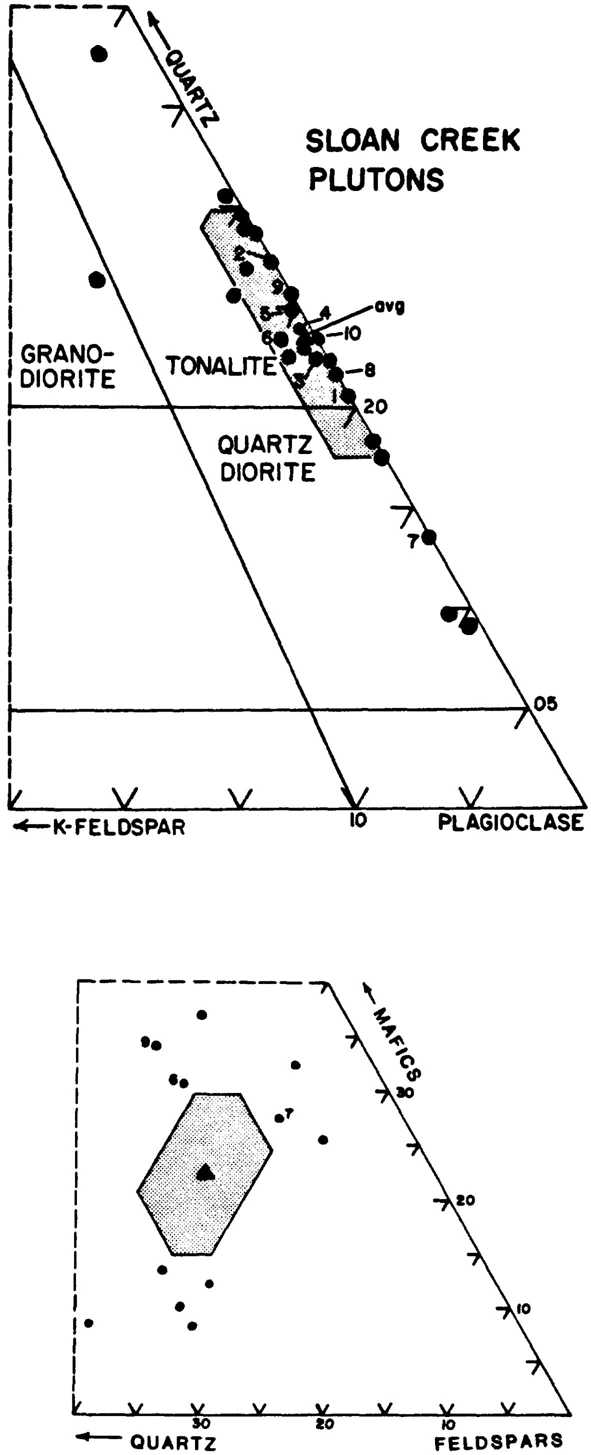


Figure 46.--Proportions of modal minerals of the Sloan Creek plutons of the study area, showing rock classification in upper diagram.

Table 14.--Modes (volume percent) and specific gravities of samples from the Sloan Creek plutons

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite		Hornblende	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others	
80F104E	1	TOf	2.753	tr	62.1	15.9	22.0	tr		12.0	.9	8.2	.5	.2	.2	(sec)
80R122A	2	TO	2.706	tr	60.9	23.0	16.1	9.5		4.6	.4	1.0	.3	.2	tr	(ap)
80R136A	3	TOf	2.737	.2	58.0	17.2	24.6	7.9		10.9	tr	3.8	.3	.3	1.4	(sec,p,m)
80R138A	4	TOf	2.721	.2	56.7	17.7	25.4	10.5		12.2	tr	1.4	.4	.1	.7	(sec,p,ap,m)
80S5A	5	TOf	2.732	.2	59.4	19.8	20.7	10.1		7.9	tr	1.4	.5	.2	.5	(p,ap)
81F312A	6	TO	2.805	1.3	51.9	16.0	30.8	13.0		11.2	tr	4.9	1.4	tr	.3	(sec,ap)
81S48A	7	QD	2.760	tr	62.6	10.0	27.3	2.7		21.7	tr	1.7	1.2	0	tr	(ap)
82F160A	8	TOf	2.762	0	57.6	15.9	26.5	12.7		12.9	tr	.3	.1	tr	.4	(p)
82F162A	9	TOf	2.760	0	49.0	16.8	34.1	13.0		19.5	0	tr	.5	tr	1.1	(p)
82F272A	10	TOf	2.758	0	57.9	17.6	24.6	16.3		8.0	tr	.1	.2	tr	tr	(ap)
80F104A		TOf	2.723	.1	63.1	26.7	10.1	tr		s	s	m	s	s	tr	(ap,m)
80H140A		QD	2.762	0	57.7	12.6	29.7	m	<	m	0	0	s	0	tr	(ap)
80H140B		TO	2.769	1.0	54.6	20.5	23.9	m	<	m	tr	s	s	0	tr	(ap)
80H141A		TO	2.750	.1	58.4	23.9	17.6	m	≈	m	s	m	s	0	tr	(ap)
80H143A		GD	2.720	7.4	57.3	23.0	12.2	0		s	s	m	s	tr	tr	(ap)
80R121A		TO	2.700	tr	65.0	26.6	8.4	s		0	s	m	s	tr	s	(m)
80R135A		TOf	2.675	.6	59.6	26.0	13.8	tr		m	s	m	s	tr	s	(p)
80R137A		TOf	2.685	2.1	55.0	19.5	23.5	0		m	tr	m	s	tr	s	(p)
81F313A		TO	2.698	2.1	54.8	34.5	8.7	s		0	tr	m	s	0	s	(p,m)
81F318A		QD	2.780	.8	66.2	7.3	25.7	m		0	tr	m	s	tr	tr	(ap)
81S49A		TO	2.720	.4	57.9	17.9	23.8	s		m	tr	s	tr	tr	s	(p,sec)
81S50A		QD	2.812	.2	60.9	6.3	32.5	0		m	s	s	s	tr	s	(sec)
81S53A		GD	2.855	0	51.3	11.7	37.0	0		m	s	m	s	s	s	(sec)
81S55A		TO	nd	1.2	61.6	19.1	18.1	m	≈	m	s	s	s	tr	s	(sec,p)
82F270A		TOf	2.739	0	57.1	16.6	26.3	m	≈	m	tr	tr	s	tr	s	(ap)
Average			2.745	.7	58.3	18.5	22.5	9.6		12.1	tr	2.3	.5	.1	.5	
Standard dev.			.042	1.5	4.1	6.4	7.8	5.0		5.2	--	2.6	.4	.1	.5	
n			24→	25 →				10 →								

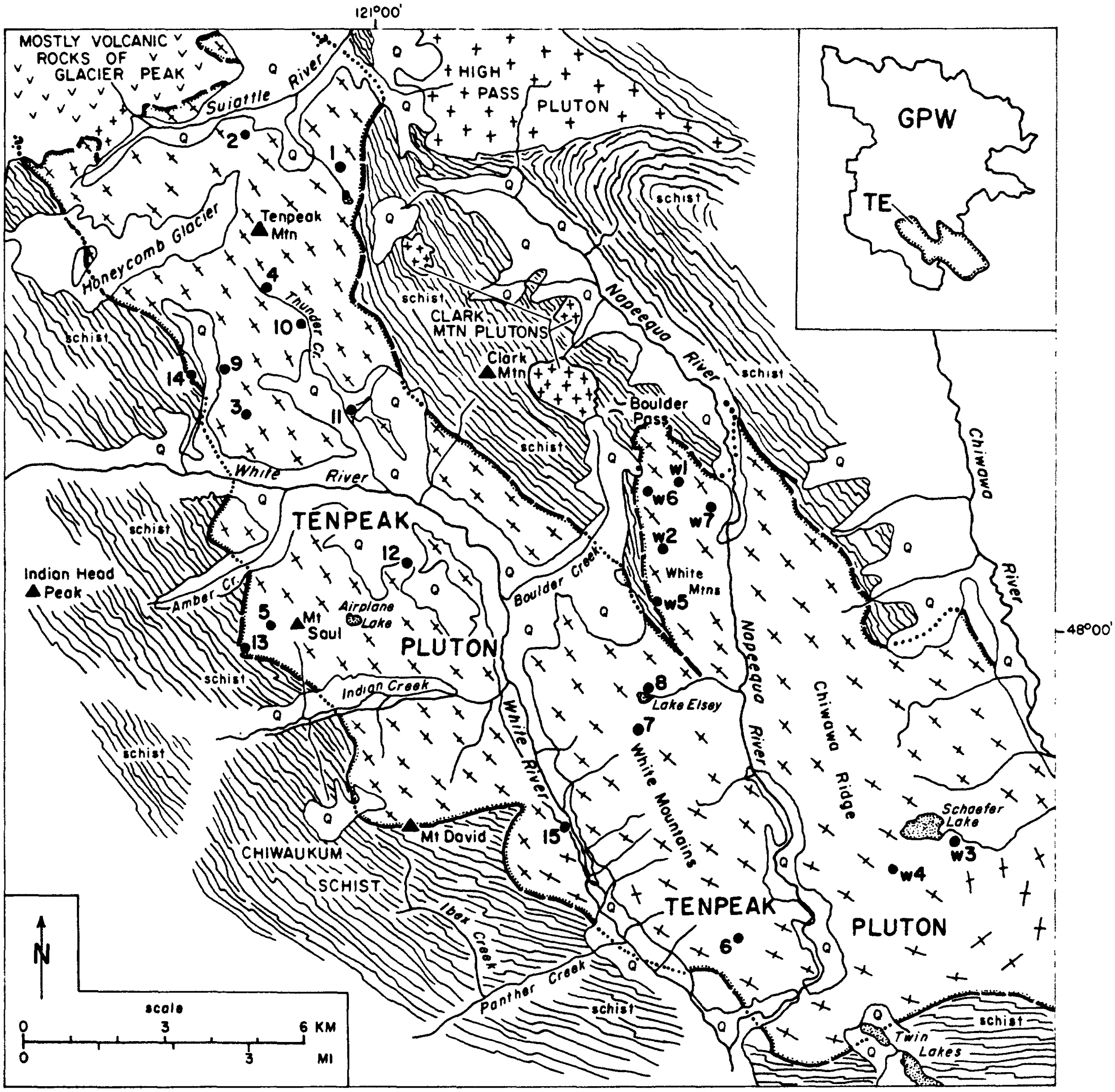


Figure 47.--Geologic sketch map of the major part of the Tenpeak pluton, showing approximate sample sites. From numerous sources, as shown by Ford (1983a).

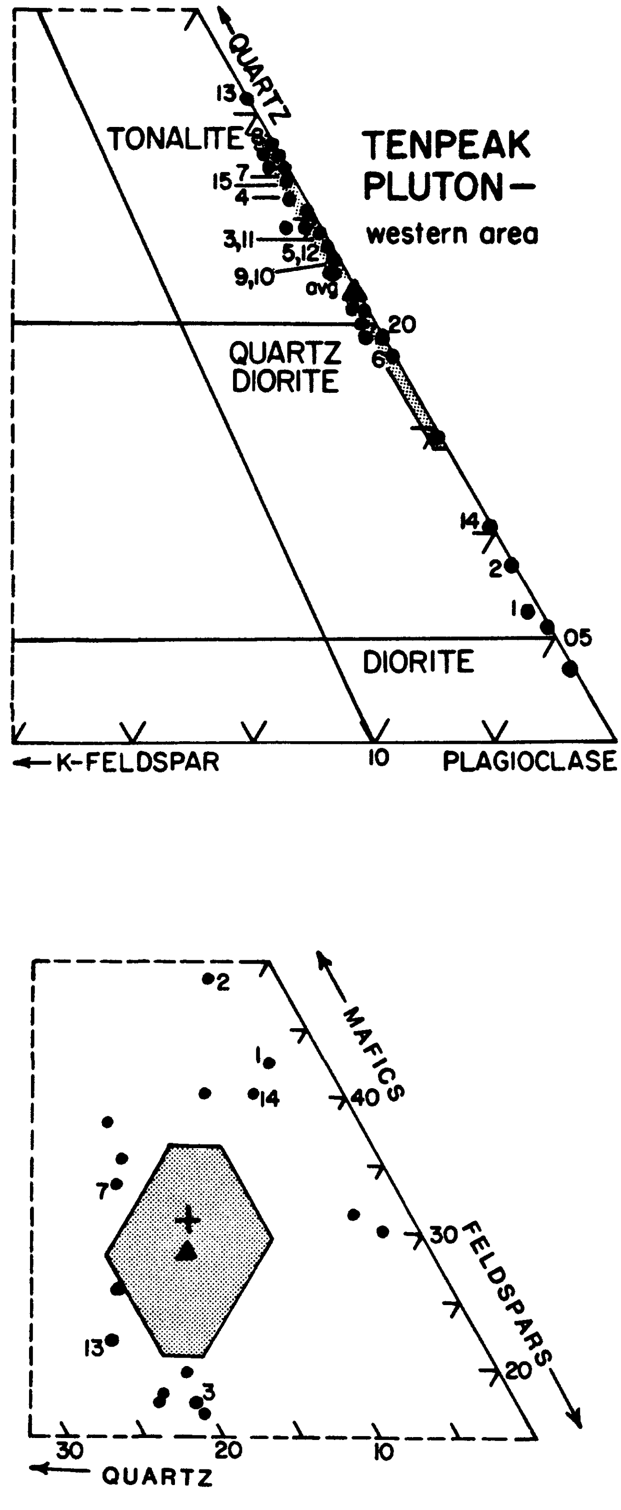
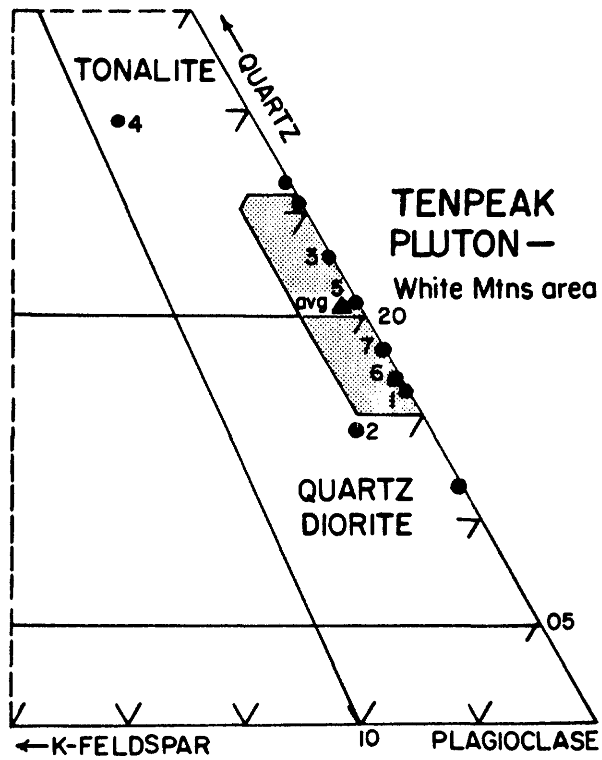


Figure 48.--Proportions of modal minerals of the area of the Tenpeak pluton west of southern part of Napeequa River, showing rock classification in upper diagram. Average for area east of southern part of Napeequa River and in the northern White Mountains, marked by "+" in lower diagram, is about same as in upper diagram (see fig. 49).

Table 15A.--Modes (volume percent) and specific gravities of samples from the Tenpeak pluton: western area

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite		Hornblende	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
81F300A	1	QDf	2.902	.2	53.8	3.6	42.4	3.6		33.1	3.9	.6	1.0	0	.1 (m)
81F302A	2	QDf	2.903	0	46.9	4.4	48.8	5.0		40.9	.5	1.1	1.2	.1	tr (ap)
81F332A	3	TOF	2.760	0	62.1	20.4	17.6	7.4		5.1	3.5	1.1	.1	.3	tr (ap,al,m)
81F334A	4	TOf	2.798	.5	54.8	19.4	25.3	6.9		13.6	3.0	.9	.9	tr	.1 (al,ap)
81F340A	5	TOf	2.803	0	58.1	17.8	24.1	9.4		10.4	3.0	.6	.4	.2	.1 (g,ap)
82F13A	6	QDf	2.874	0	56.4	12.7	30.9	0		11.3	10.3	3.5	1.0	.2	4.6 (m)
82F14A	7	TO	2.832	0	47.7	17.8	34.5	8.5		17.0	5.1	3.1	.3	.7	tr (ap,m)
82F15A	8	TOf	2.820	0	51.8	20.7	27.6	4.4		10.9	7.0	4.6	.4	.3	tr (ap,m)
82F109A	9	TOf	2.783	0	50.9	15.4	33.7	20.4		3.3	8.2	1.1	.3	.2	tr (al,ap,m)
82F110A	10	TOf	2.818	0	53.8	16.2	30.0	10.3		14.0	3.4	.2	.7	.2	1.2 (g,ap,al,m)
82F111A	11	TOf	2.780	0	58.3	18.4	23.4	9.8		7.8	4.0	.3	.5	.4	.6 (g,ap,m)
82F115A	12	TOf	2.798	0	57.6	17.8	24.7	8.3		12.4	3.2	tr	.8	tr	tr (ap)
82F139A	13	TOf	2.775	0	54.1	23.8	22.1	10.2		7.8	2.6	.7	.1	.5	.1 (g,ap,m)
82G61A	14	QDf	2.838	0	53.9	6.1	40.1	11.6		27.1	.2	.1	.4	.7	tr (ap)
82G89A	15	TOf	2.782	.1	52.2	19.3	28.3	18.5		4.4	4.6	.1	.1	.6	tr (ap)
81F333A		QDf	2.830	0	57.7	13.8	28.4	m	<	m	s	s	s	tr	s (m,ap)
81F335A		TOf	2.806	.1	57.6	17.4	24.9	m	<	m	m	s	s	tr	tr (ap,m)
82F112A		TOf	2.828	0	57.1	14.9	28.0	m	≈	m	m	s	s	s	s (m,ap)
82F113A		DI	2.823	0	67.2	2.5	30.2	m	<	m	s	s	tr	s	s (m,ap)
82F114A		TOf	2.770	0	59.5	15.3	25.2	m	≈	m	s	tr	tr	s	tr (m,ap)
82F116A		TOf	2.741	0	57.7	19.6	22.6	m	≈	m	m	tr	s	s	tr (ap)
82F134A		TOf	2.753	0	57.7	19.6	22.7	m	>	m	m	tr	tr	s	tr (ap)
82F140A		TOf	2.718	0	59.3	22.6	18.1	m	>	m	s	tr	tr	s	tr (ap,z)
82G8A		TOf	2.750	.2	59.9	20.0	19.9	s		m	m	s	tr	s	m (m)
82G10A		QD	nd	0	64.9	3.6	31.5	s		m	s	s	tr	s	m (m)
82G11A		TOf	2.789	0	45.8	6.1	38.1	m	≈	m	m	s	tr	s	tr (m,ap)
82G18A		TOf	2.717	0	52.7	21.3	26.0	m	≈	m	m	tr	tr	s	tr (m,ap)
82G63A		QDf	2.811	.2	52.6	12.9	34.3	m	≈	m	m	s	tr	s	tr (m,ap)
82G64A		TO	2.746	0	56.1	17.7	26.3	m	>	m	m	s	s	s	s (m,ap)
82G64A1		TO	2.705	1.4	61.3	20.3	16.9	--		--	--	--	--	--	--
82G65A		TO	2.755	0	59.5	22.8	17.7	m	<	m	s	s	s	tr	tr (m,ap)
82S39A		QDf	2.828	0	50.9	8.8	40.3	m	<	m	m	s	tr	s	s (m,ap)
82S76A		TO	2.768	.1	47.9	16.4	35.5	--		--	--	--	--	--	--
Average			2.794	tr	55.7	15.7	28.5	9.0		14.6	4.2	1.2	.5	.3	tr
Standard dev.			.048	--	5.0	5.9	7.7	5.3		10.9	2.7	1.4	.4	.2	--
n			32	33 →				15 →							



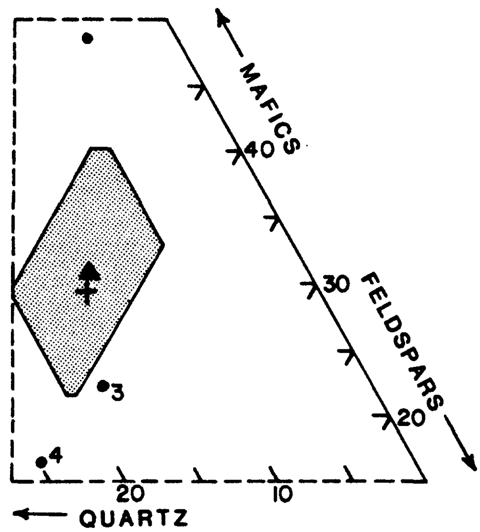


Figure 49.--Proportions of modal minerals of the area of the Tenpeak pluton east of the southern part of Napeequa River and in the northern White Mountains (White Mountains pluton of Cater and Crowder, 1967), showing rock classification in upper diagram. Average for area to west, marked by "+" in lower diagram, is about same as in upper diagram (see fig. 48).

Table 15B.--Modes (volume percent) and specific gravities of samples from the Tenpeak pluton: eastern area

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
81F338A	1	QDf	2.789	0	54.7	10.6	34.7	15.9	7.9	9.3	.1	.3	.9	.2 (ap)
81F339A	2	QD	2.834	2.0	50.8	9.0	38.2	11.8	17.5	6.4	1.8	.7	0	tr (m)
82F1A	3	TOf	2.778	0	59.8	17.9	22.3	9.5	8.0	1.4	1.8	.9	.7	tr (m,ap)
82F3A	4	TO	2.733	4.8	54.1	24.8	16.3	9.4	3.5	2.6	0	.1	.3	.4 (m)
82F16A	5	TOf	2.820	0	53.9	14.0	32.2	15.3	9.3	6.4	tr	.4	.7	.1 (ap,m)
82F210A	6	QDf	2.813	0	55.1	10.6	34.3	12.8	15.2	5.1	.4	tr	.8	tr (ap,m,z)
82G12A	7	QDf	2.767	0	52.1	11.6	36.3	19.7	8.0	7.6	0	.1	.8	.2 (ap)
82F4A		TOf	2.755	0	57.0	19.8	23.2	m	0	m	s	tr	s	s (m)
82G6A		TOf	2.766	.1	56.5	20.4	23.0	m >	m	s	tr	tr	s	tr (m,ap)
82G13A		QD	nd	0	45.4	5.9	48.7	0	0	m	m	tr	s	tr (m,ap)
Average			2.784	.7	53.9	14.5	30.9	13.5	9.9	5.5	.6	.4	.6	tr
Standard dev.			.033	1.6	3.9	6.0	9.6	3.7	4.8	2.8	.8	.3	.3	--
n			9	10 →				7 →						

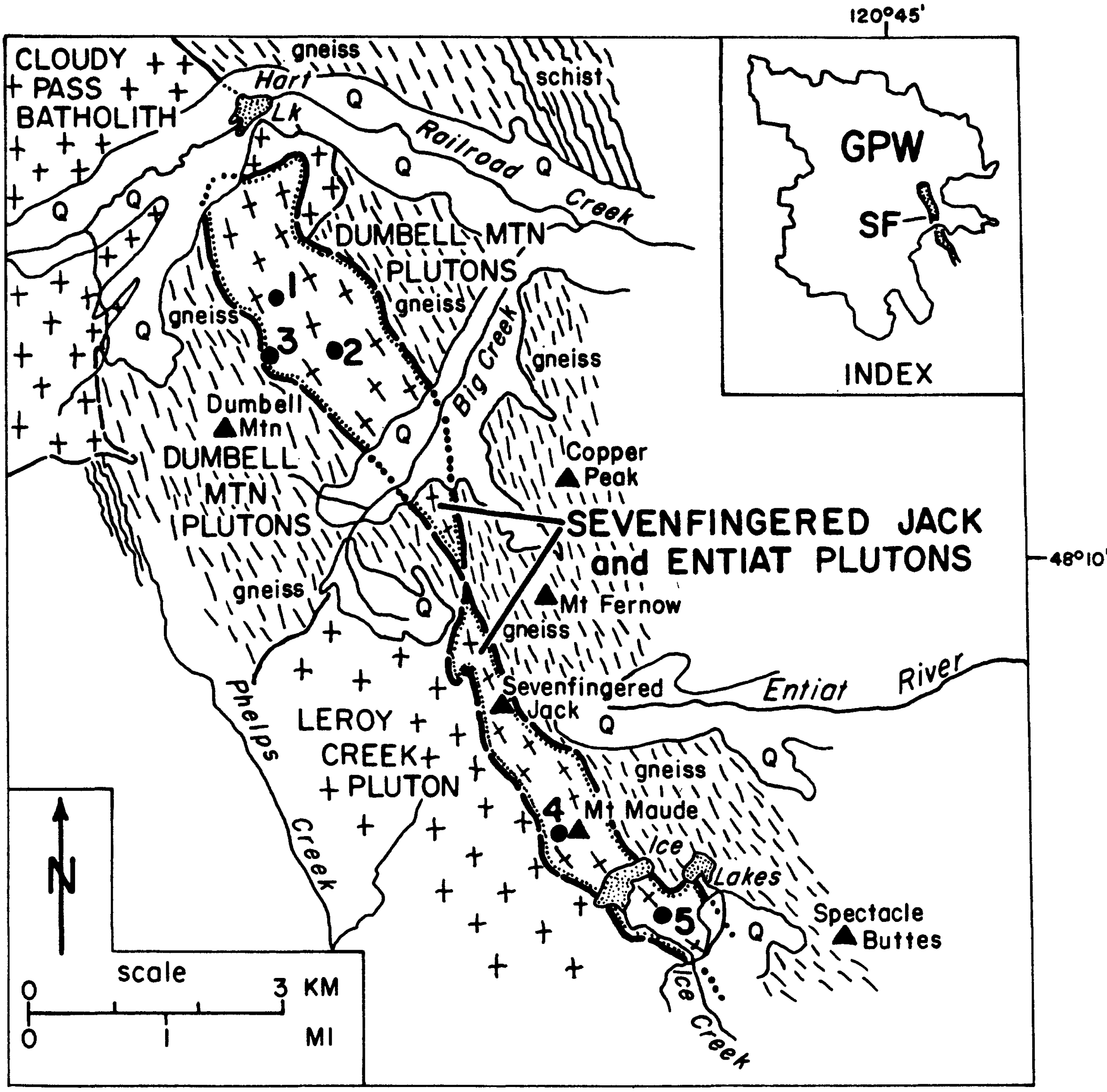


Figure 50.--Geologic sketch map of the Seven-fingered Jack and Entiat plutons, showing approximate sample sites. From mapping by Cater and Crowder (1967) and Cater and Wright (1967). Plutons extend farther southeast.

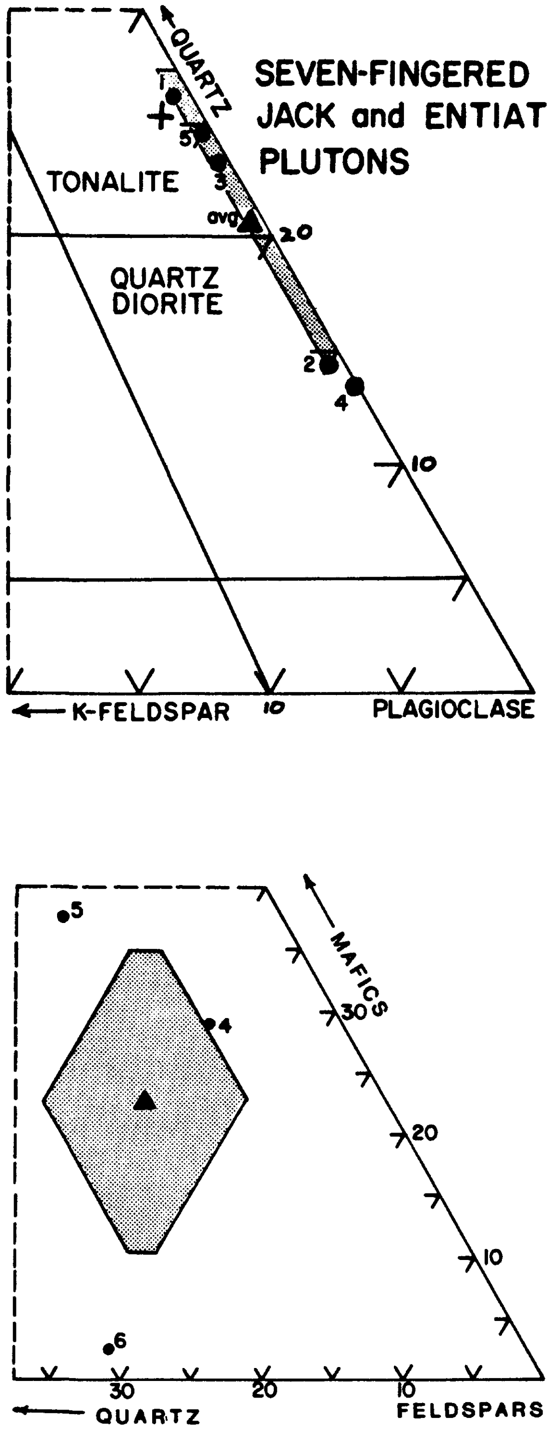


Figure 51.--Proportions of modal minerals of samples from the Seven-fingered Jack and Entiat plutons, showing rock classification in upper diagram. Cater's (1981, p. 30) average shown by "+" in upper diagram.

Table 16.--Modes (volume percent) and specific gravities of samples from the Seven-fingered Jack and Entiat plutons

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others	
81F282A	1	TO	2.735	.8	62.6	22.4	14.2	8.4	.9	2.5	.9	.1	.7	.7	(sec,ap)
81F283A	2	QDf	2.762	.4	60.5	10.4	28.6	0	10.4	1.4	12.1	.8	0	3.9	(sec,c)
81N154A	3	TO	2.756	.3	59.2	17.9	22.6	1.9	6.7	2.6	9.4	1.0	.6	.4	(sec, p)
82F37A	4	QDf	2.823	.1	61.3	9.6	29.0	12.0	14.1	1.3	.8	.8	.1	tr	(ap)
82G30A	5	TOf	2.798	.1	46.8	15.5	37.6	7.1	25.9	2.5	1.2	.9	0	.1	(p)
82F35A		TOf	2.668	.5	67.7	29.4	2.4	s	0	s	tr	s	tr	s	(m,ap,al)
Average			2.757	.4	59.7	17.5	22.4	5.9	11.6	2.1	4.9	.7	.3	1.0	
Standard dev.			.054	.3	7.0	7.5	12.5	4.9	9.4	.7	5.4	.4	.3	1.6	
n			6 →					5 →							

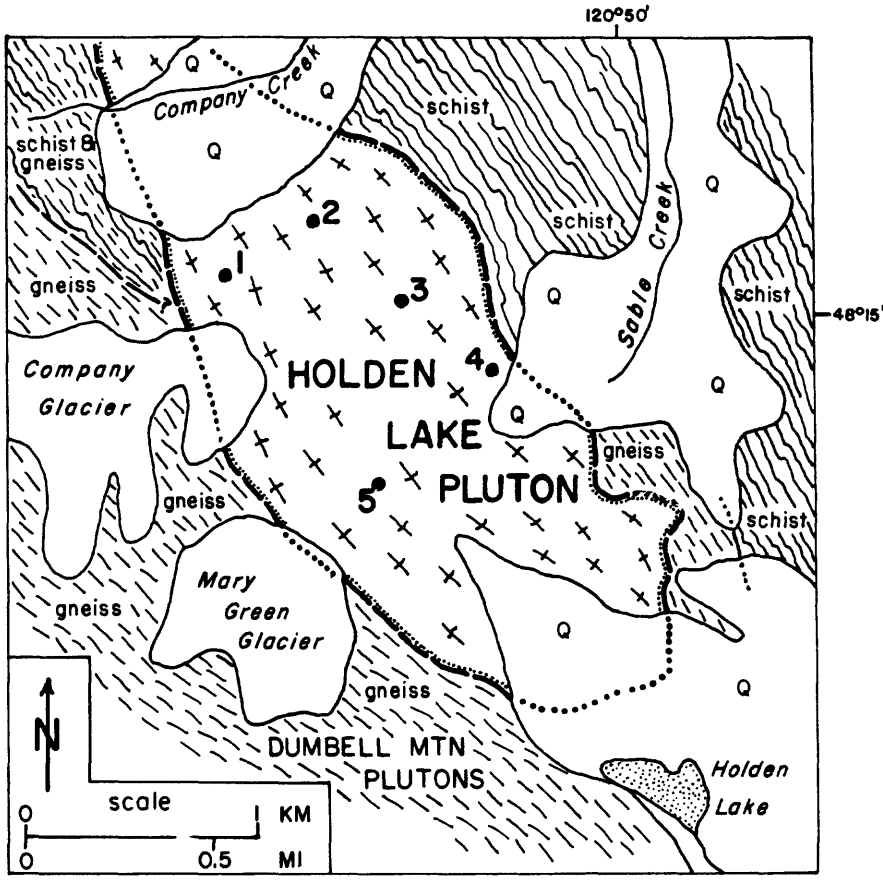
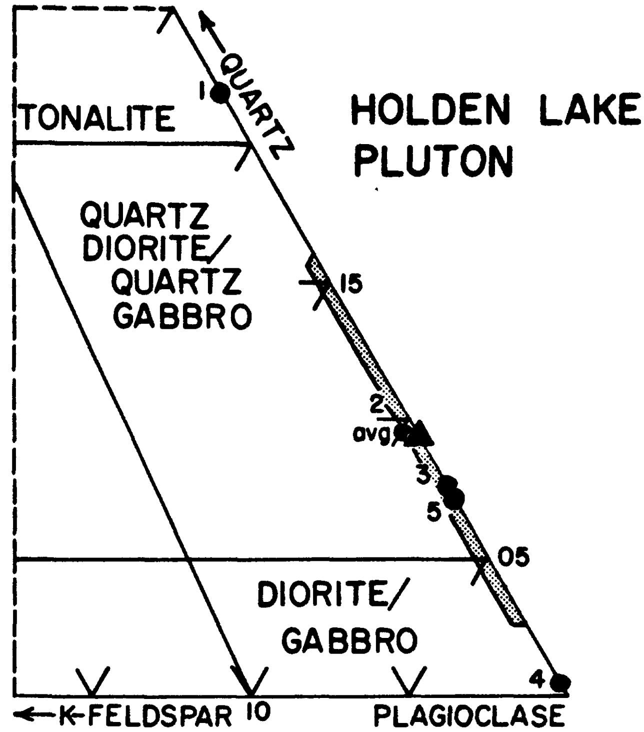


Figure 52.--Geologic sketch map of the Holden Lake pluton, showing approximate sample sites. In part, from mapping by Cater and Crowder (1967).



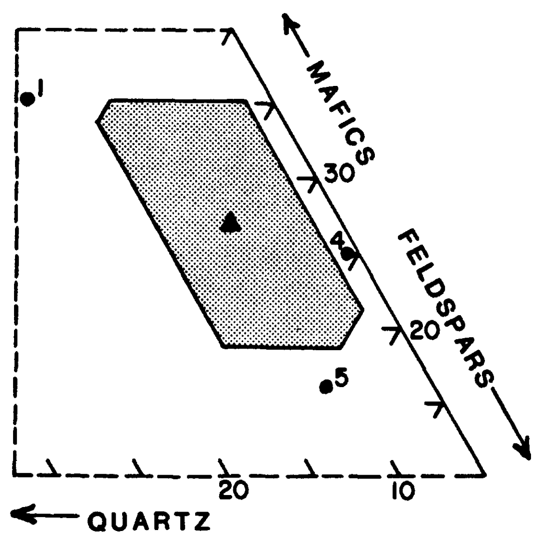


Figure 53.--Proportions of modal minerals of samples from the Holden Lake pluton, showing rock classification in upper diagram.

Table 17.--Modes (volume percent) and specific gravities of samples from the Holden Lake pluton

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Pyroxene	Chlorite	Fe_ti oxides	Others
81F262B	1	QG	2.818	0	50.4	14.2	35.4	3.2	29.2	1.4	1.0	.5	tr (sf)
81F263A	2	QG	2.806	.3	68.6	7.2	23.9	2.1	20.8	tr	.6	.3	.1 (p,ap,sf)
81F264A	3	QG	2.870	0	60.3	5.1	34.5	.5	23.4	0	4.9	5.0	.6 (sec,p)
82F56A	4	GA	2.861	0	74.4	.5	25.0	2.1	18.5	0	.9	3.5	0
82F57A	5	QG	2.775	0	77.5	6.4	16.1	0	2.6	10.8	0	2.7	0
Average			2.826	tr	66.2	6.7	27.0	1.6	18.9	2.4	1.5	2.4	.1
Standard dev.			.039	--	11.0	4.9	8.1	1.3	10.0	4.7	2.0	2.0	.3
n			5 ⟶										

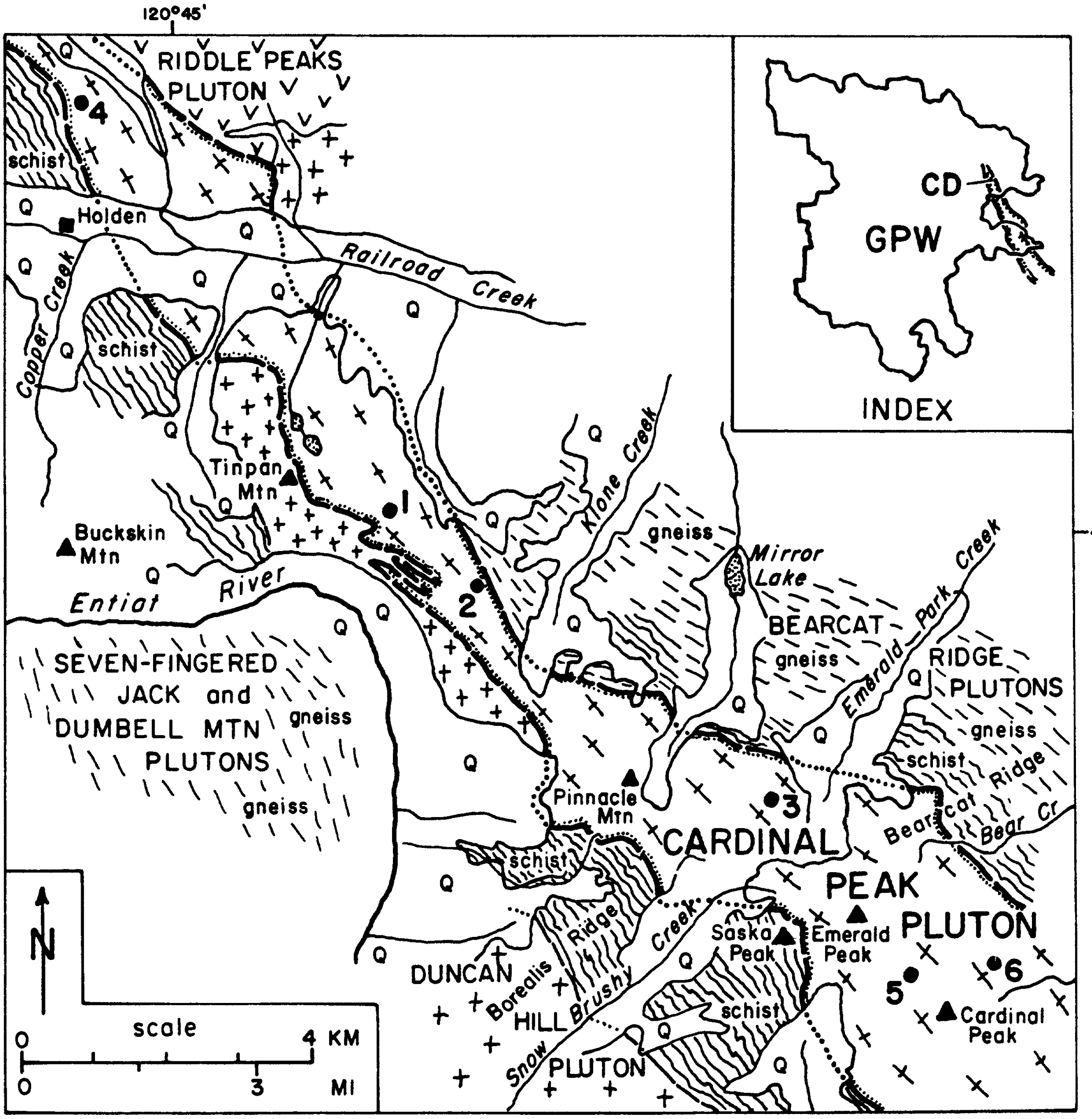


Figure 54.--Geologic sketch map of northern part of the Cardinal Peak pluton, showing approximate sample sites. From mapping of Cater and Crowder (1967) and Cater and Wright (1967, and includes areas they mapped separately as contact complexes.

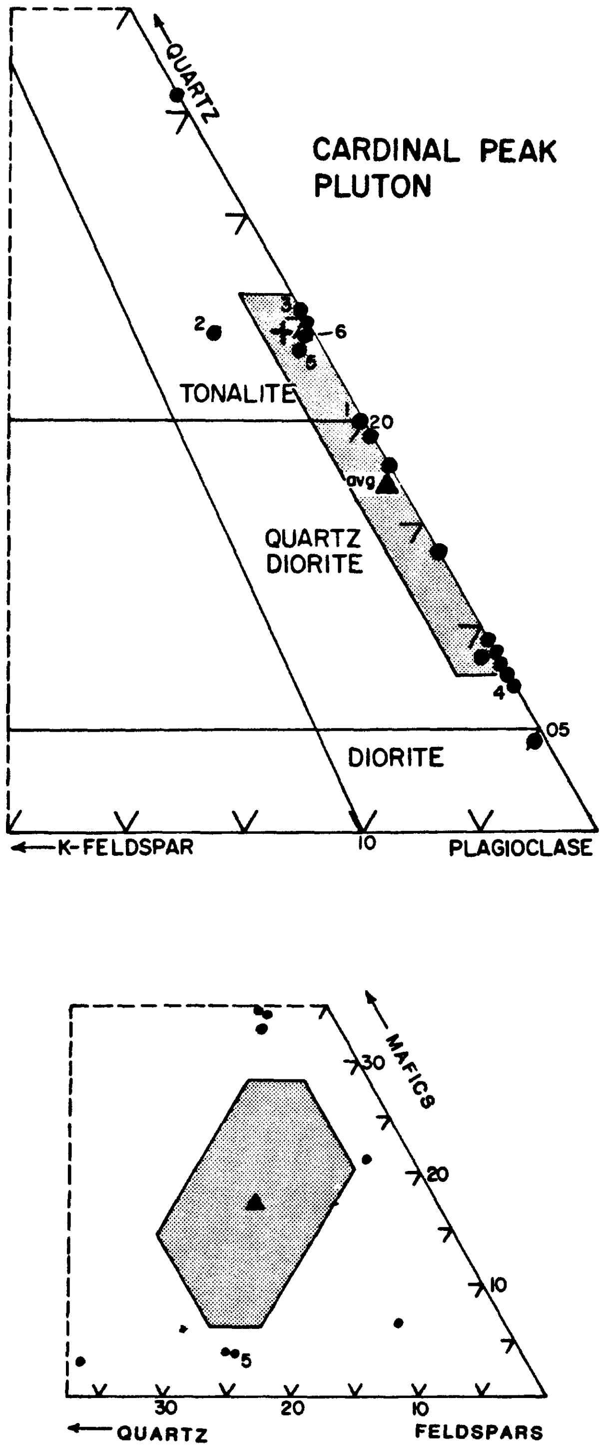


Figure 55.--Proportions of modal minerals of samples from the Cardinal Peak pluton, showing rock classification in upper diagram. "+" in upper diagram marks average of Cater's (1982, p. 51) modes from nearly the entire pluton.

Table 18.--Modes (volume percent) and specific gravities of samples from the Cardinal Peak pluton

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
82F47A	1	TOf	2.710	0	72.1	18.1	9.8	9.0	0	0	.2	.5	0	tr (ap)
82F48A	2	TOf	2.658	3.9	66.3	22.6	7.2	3.2	1.3	tr	1.9	.7	0	.1 (sec)
82G39A	3	TOf	2.678	0	67.5	22.7	9.8	6.8	.2	.9	.6	.9	0	.5 (sec)
82G48A	4	QDf	2.760	0	66.9	5.3	27.8	7.4	17.7	0	.5	2.2	0	tr (ap)
82S10A	5	TOf	2.683	.9	72.5	22.6	3.9	1.6	0	.4	1.2	.4	.1	.3 (sec,m)
82S11A	6	TOf	2.679	.5	70.6	22.6	6.4	3.7	0	1.3	.6	.5	.1	.2 (sec,p,m)
80H75B		QD	nd	0	61.1	6.1	32.8	s	m	tr	s	s	0	tr (p,ap)
80H75C		QD	nd	0	69.0	6.2	24.8	s	m	tr	s	s	0	tr (p,ap)
80H95A		QD	nd	0	62.6	15.2	22.1	m ≈	m	s	s	s	0	tr (ap)
80H209A		QD	nd	0	60.5	5.1	34.4	m <	m	tr	s	s	0	tr (ap)
80H210A		QD	nd	0	62.3	10.1	27.7	s	m	s	m	s	0	s (ap)
80H216B		QD	nd	.4	59.4	5.4	34.8	s	m	tr	s	s	tr	tr (ap)
82G37A		TO	2.658	0	68.2	22.8	8.9	0	s	s	s	s	tr	tr (ap)
82G38A		TOf	2.660	tr	m	m	m	s	0	s	m	s	0	tr (ap)
82G40A		DI	2.773	.5	74.8	3.6	21.2	0	m	s	s	tr	s	tr (ap)
82G41A		QDf	2.730	0	72.9	15.9	11.2	m	m	0	tr	s	tr	s (ap)
82G42A		TOf	2.658	0	62.0	34.9	3.1	s	0	s	s	s	tr	s (m)
82S9A		QDf	2.696	1.1	84.1	8.2	6.6	m	0	s	tr	s	s	tr (ap)
Average			2.695	0.4	67.8	14.6	17.2	5.3	3.2	.4	.8	.9	tr	tr
Standard dev.			.040	1.0	6.4	9.1	11.4	2.9	7.1	.6	.6	.7	--	--
n			12	17 →				6 →						

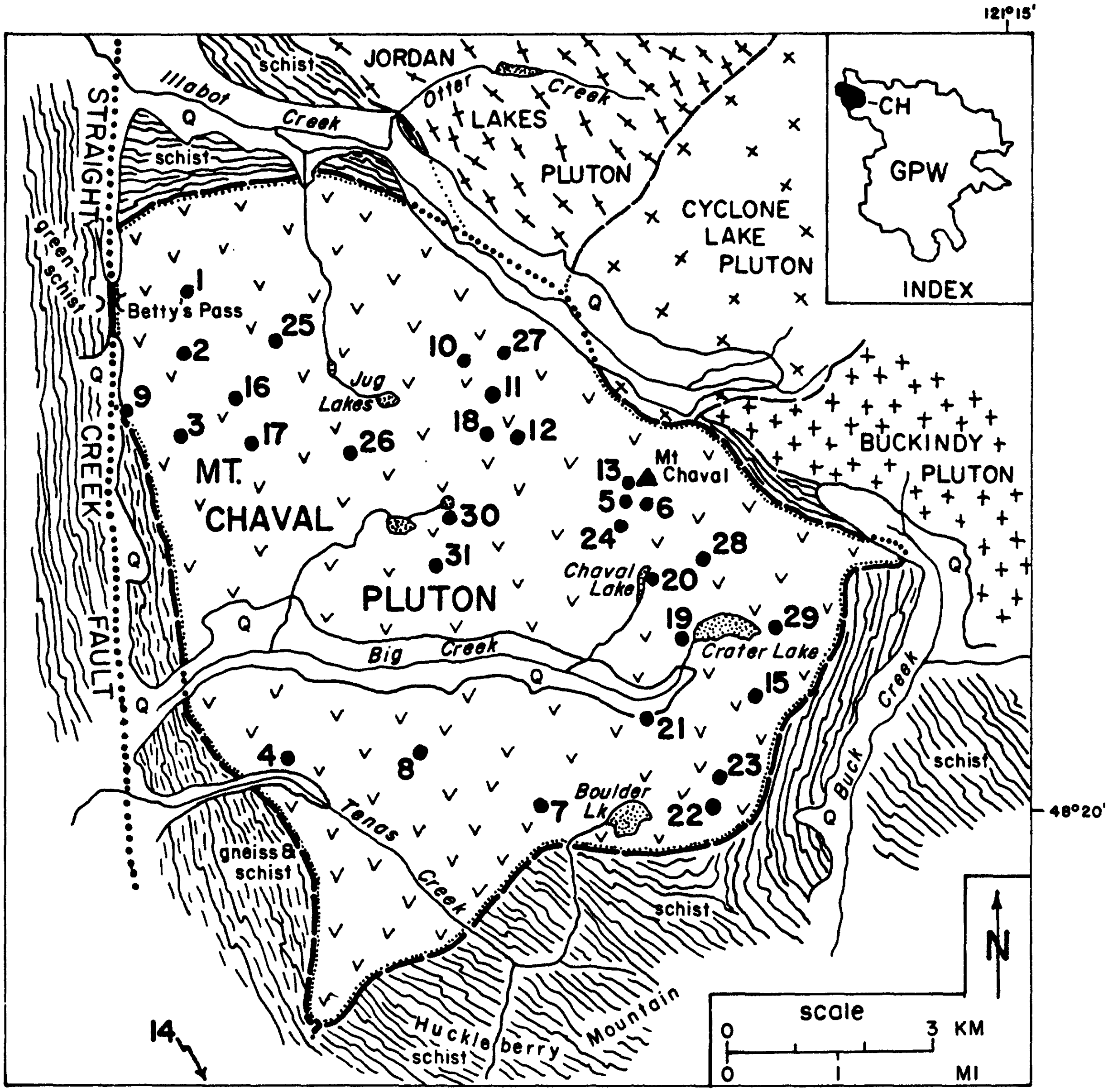


Figure 56.--Geologic sketch map of the Mt. Chaval pluton, showing approximate sample sites. In large part, from Boak (1977).

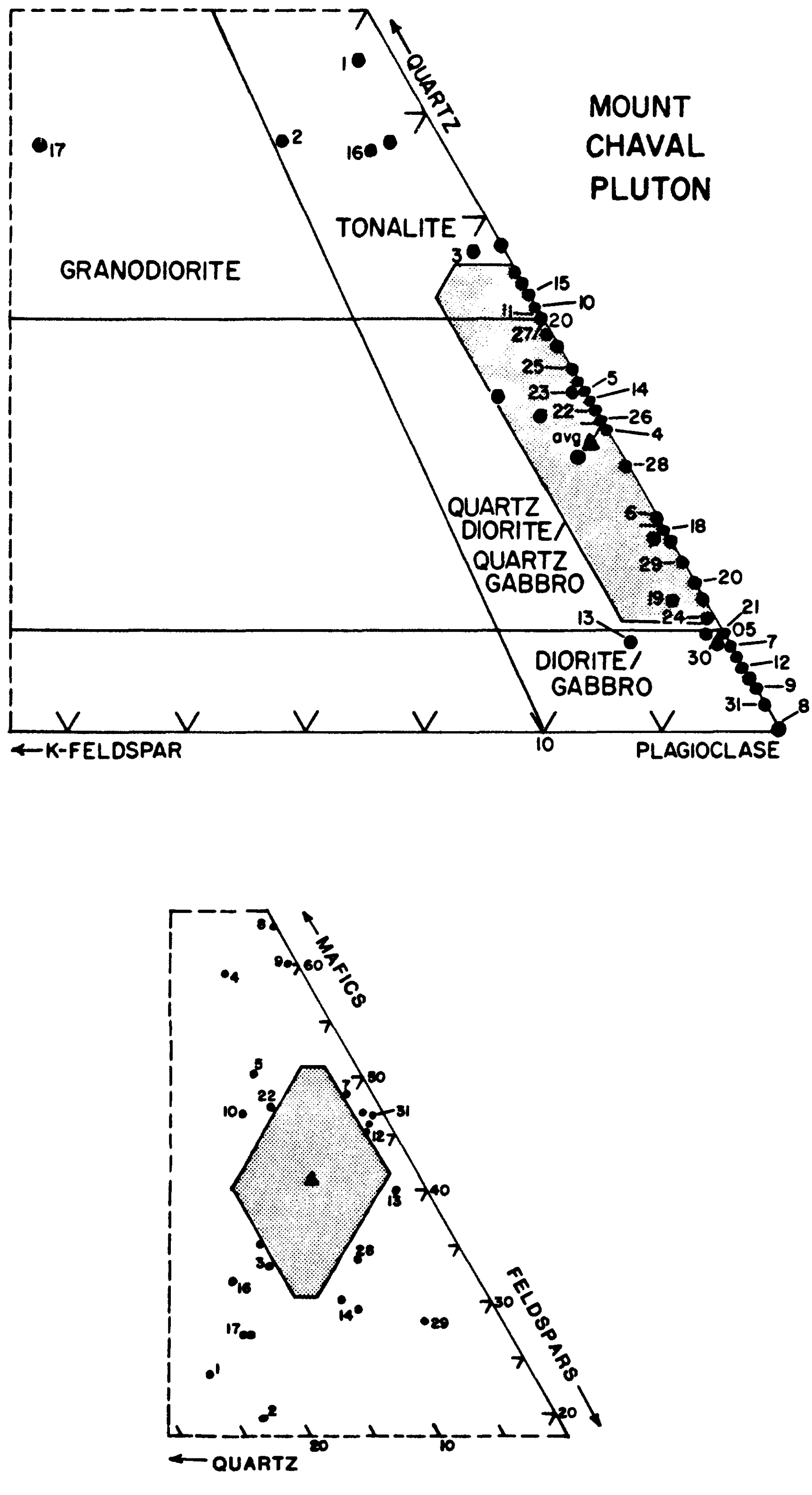


Figure 57.--Proportions of modal minerals in samples from the Mount Chaval pluton, showing rock classification in upper diagram.

Table 19.--Modes (volume percent) and specific gravities of samples from the Chaval pluton. Rock-type names based in part on chemical analysis (QG and GA have CIPW an>50 percent)

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Pyroxene	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
80F71A	1	TOf	2.730	1.0	50.2	25.0	23.8	2.6	0	0	5.2	14.0	.5	.8	.7(ap,m,p)
80F74A	2	TOf	2.690	5.6	51.6	23.0	19.8	.8	.7	0	1.8	12.3	1.2	.7	2.2 (c,p,m)
80F75A	3	TOf	2.750	.9	50.2	15.7	33.3	.8	12.6	0	3.9	12.3	.4	.6	2.7 (p,sec)
80H130A	4	QG	2.917	0	34.4	6.0	59.6	4.7	50.1	0	.2	3.4	.8	.2	.2(p,m,ap)
80L36A	5	QG	2.937	0	41.3	8.3	50.4	tr	45.7	0	0	2.6	.7	0	1.4 (p,sec)
80L37A	6	QGf	2.867	0	54.2	6.2	39.6	5.9	32.5	0	tr	.2	.9	0	tr (al,p)
80N40A	7	QGf	2.816	0	49.1	2.0	48.8	4.3	37.3	0	.2	4.3	1.9	tr	.7(sec,sf)
80N41A	8	GA	2.950	0	35.7	0	64.3	1.2	60.5	0	.2	tr	1.9	tr	.5 (p,ap)
80R113B	9	GA	3.033	0	39.0	.9	60.1	.3	51.0	0	.4	2.5	2.8	tr	3.1 (g,sf)
80R146A	10	QG	2.873	0	41.9	11.0	47.0	--	--	--	--	--	--	--	--
80R147A	11	QG	2.872	0	47.4	11.9	40.8	3.8	25.4	0	3.8	6.1	.9	.6	.2 (sec, ap,m)
80R149B	12	QGf	2.904	0	52.6	2.1	45.2	0	24.2	19.1	0	.9	1.0	0	tr (ap)
80R151A	13	QG	2.868	2.5	54.8	2.7	40.0	5.5	32.6	.8	0	.3	.6	0	.3 (sec, p,ap)
80S14A	14	QGf	2.822	0	58.9	11.6	29.4	12.2	16.2	0	.1	.1	.8	0	tr (ap,p)
80S36A	15	TO	2.815	0	52.4	14.1	33.4	7.5	22.7	0	2.5	.2	.3	tr	tr (ap,m)
81F101A	16	TOf	2.775	2.3	46.6	19.1	32.0	10.3	16.2	0	3.5	1.1	.3	.7	tr (ap,m)
81F102A	17	GDf	2.777	12.4	39.7	20.8	27.1	.2	16.9	0	3.7	4.8	.4	1.3	tr (m)
81F104A	18	QG	2.910	0	50.2	5.5	44.3	0	32.1	0	1.4	7.2	1.2	0	2.4 (sec,m)
81F127A	19	QGf	2.869	1.1	55.1	3.7	40.2	4.5	33.6	.3	.1	.5	1.3	tr	tr (ap)
81F128A	20	QG	2.852	0	54.7	4.2	41.1	.2	35.1	0	tr	3.1	1.5	.7	.6 (p,m)
81F129A	21	GAf	2.890	.4	47.8	2.5	49.3	4.0	40.2	0	tr	.4	1.5	.3	2.8 (g)
81F132A	22	QGf	2.848	0	44.2	8.2	47.6	15.9	25.4	0	3.5	.5	.3	.8	1.1(g,ap,m)
81F167A	23	QG	2.843	.2	48.8	9.8	41.3	4.3	30.4	0	tr	.4	1.0	.6	4.6 (g)
81F168A	24	QG	2.860	.2	49.7	2.8	47.2	0	38.5	0	1.3	5.8	.8	.4	.4 (p,sec)
81L9A	25	QDf	2.815	0	54.0	11.5	34.6	7.1	19.0	0	.4	1.3	1.0	.5	5.3 (sec,p)
81L10A	26	QGf	2.840	0	53.3	10.0	36.7	5.0	29.5	0	tr	1.8	.4	.0	tr (ap)
81N8A	27	QG	nd	.1	55.2	13.3	31.4	0	18.0	0	.5	9.7	1.8	.7	.6(sec,ap)
82C7A	28	QDf	2.810	0	57.4	8.6	33.9	12.4	20.3	0	.9	0	.3	0	tr (ap)
82C8A	29	QDf	2.755	0	65.8	6.0	28.2	10.7	13.4	0	3.4	0	.7	0	tr (ap,m)
82C16B	30	QGf	2.879	0	53.4	2.4	44.3	1.6	38.9	2.6	0	0	1.2	0	tr (ap)
82C18A	31	GAf	2.918	0	52.5	.7	46.9	0	27.4	18.2	0	0	1.3	0	tr (ap)
80L16B		TO	2.823	0	49.7	13.9	36.3	m <	m	0	s	tr	s	tr	s (g)
80R145A		TO	2.840	0	50.3	14.3	35.5	--	--	--	--	--	--	--	--
80R147B		TO	2.855	0	49.3	15.4	35.2	m <	m	0	0	s	s	0	s (p,ap)
80R148A		QD	2.890	0	45.0	4.8	50.2	0	m	0	s	m	s	tr	s (m)
80R150A		QD	2.860	0	53.3	3.8	42.9	s	m	0	tr	s	s	0	tr (ap)
80S34B		QD	2.830	2.3	45.8	9.3	42.6	s	m	0	s	m	s	tr	s (p)
80S37A		QD	2.778	0	58.0	11.8	30.2	m <	m	0	s	tr	tr	tr	s (g)
81F43A		QD	2.780	1.7	51.6	9.5	37.2	s	m	0	s	m	s	tr	s (g)
81F44A		DI	2.890	0	53.2	2.6	44.1	s	m	s	tr	s	s	0	tr (ap)

Table 19.--(Continued)

Sample No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Pyroxene	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
81F103A	DIf	2.890	0	52.4	1.6	46.0	0	m	0	tr	s	s	tr	tr (ap)
81F105A	DI	2.862	.4	50.3	2.4	46.9	s	m	tr	tr	m	tr	0	tr (p,ap)
81L11A	QD	2.860	0	50.0	11.9	38.1	s	m	0	s	m	s	0	tr (ap,m)
81L12A	QD	2.845	1.0	47.5	7.5	43.9	s	m	0	tr	s	s	tr	s (p,ap)
81N7A	QD	nd	0	54.0	5.7	40.3	--	--	--	--	--	--	--	--
81N59A	TO	2.708	1.7	50.3	20.8	27.1	s	m	0	s	m	tr	s	s (p)
Average		2.845	.8	50.1	8.8	40.4	4.2	28.2	tr	1.2	3.2	1.0	.3	tr
Standard dev.		.065	2.0	6.0	6.4	9.3	4.4	14.0	--	1.6	4.1	.6	.4	--
n		44	46 →				30 →							

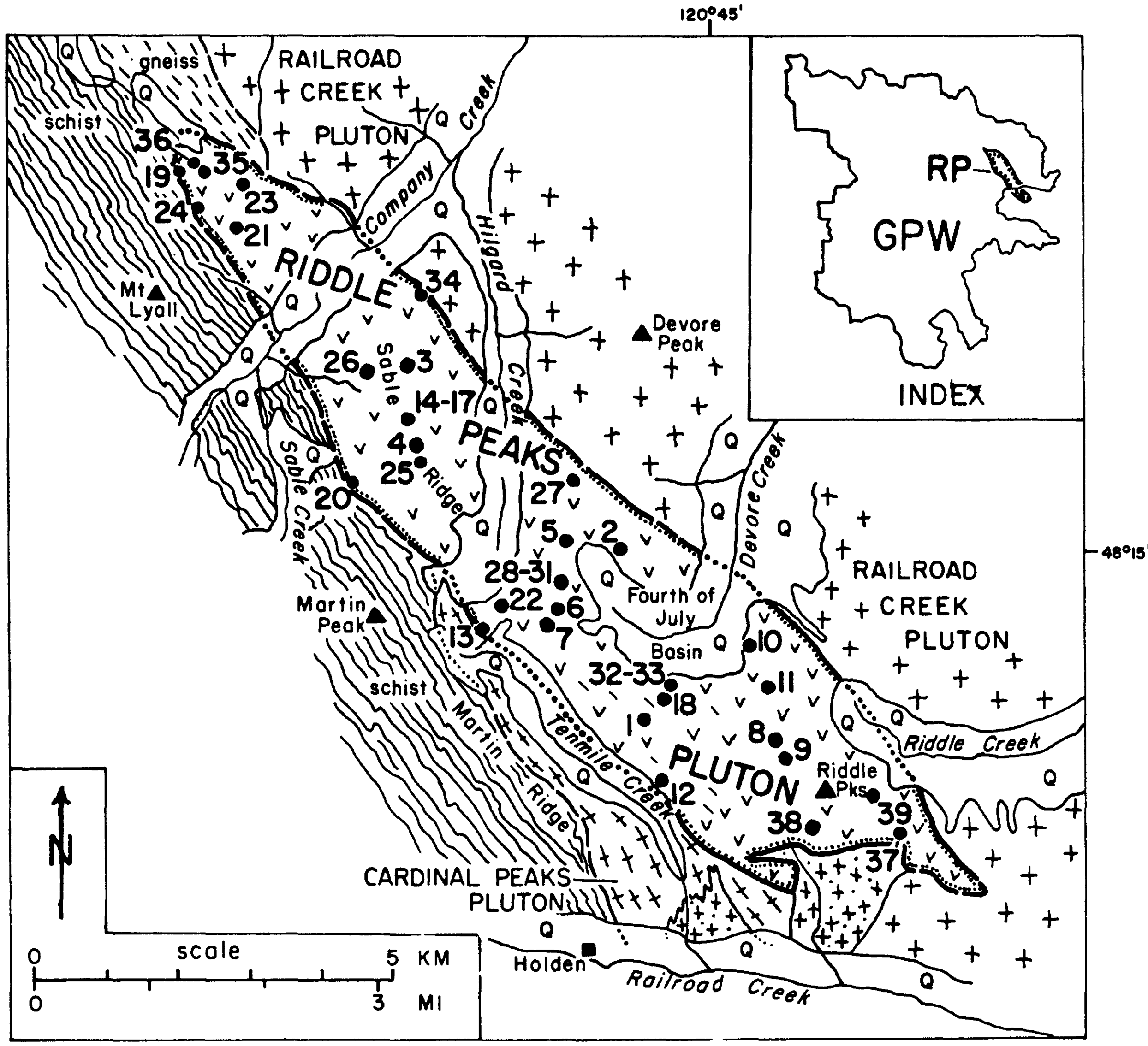


Figure 58.--Geologic sketch map of the Riddle Peaks pluton, showing approximate sample sites. From various sources, including the late Carl Huie (unpublished thesis field data, Univ. Montana).

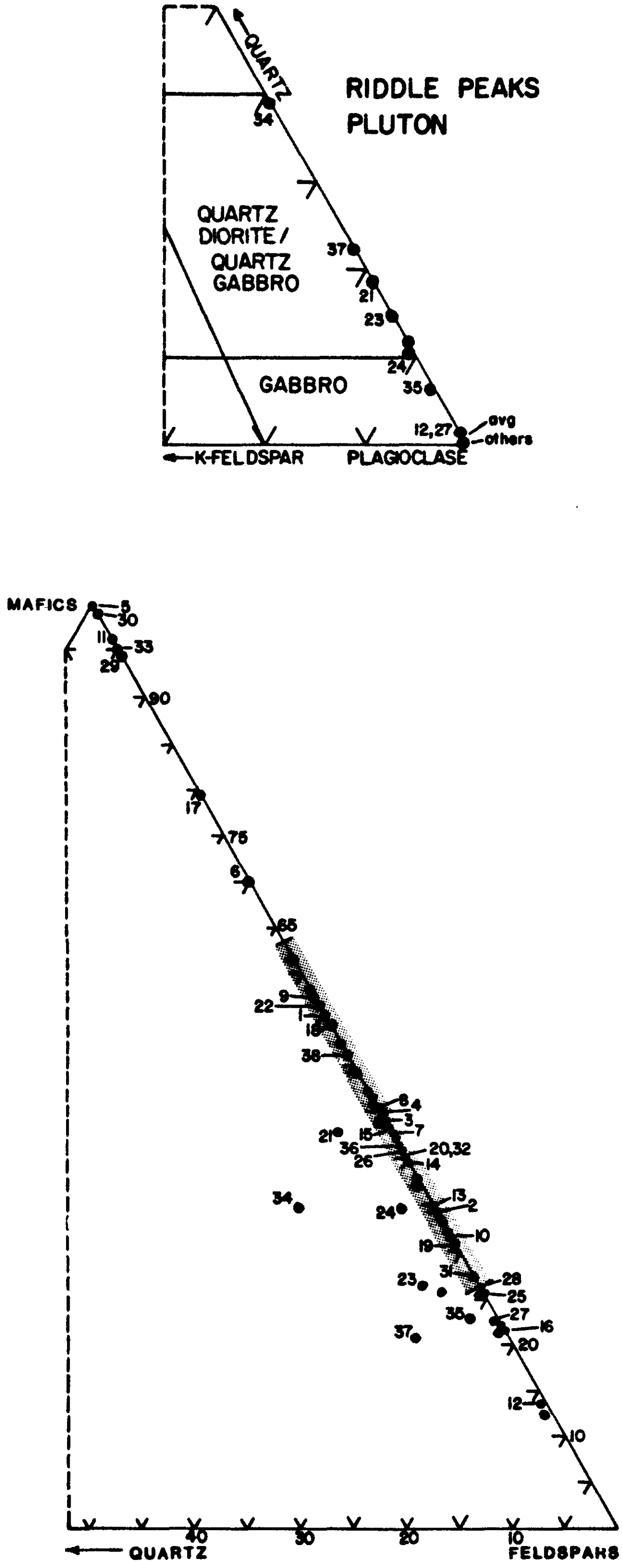


Figure 59.--Proportions of modal minerals in samples from the Riddle Peaks pluton, showing rock classification in upper diagram.

Table 20.--Modes (volume percent) and specific gravities of samples from the Riddle Peaks pluton

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Pyroxene	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
80H37B	1	GAM	3.048	0	44.3	0	55.7	0	48.3	tr	tr	.6	5.5	.1	1.2 (sec)
80H63B	2	GA	2.875	0	64.6	0	35.4	tr	23.3	0	3.3	2.0	5.5	tr	1.3 (ap)
80H70A	3	GA	3.010	0	56.1	0	43.9	0	38.3	0	tr	.5	5.1	tr	tr (sf)
80H72A	4	GA	2.918	0	55.1	0	44.9	0	40.8	0	tr	.4	3.4	.4	tr (sf)
80H89B	5	HB	3.175	0	0	0	100.0	0	56.3	40.8	1.0	.6	.8	.4	0
80H97A	6	GAM	3.001	0	30.0	0	70.0	0	68.3	0	tr	.2	1.5	0	tr (sf)
80H98A	7	GA	3.012	0	57.6	0	42.5	0	31.4	0	0	1.0	10.1	0	tr (ap,sf)
80H127A	8	GA	2.970	0	54.8	.1	45.1	8.4	24.0	tr	0	7.4	5.0	.3	tr (sf)
80H129D	9	GA	nd	0	42.3	0	57.6	1.3	40.5	12.9	.8	tr	2.1	0	tr (sf)
80R32A	10	GA	2.923	0	68.3	0	31.7	0	22.8	0	.7	3.4	4.9	0	tr (sc,sf)
80R35A	11	HB	3.122	0	4.0	0	96.0	0	93.4	0	0	0	2.6	0	tr (sf)
80R40A	12	GA	2.743	0	85.9	.4	13.7	1.5	5.3	tr	.2	3.3	3.1	.2	.1 (p)
80R83A	13	GA	2.947	0	65.2	0	34.8	0	28.7	0	.1	.1	5.7	.2	tr (ap,sf)
81F178A	14	GA	2.958	0	61.1	0	38.9	0	31.8	0	0	.3	6.9	tr	tr (sf)
81F178B	15	GA	2.922	0	56.7	0	43.3	0	32.6	0	tr	3.2	7.5	tr	s (sf)
81F178C	16	GAL	2.806	0	78.5	0	21.5	0	14.1	0	.3	1.6	5.5	0	s (sf)
81F178D	17	HB	3.013	0	20.7	0	79.3	0	67.8	0	1.6	1.3	8.6	tr	tr (sf)
81F179A	18	GA	2.948	0	45.3	0	54.7	0	50.7	0	0	.4	3.6	0	tr (ap,sf)
81N32A	19	GA	2.846	0	69.3	0	30.8	0	18.9	0	.5	1.8	9.6	0	tr (ap,sf)
81N144A	20	GA	2.869	0	59.8	0	40.2	.2	37.2	0	0	.7	2.2	0	tr (p)
81N147A	21	QG	2.810	0	52.2	5.4	42.5	2.1	35.5	0	.3	2.6	2.0	0	tr (p,sf)
82F60A	22	GA	2.994	0	43.2	0	56.7	0	44.8	0	0	1.3	10.6	0	tr (ap,sf)
82F64A	23	QG	2.777	0	68.4	5.5	26.1	0	17.9	0	0	3.5	4.4	0	.3 (c,ap)
82F65A	24	QG	2.805	.1	62.0	3.4	34.5	0	24.1	0	1.8	7.2	1.5	tr	tr (sf,c)
82F71A	25	GA	2.870	0	74.7	0	25.3	0	19.7	0	.1	.6	4.9	0	tr (ap,sf)
82F73A	26	GA	2.825	0	59.1	0	40.9	0	32.3	0	.2	.6	7.8	0	tr (sf)
82F76A	27	GA	2.779	0	77.1	.4	22.5	2.4	16.5	.4	.2	tr	3.0	0	.1 (p)
82F78A	28	GA	2.926	0	74.3	0	25.7	0	19.6	0	.2	1.2	4.7	tr	tr (sf)
82F78B	29	HB	3.090	0	4.7	0	95.3	.9	90.0	0	0	.7	2.3	0	1.4 (ap)
82F78C	30	HB	3.143	0	.5	0	99.5	0	96.4	0	0	.3	2.8	tr	0
82F78D	31	GAL	2.880	0	72.7	tr	27.2	tr	18.0	0	0	2.8	6.1	0	.3 (p,ap)
82F79A	32	GA	3.012	0	59.8	0	40.2	0	32.4	0	tr	tr	7.8	0	s (ap,sf)
82F79B	33	HB	3.135	0	4.8	0	95.2	0	93.3	0	0	.3	1.6	tr	tr (sf)
82F89A	34	QGf	2.746	0	52.4	13.0	34.5	tr	22.0	0	0	10.4	1.6	.5	tr (ap)
82F90A	35	QG	2.778	.1	74.5	2.5	22.9	.1	20.2	0	.6	1.2	.7	tr	tr (sf,ap)
82F91A	36	GA	2.910	0	58.5	0	41.5	0	30.6	0	0	1.6	9.0	tr	.3 (ap,sf)
82F96A	37	QGf	2.753	.1	70.4	8.8	20.7	4.5	12.5	0	.2	2.6	.7	.2	0
82F97A	38	GA	2.928	0	47.6	0	52.3	0	42.9	0	tr	4.2	3.5	.4	1.3 (ap)
82G46A	39	GA	2.924	.2	53.5	0	46.3	tr	43.4	0	0	1.9	.9	.1	tr (sf)
80H38A		GA	2.958	.2	45.8	.4	53.6	s	m	0	s	s	m	0	s (sf)

Table 20.--Continued

Sample No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Pyroxene	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
80H44A	GA	2.922	0	53.3	0	46.7	0	m	0	tr	tr	s	0	s (sf)
80H44C	GA	2.911	.1	56.8	0	43.1	0	m	0	s	tr	s	tr	tr (sf)
80H52C	GA	2.943	0	62.4	.1	37.5	0	m	0	tr	tr	m	0	s (sf)
80H100C	GA	2.833	0	78.0	0	22.0	0	m	0	tr	s	m	tr	tr (ap)
80H102A	GA	2.991	0	57.8	0	42.2	--	--	--	--	--	--	--	--
80H129B	GAM	nd	0	47.7	0	52.3	0	m	s	tr	tr	s	0	tr (sf,ap)
80R31A	GAM	2.989	0	41.9	0	58.1	0	m	0	tr	tr	s	0	tr (ap,sf)
80R42A	GA	2.874	.3	66.0	0	33.6	0	m	0	tr	s	s	s	tr (sc,sf)
80R43A	GA	2.785	0	78.3	.5	21.2	tr	m	0	s	s	m	tr	tr (ap)
80R43B	GA	2.845	0	74.2	.2	25.6	0	m	0	tr	s	s	tr	s (ap,sf)
80R82C	QG	2.904	0	62.5	.6	36.9	0	m	tr	tr	tr	m	0	s (ap)
81N35B	GA	2.930	0	50.4	.3	49.3	--	--	--	--	--	--	--	--
82F66B	QG	2.781	0	86.8	.8	12.4	0	s	0	s	m	s	0	s(sec,ap,s)
82F72A	GA	2.848	0	66.0	0	34.0	0	m	0	s	s	s	tr	tr (sec)
82F73B	GA	2.880	0	66.8	0	33.2	0	m	0	tr	s	s	0	0
82F77A	QG	2.742	0	70.4	3.9	25.7	0	m	0	tr	m	tr	s	tr (ap,sf)
82F80A	GAM	3.065	0	38.9	0	61.1	0	m	0	tr	tr	s	0	tr (sf)
82F87A	GA	2.930	0	59.1	0	40.9	0	m	0	0	tr	s	0	tr (sf)
82G53A	GA	2.865	0	69.1	0	30.9	0	m	0	s	tr	s	tr	tr (sf)
Average		2.915	tr	55.3	.8	42.9	.6	38.1	tr	.3	1.8	4.5	tr	tr
Standard dev.		.105	--	20.6	2.3	19.9	1.6	23.6	--	.7	2.3	2.8	--	--
n		57	59 →				39 →							

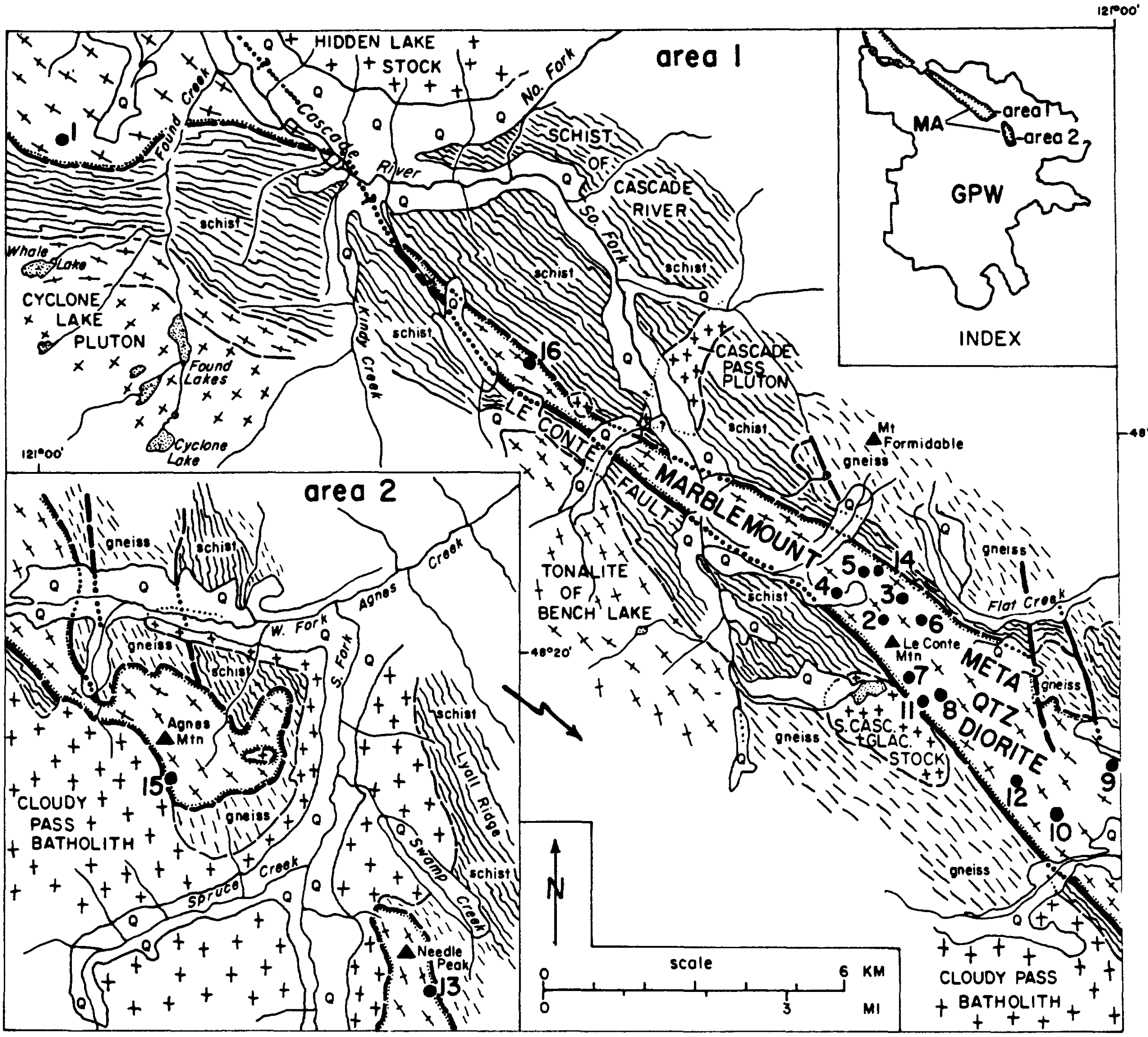


Figure 60.--Geologic sketch map of part of the Marblemount Meta Quartz Diorite. From mapping by Bryant (1955) northwest of Kindy Creek, Grant (1966) south of West Fork Agnes Creek, and Tabor (1961) in intervening area. Contiguous with type area of unit to northwest mapped by Misch (1979). Inset map (area 2) slightly overlaps main map on southeast corner.

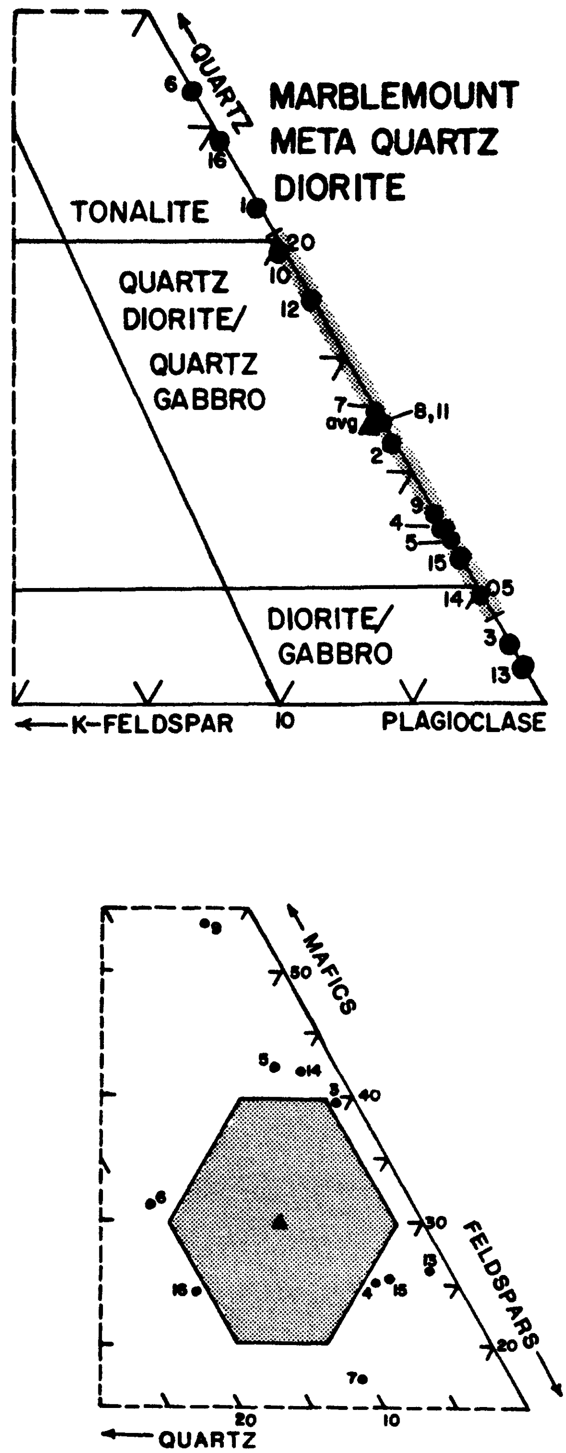


Figure 61.--Proportions of modal minerals in samples from the Marblemount Meta Quartz Diorite, showing rock classification in upper diagram.

Table 21A.--Modes (volume percent) and specific gravities of samples from the Marblemount Meta Quartz Diorite of type locality

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
6.23.49.14	1	MQ	2.711	0	m	m	m	0	0	m	m	s	0	tr (ap)
6.23.49.16	2	MQ	2.763	0	m	m	m	0	0	m	m	tr	0	tr (ap)
9.15.52.22	3	MQ	2.762	0	m	m	m	0	0	m	s	tr	0	tr (ap)
10.7.54.25	4	MQ	2.870	0	m	m	m	s	m	m	s	s	0	tr (ap)
4.8.55.8	5	MQ	2.794	0	m	m	m	tr	m	s	m	tr	0	tr (ap)
10.18.59.14	6	MQ	2.774	0	m	m	m	0	0	m	m	tr	tr	s (c)

Table 21B.--Modes (volume percent) and specific gravities of samples from the Marblemount Meta Quartz Diorite of Glacier Peak Wilderness

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Epidote	Chlorite	Fe_ti oxides	Sphene	Others
80N62D	1	MQ	2.803	0	59.2	16.5	24.2	2.0	12.2	8.7	.2	.6	.5	0
81F85A	2	MQ	2.816	.1	60.2	7.5	32.2	0	.2	15.6	12.3	2.7	0	1.5 (sec)
81F86A	3	MQ	2.953	0	58.7	1.6	39.7	0	13.6	14.5	5.6	2.1	tr	3.9 (sec)
81F87A	4	MQ	2.802	0	69.1	5.8	25.1	0	tr	16.2	6.6	1.6	0	.7 (sec)
81F90A	5	MQ	2.875	0	53.4	4.4	42.2	0	21.7	8.9	6.1	1.4	0	4.2 (sec)
81F91A	6	MQ	2.875	0	50.4	18.4	31.2	1.7	1.6	12.4	12.6	1.1	0	1.7 (sec)
81F139A	7	MQ	2.804	0	72.0	10.6	17.3	2.0	8.3	5.0	.6	1.4	0	tr (p,sf)
81F140A	8	MQ	2.828	0	58.0	7.8	34.2	0	11.2	8.8	7.0	3.1	tr	4.0 (sec,m)
81F231A	9	MQ	3.023	0	42.6	3.5	53.9	0	36.5	14.8	1.0	1.5	0	tr (sf)
81L20A	10	MQ	2.722	0	61.6	15.3	23.0	0	1.4	5.7	12.6	1.8	0	1.4 (c,m)
81L29A	11	MQ	2.773	0	66.7	5.2	28.1	12.4	11.9	.2	1.7	1.7	tr	.1 (p,m)
81L55A	12	MQ	2.757	0	64.3	13.9	21.8	0	0	10.2	8.6	1.9	tr	1.1 (c,m)
81N126A	13	MQ	2.727	.3	72.4	1.2	26.1	20.1	tr	.6	2.4	2.8	.2	tr (p)
81S9A	14	MQ	2.920	0	55.2	2.8	42.0	.2	20.8	8.9	7.5	1.0	0	3.8 (sec)
81S40E	15	MQ	2.845	0	69.9	4.6	25.5	6.6	17.7	.1	tr	1.1	0	tr (ap)
82F348A	16	MQ	2.680	0	57.0	18.7	24.3	0	.3	6.8	13.3	2.5	0	1.4 (sec)
81L54A		MQ	2.785	0	51.8	31.9	16.3	0	0	m	m	s	tr	s (sec)
Average			2.823	tr	60.2	10.0	29.8	2.8	9.8	8.6	6.1	1.8	tr	1.5
Standard dev.			.087	--	8.3	8.2	9.9	5.7	10.6	5.4	4.8	.7	--	1.6
n			17 →				→	16 →					→	

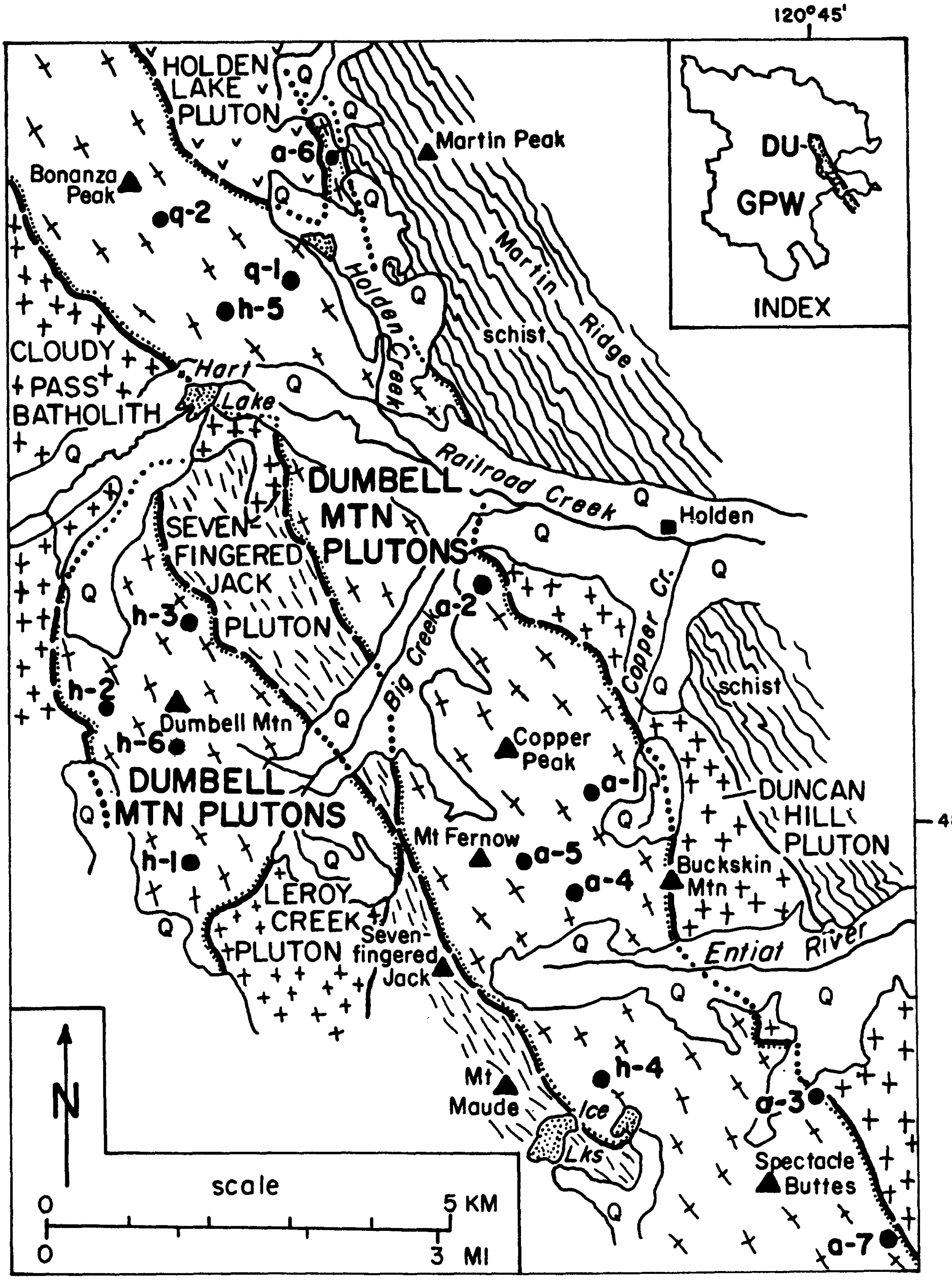


Figure 62.--Geologic sketch map of part of the Dumbell Mountain plutons, showing approximate sample sites. From mapping of Cater and Crowder (1967) and Cater and Wright (1967). Consists of three plutons mapped separately by above authors: see figure 63 for explanation of the symbols "a," "h," and "q" designating samples from different plutons.

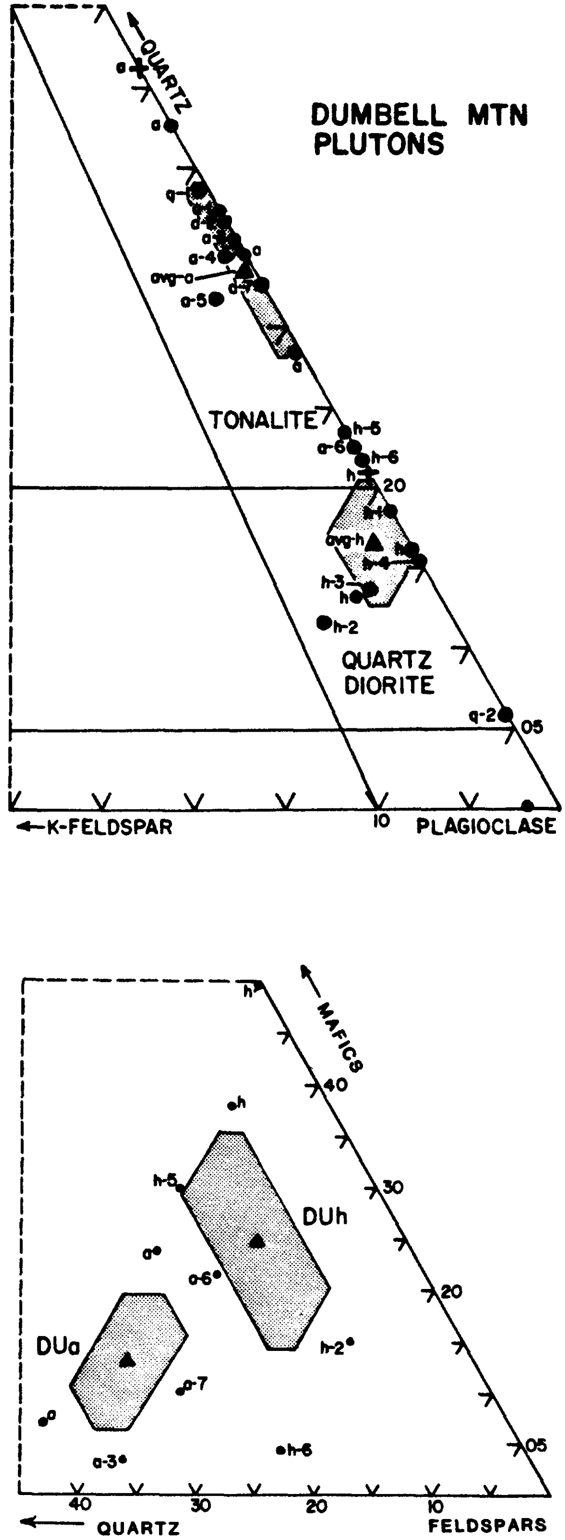


Figure 63.--Proportions of modal minerals in samples from the Dumbell Mountain plutons, showing rock classification in upper diagram. "a," unit dag; "h," unit dhg; and "q," unit dqg of geologic maps of Cater and Crowder (1967) and Cater and Wright (1967). Averages of Cater's (1982, p. 13) modes shown by "+" in upper diagram.

Table 22A.--Modes (volume percent) and specific gravities of samples from the Dumbell Mountain plutons: unit "dhg" of Cater and Crowder (1967)

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
81F279A	1	Gqd	2.824	0	59.4	13.5	27.1	4.3	13.6	4.4	3.2	.5	.6	.6 (sec)
81F280A	2	Gqd	2.710	6.2	69.0	9.6	15.1	0	0	2.7	5.7	1.5	tr	5.2 (sec)
81F281A	3	Gqd	2.744	2.6	57.5	9.6	30.2	0	13.7	6.8	8.0	1.4	.3	tr (ap)
82F36A	4	Gqd	2.830	0	57.4	10.4	32.2	3.0	26.4	.5	.7	1.6	0	tr (ap)
82F58A	5	Gto	2.811	0	53.5	16.6	29.9	7.8	15.6	3.8	2.3	.4	0	tr (ap)
82F59A	6	Gto	2.689	0	74.5	20.7	4.7	.1	0	.9	2.8	.5	0	.5 (sec,m)
82F32A		Gqd	2.740	2.8	51.0	8.1	38.0	m <	m	s	s	s	tr	tr (ap)
82F33A		Gqd	2.732	0	65.7	12.6	21.7	s	m	tr	s	s	0	tr (ap,al)
82F34A		Gdi	2.888	1.3	48.7	0	49.9	0	m	tr	s	s	tr	tr (ap)
Average			2.774	1.4	59.6	11.2	27.6	2.5	11.5	3.2	3.8	1.0	.2	tr
Standard dev.			.066	2.1	8.6	5.8	13.0	3.2	10.1	2.4	2.6	.6	.3	--
n			9 →					6 →						

Table 22B.--Modes (volume percent) and specific gravities of samples from the Dumbell Mountain plutons: unit "dag" of Cater and Crowder (1967) (Headings as in table 22A)

81F287A	1	Gto	2.749	0	56.1	33.3	10.6	0	9.3	tr	0	1.2	.1	tr (ap)
81N159A	2	Gto	2.724	0	54.8	32.1	13.1	4.6	6.8	.7	.4	.5	.2	tr (p,z)
82F38A	3	Gto	2.674	0	61.9	34.6	3.6	tr	3.0	tr	.1	.4	tr	0
82F42A	4	Gto	2.713	1.0	57.4	30.4	11.2	4.2	1.3	3.0	2.1	.6	0	tr (ap)
82F43A	5	Gto	2.710	2.8	57.9	28.0	11.2	8.2	0	2.6	tr	.3	.1	tr (al,ap)
82F55A	6	Gto	2.826	0	60.8	17.7	21.6	.6	18.2	0	1.4	1.4	0	
82G36A	7	Gto	2.662	tr	53.4	26.2	20.4	9.0	0	0	1.1	tr	0	10.3 (m)
82G31A		Gto	2.686	0	53.1	39.8	7.1	tr	m	tr	s	s	tr	tr (ap)
82G32A		Gto	2.784	.1	54.3	21.8	23.8	s	m	tr	tr	s	tr	tr (ap)
82G35A		Gto	2.708	0	60.3	31.6	8.1	tr	m	s	s	s	tr	tr (ap)
Average			2.724	.4	57.0	29.6	13.1	3.8	5.5	.9	.7	.6	0	tr
Standard dev.			.051	.9	3.2	6.4	6.7	3.8	6.6	1.3	.8	.5	0	--
n				10 →				7 →						

Table 22C.--Modes (volume percent) and specific gravities of samples from the Dumbell Mountain plutons: unit "dqg" of Cater and Crowder (1967) (Headings as in table 22A)

82S17A	1	Gto	2.637	.4	59.2	37.4	3.0	0	2.7	.1	.1	tr	tr	tr (ap)
82S18A	2	Gqd	2.867	0	60.3	3.7	36.0	3.1	24.8	6.1	1.4	.7	0	tr (ap)
Average			2.752	.2	59.7	20.6	19.5	1.6	13.8	3.1	.8	.4	tr	tr
Standard dev.			.163	.3	.8	23.8	23.3	2.3	15.6	4.2	.9	.5	--	--
n			2 →											

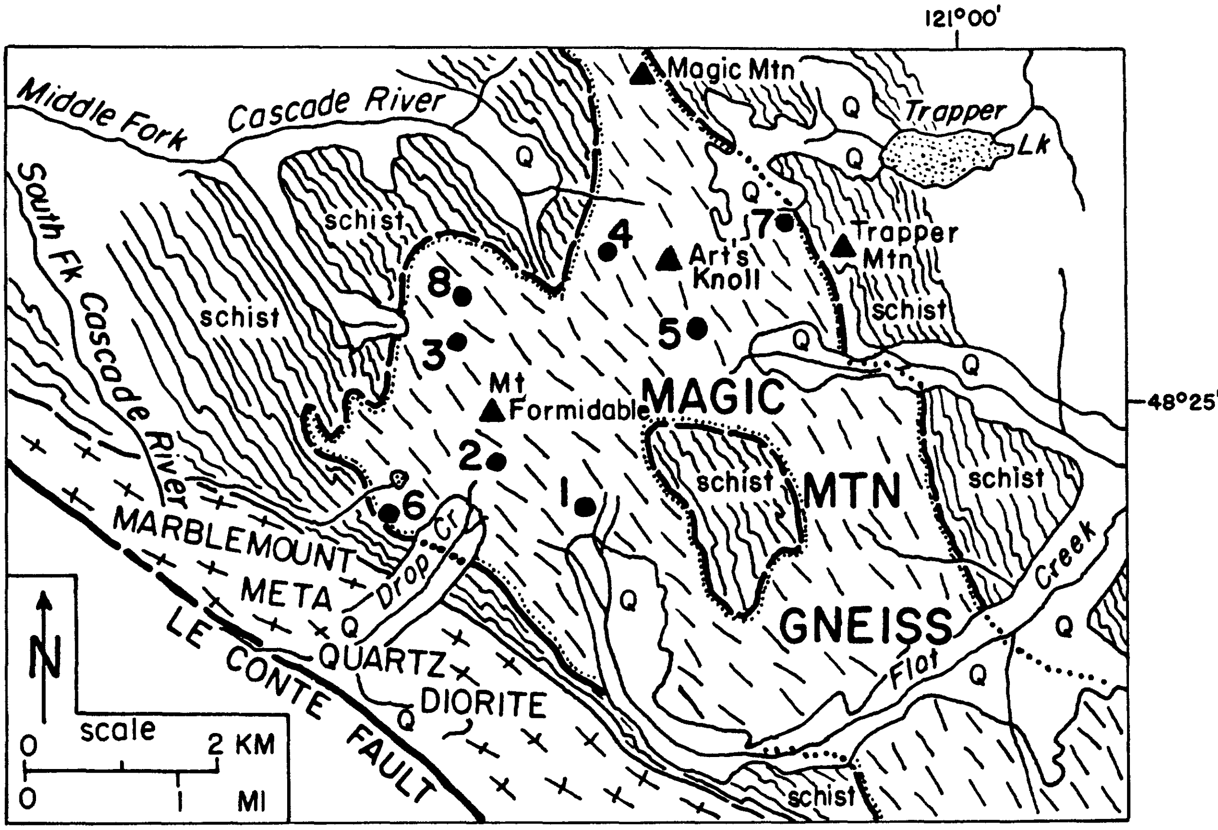


Figure 64.--Geologic sketch map of the Magic Mountain Gneiss, showing approximate sample sites. Chiefly from mapping of Tabor (1961).

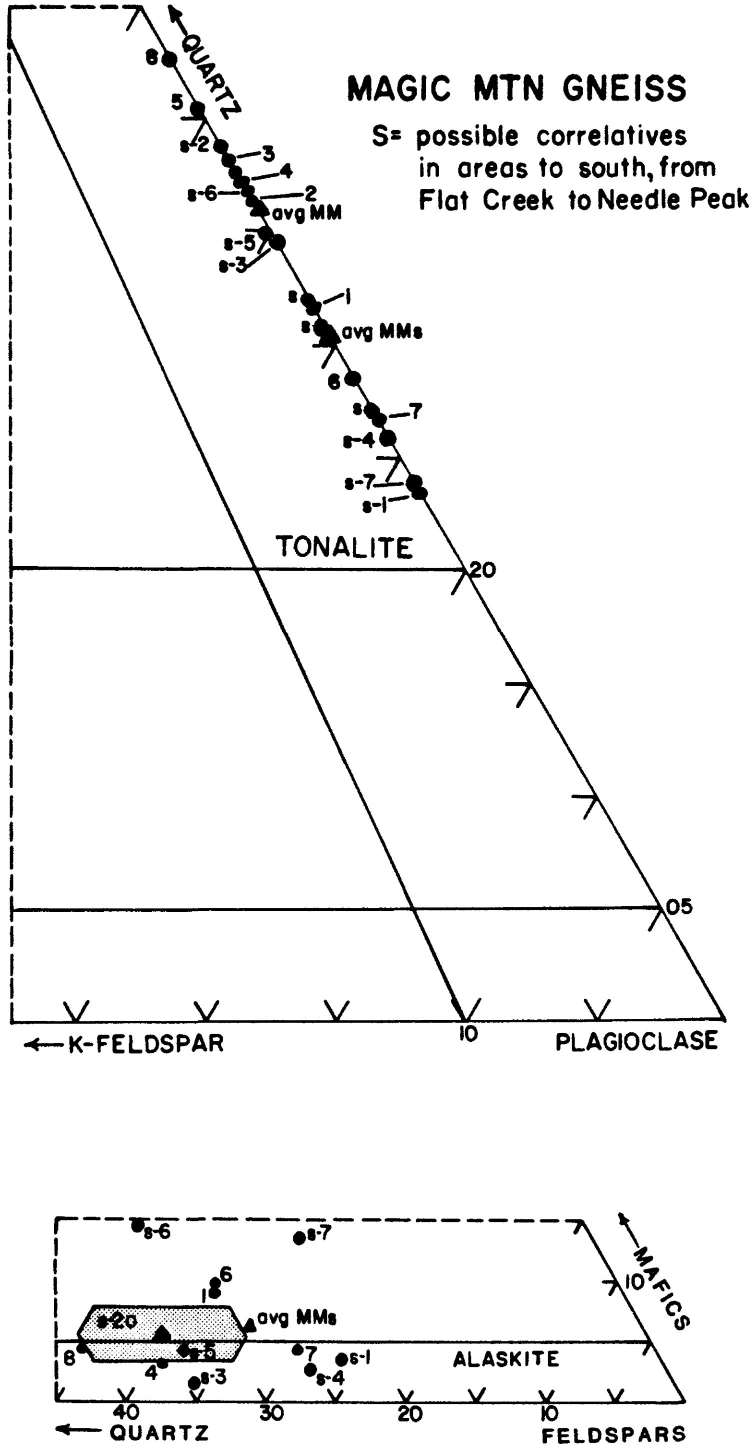


Figure 65.--Proportions of modal minerals in leucocratic samples from the Magic Mountain Gneiss, showing rock classification in upper diagram. Unit also includes locally major amounts of schistose mafic rock. Samples marked "s" are from units to south of map area (fig. 64) which possibly correlate with the Magic Mountain Gneiss.

Table 23A.--Modes (volume percent) and specific gravities of samples from the Magic Mountain Gneiss in area north of Flat Creek

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Muscovite	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
81F95A	1	Gto	2.662	0	61.9	29.1	9.0	0	0	2.4	4.0	1.7	tr	.9 (g)
81F96A	2	Ga	2.672	0	61.3	35.1	3.6	0	tr	.3	.2	1.7	0	1.4 (sec,c)
81F97A	3	Gto	2.727	0	58.5	35.9	5.6	0	tr	4.3	1.1	.1	0	.1 (g)
81F100A	4	Ga	2.638	0	60.8	35.8	3.4	0	tr	.3	2.1	1.0	0	tr (ap)
81F201A	5	Ga	2.692	0	55.4	37.6	4.6	0	2.4	3.1	1.1	.4	0	tr (g)
81L1A	6	Gqd	2.635	0	59.6	28.9	9.5	0	2.0	.4	8.9	.2	0	0
81N112A	7	Ga	2.692	0	69.8	25.6	4.6	0	tr	.6	.9	.7	0	2.3 (sec,m)
82F234A	8	Ga	2.657	0	46.9	41.0	4.4	0	7.7	0	3.4	1.0	0	0
81F199A		Gto	2.723	0	59.2	35.5	5.3	tr	s	s	s	s	0	0
Average			2.678	0	59.3	34.5	5.6	0	tr	1.4	2.7	.9	0	tr
Standard dev.			.034	--	6.1	4.9	2.2	--	--	1.6	2.8	.6	--	--
n			9 →					8 →						

Table 23B.--Modes (volume percent) and specific gravities of samples from probable correlatives of the Magic Mountain Gneiss in area south of Flat Creek (Headings as in table 23A)

Sample No.															
81F233B	1	Ga	2.637	0	73.8	22.8	3.4	0	0	0	.2	1.6	.8	0	.7 (sec,p)
81F234A	2	Gto	2.687	0	57.2	36.2	6.6	2.0	0	0	2.0	2.3	.3	0	tr (m)
81F237A	3	Ga	2.633	0	64.5	34.1	1.4	0	tr	0	tr	.8	.3	0	.2 (m)
81F238A	4	Ga	2.662	0	72.0	25.2	2.8	0	.5	0	.1	1.2	.8	0	.2 (sec)
82F119A	5	Ga	2.662	.2	62.1	33.4	4.4	.1	0	.2	.6	1.8	.9	tr	.9 (p,sec)
82F121A	6	Gto	2.733	0	53.7	31.9	14.4	.1	5.5	.1	3.0	4.2	1.6	0	tr (ap)
82F123A	7	Gto	2.782	0	65.9	20.7	13.4	tr	8.7	.2	1.1	1.5	1.4	0	.5 (m)
81F239A		Gto	2.685	0	64.0	29.8	6.2	tr	m	0	s	s	s	tr	tr (ap)
81F261A		Ga	2.659	0	70.7	26.1	3.2	tr	0	0	s	s	s	0	tr (al,ap)
82F124A		Gto	2.757	.2	65.0	29.0	5.8	0	0	s	s	s	s	0	tr (ap)
Average			2.690	tr	64.9	28.9	6.2	tr	2.1	tr	1.0	1.9	.9	tr	.4
Standard dev.			.051	--	6.3	5.1	4.4	--	3.5	--	1.1	1.1	.5	--	.4
			10 →					7 →							

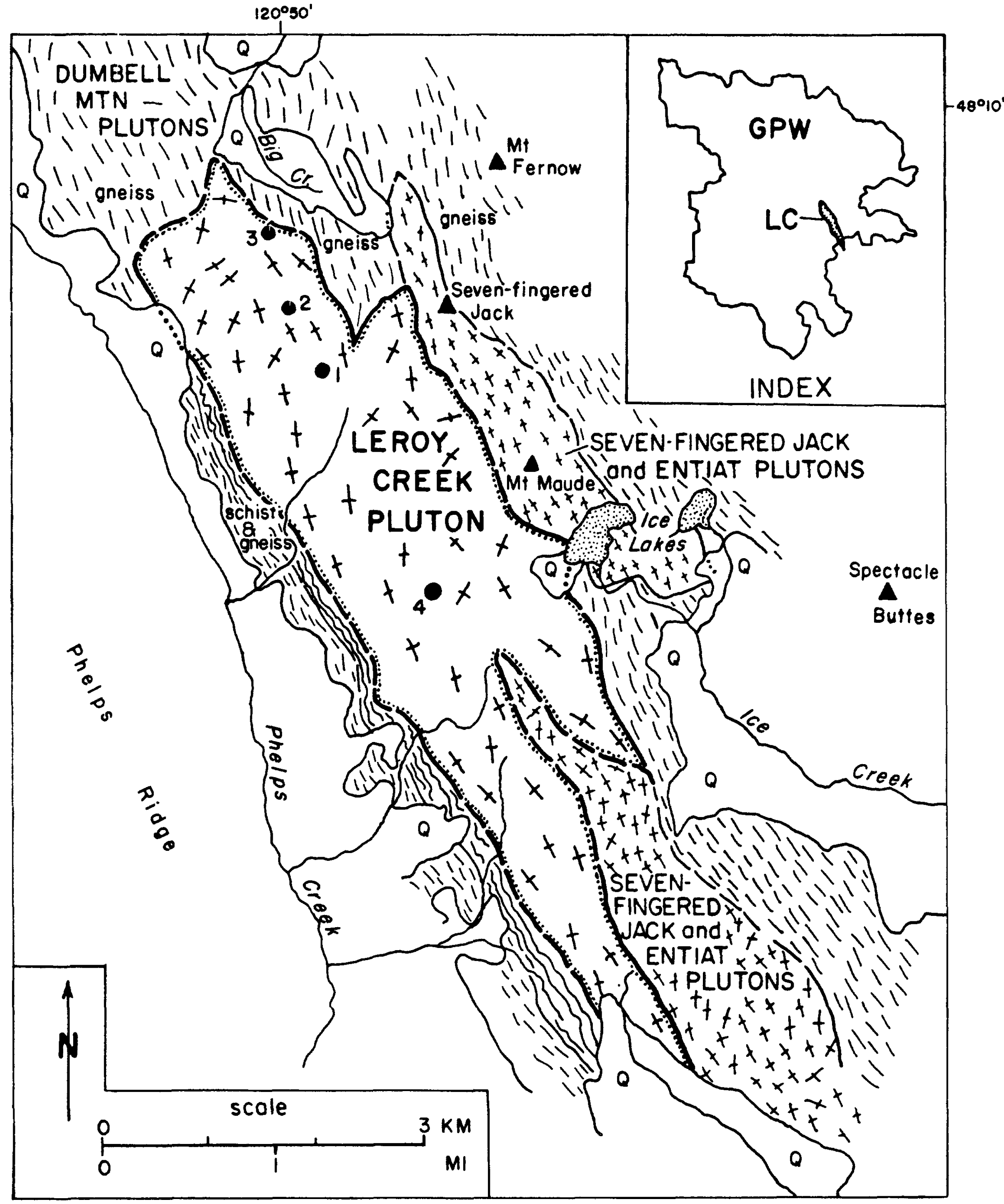


Figure 66.--Geologic sketch map of the Leroy Creek pluton, showing approximate sample sites. From mapping of Cater and Crowder (1967).

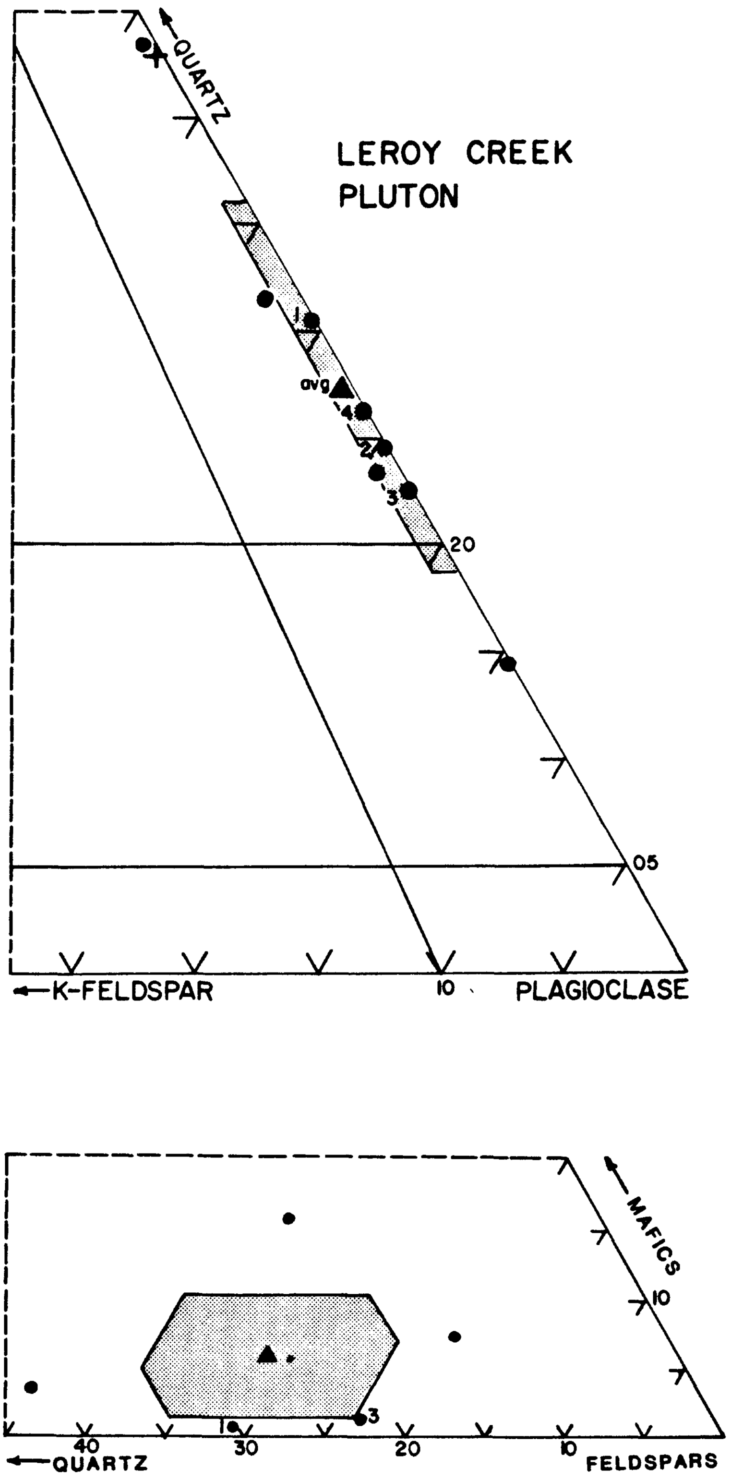


Figure 67.--Proportions of modal minerals in samples from the Leroy Creek pluton, showing rock classification in upper diagram.

Table 24.--Modes (volume percent) and specific gravities of samples from the Leroy Creek pluton

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Muscovite	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
81F277A	1	Ato	2.633	0	69.0	30.2	.8	.1	0	0	tr	.6	.1	0	tr (sec)
81F278A	2	Ato	2.652	0	72.3	23.9	3.8	3.0	0	tr	.3	tr	.2	0	tr (ap)
81F285A	3	Ato	2.671	.1	76.4	22.2	1.3	.6	0	s	.3	.3	.1	0	tr (sec,ap)
81G26A	4	TO	2.660	0	68.7	24.7	6.7	5.5	0	tr	.3	.2	.6	0	.1 (sec)
81F278B		TOf	nd	.8	64.0	19.5	15.7	0	s	0	m	tr	s	tr	tr (z,ap)
82G25A		TO	2.619	1.6	62.6	29.9	6.0	s	0	s	s	s	s	tr	tr (al,ap)
82G27A		QDf	2.697	0	79.5	13.3	7.2	s	0	s	s	s	s	tr	s (p)
82G29A		Ato	2.637	.5	54.4	41.8	3.4	s	0	0	tr	s	s	tr	tr (ap)
Average			2.653	.4	68.4	25.7	5.6	2.3	tr	tr	.2	.3	.3	tr	tr
Standard dev.			.026	.6	8.0	8.5	4.7	2.5	--	--	.2	.3	.2	--	--
n			7	8 ⟶				4 ⟶							

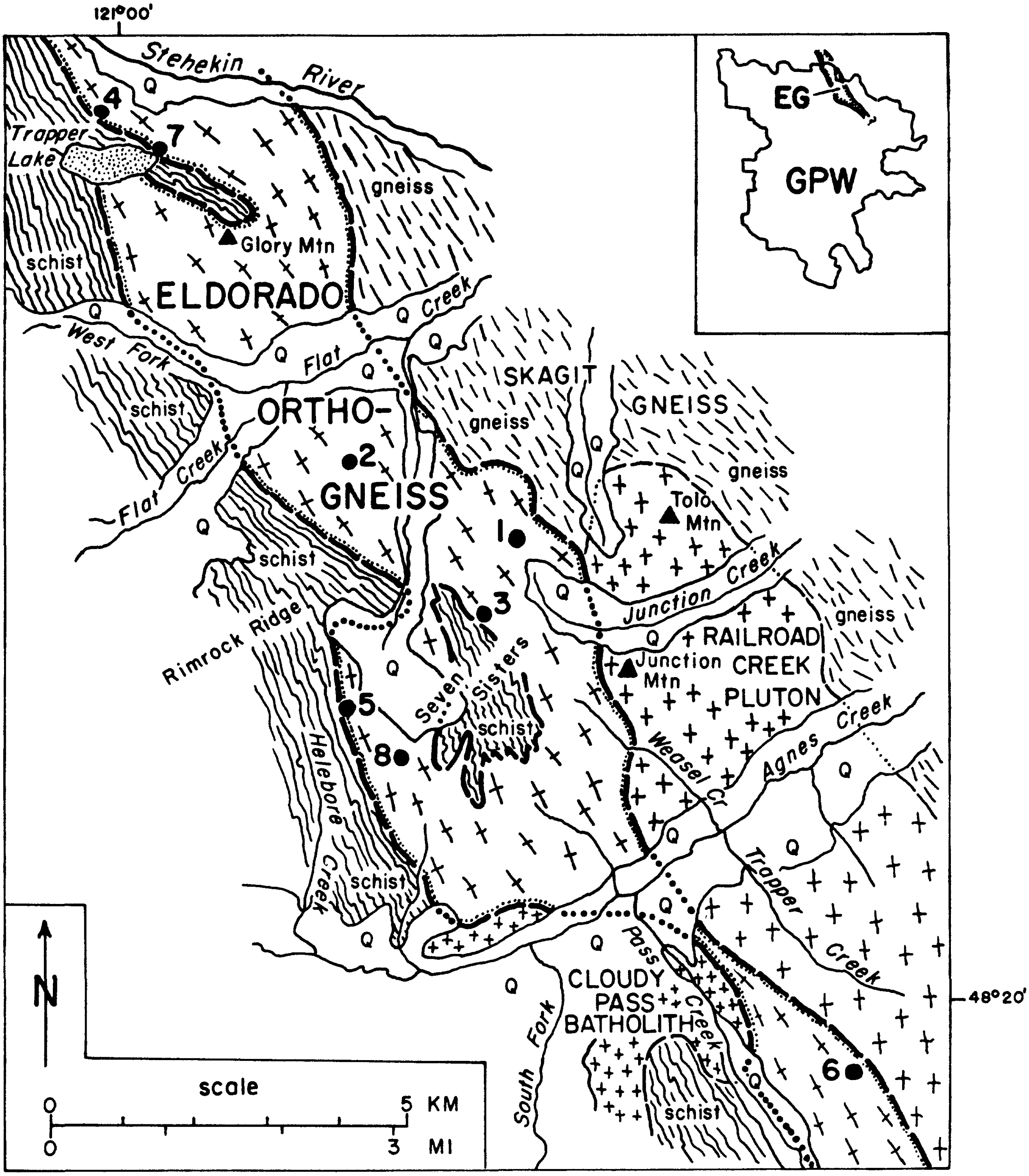


Figure 68.--Geologic sketch map of the Eldorado Orthogneiss, showing approximate sample sites. From mapping of Tabor (1961) in area north of Agnes Creek.

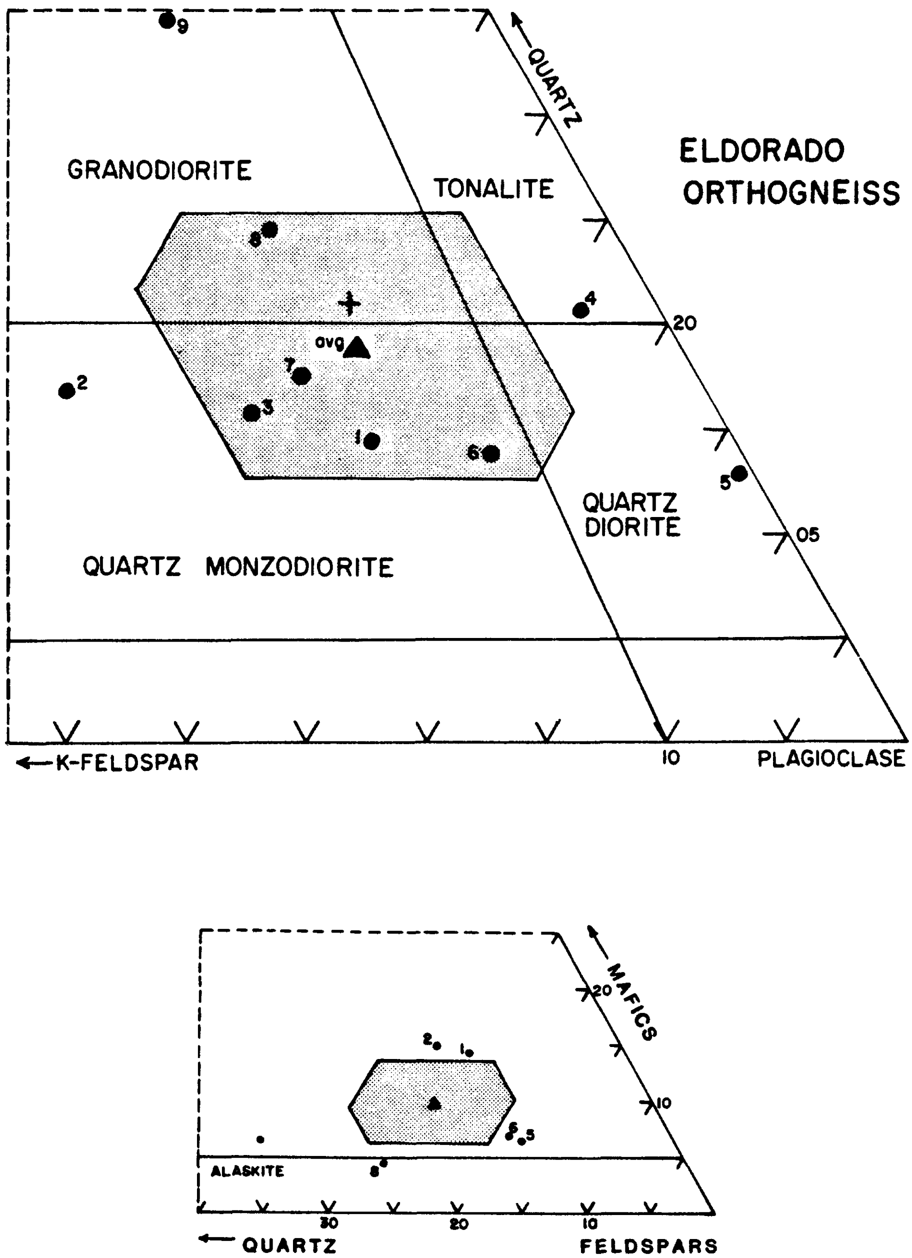


Figure 69.--Proportions of modal minerals in samples from the Eldorado Orthogneiss, showing rock classification in upper diagram. "+," porphyritic rock from small body possibly related to main unit.

Table 25.--Modes (volume percent) and specific gravities of samples from the Eldorado Orthogneiss (Sample 81F206A, from a porphyry body, not included in averages)

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others	
81F63A	1	Gqm	2.670	13.0	60.9	12.1	14.1	0	5.9	.4	4.8	.7	.7	1.6	(sec,c)
81F174A	2	Gqm	2.683	22.8	48.0	14.3	14.9	0	6.2	2.6	4.2	.7	1.0	.3	(sec)
81F175A	3	Gqm	2.671	18.0	59.6	14.2	8.2	2.2	4.0	.1	.6	.7	.4	.3	(sec)
81F205A	4	Gto	2.700	3.0	66.3	17.9	12.8	6.7	3.7	.9	.6	.1	.7	0	
81F229A	5	Gto	2.690	.7	80.8	11.9	6.5	3.2	.1	.7	1.1	1.0	0	.5	(sec,t)
81F244A	6	Gqm	2.670	9.9	70.4	12.7	7.0	0	3.6	.2	1.9	.8	.3	.2	(sec)
81N117A	7	Gqm	2.696	14.3	57.6	15.4	12.8	3.3	7.5	.2	.2	.6	.8	.1	(sec,ap,z)
81N132A	8	Gqd	2.612	13.6	58.2	23.5	4.7	0	0	0	tr	tr	tr	4.7	(sec)
81F64A	9	Gqd	2.608	12.9	48.5	32.0	6.7	--	--	--	--	--	--	--	
81F206A	10	GDp	2.729	11.1	56.8	17.7	14.4	1.2	1.3	.3	8.7	1.9	.7	.3	(sec,ap)
Average			2.667	12.0	61.1	17.1	9.7	1.9	3.9	.6	1.7	.6	.5	1.0	
Standard dev.			.034	6.9	10.3	6.7	3.9	2.4	2.7	.9	1.8	.4	.4	1.6	
n			9 ⟶					8 ⟶							

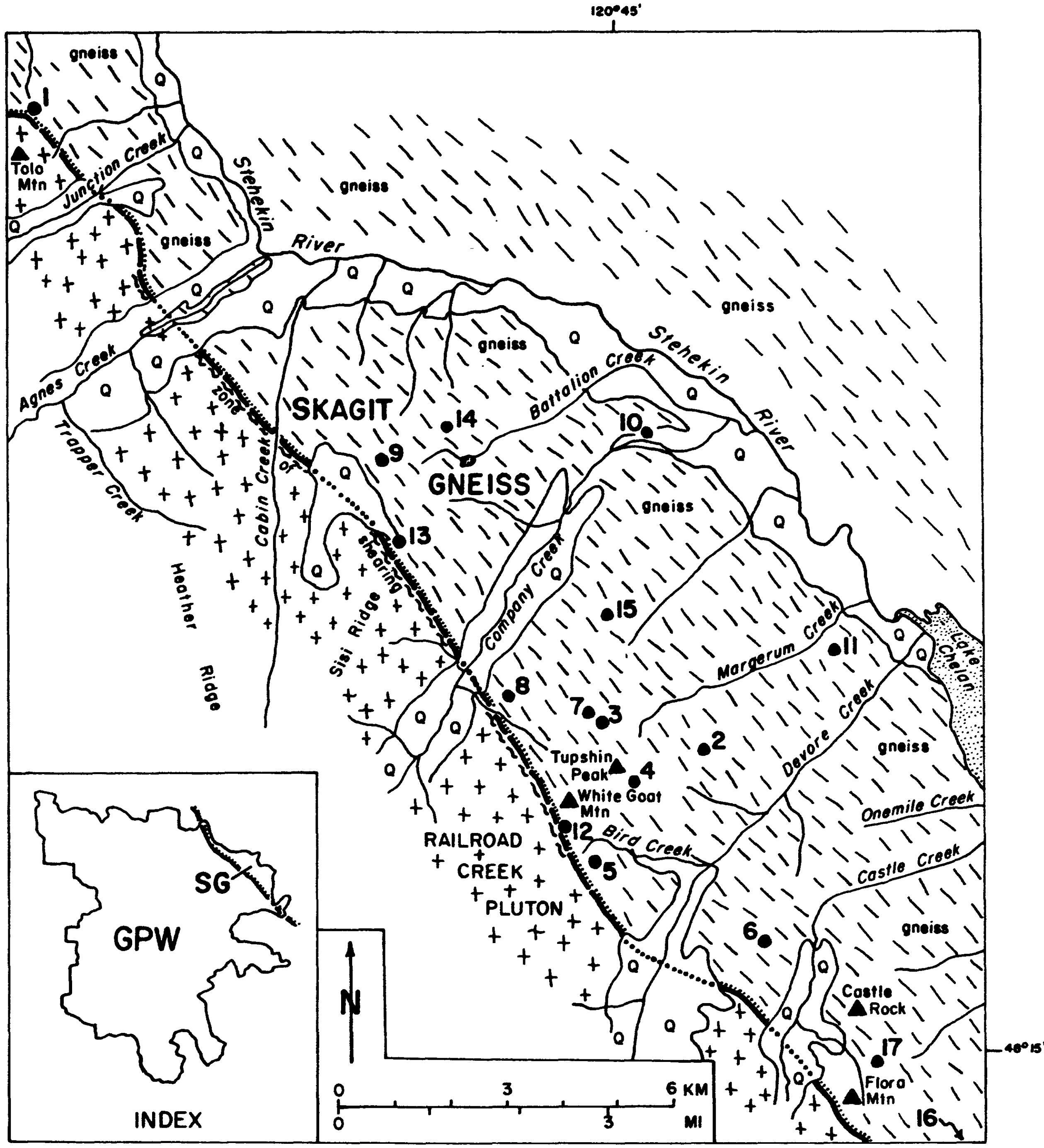
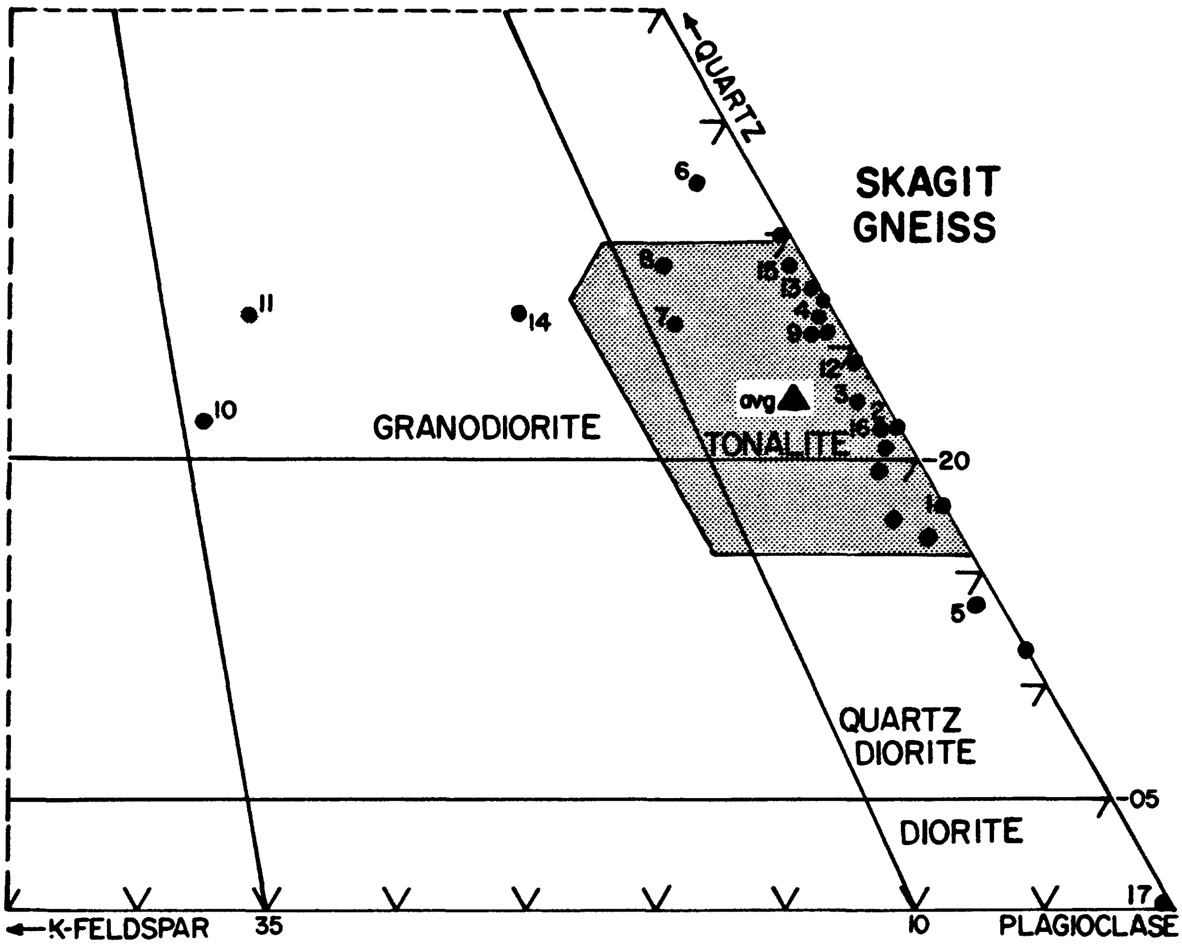


Figure 70.--Geologic sketch map of part of the Skagit Gneiss, showing approximate sample sites. From mapping of Tabor (1961) north of Agnes Creek, and Libby (1964) between Agnes Creek and Flora Mountain. Area of Flora Mountain and to southeast, mapped as Swakane Biotite Gneiss by Cater and Wright (1967), here correlated with the Skagit Gneiss.



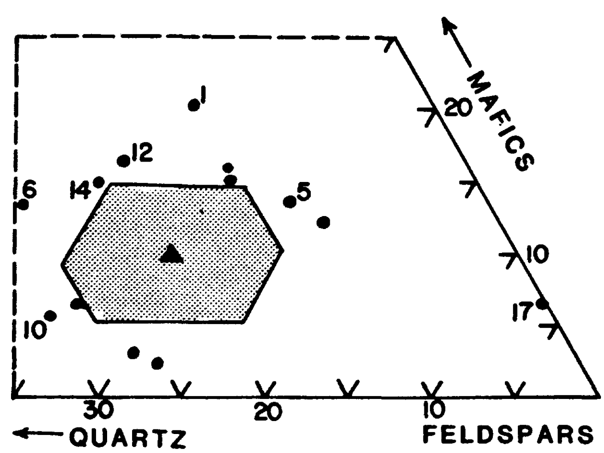


Figure 71.--Proportions of modal minerals in samples from the Skagit Gneiss, showing rock classification in upper diagram.

Table 26.--Modes (volume percent) and specific gravities of samples from the Skagit Gneiss

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
81F57A	1	Gqd	2.735	0	65.4	14.4	20.2	12.8	6.4	tr	.2	.6	tr	.2 (sec,ap,z)
81F289A	2	TOf	2.714	0	72.2	19.8	7.9	4.8	1.3	0	.1	.4	tr	1.3 (g,al)
81F290B	3	TOf	2.670	.9	69.4	20.5	9.2	7.5	0	0	.9	.8	tr	.1 (al,ap)
81F291A	4	TOf	2.660	.3	65.6	24.0	10.0	8.4	0	0	1.1	.3	.2	.1 (al,ap)
81F292A	5	Gqd	2.723	.9	73.8	11.9	13.5	1.4	7.5	0	3.4	.7	.5	tr (ap,z)
81F293A	6	TOf	2.695	2.3	56.6	27.9	13.2	11.3	0	0	.9	.3	.7	.1 (al,ap)
81L49A	7	TOf	2.685	5.8	59.2	22.8	12.2	11.2	0	0	.2	.8	0	tr (ap,z,al)
81N104A	8	Gto	2.667	5.1	61.5	26.9	6.5	5.5	0	tr	.7	.3	0	tr (ap,al)
81N138A	9	Gto	2.680	1.1	66.1	22.9	9.8	9.0	0	0	.2	.3	.2	.1 (al,ap)
81N139A	10	Gqr	nd	25.3	39.1	30.2	5.4	4.7	0	0	.3	.4	0	tr (al,ap,z)
81N140A	11	GDf	2.642	21.4	48.0	24.9	5.6	4.5	0	0	.9	.2	tr	tr (ap,z)
81N163A	12	Gto	2.690	.3	62.9	20.4	16.4	14.0	1.3	0	.8	.3	tr	tr (al,ap)
81S17A	13	TOf	2.660	.2	66.2	25.6	8.0	5.8	0	tr	1.6	.5	tr	tr (ap)
81S21A	14	GDf	2.695	10.4	52.1	22.6	14.9	13.9	.1	tr	.2	.1	.5	tr (al)
81S22A	15	TOf	2.660	.6	66.3	27.2	6.0	2.6	3.0	tr	.2	.1	.1	tr (ap,al)
82F51A	16	TOf	2.685	.2	71.4	19.9	8.6	5.7	2.0	0	.4	.4	0	tr (ap,al,z)
82F53A	17	DIf	2.680	0	93.5	.1	6.4	6.0	0	0	.1	.3	0	tr (z,ap)
81F59A		QDf	2.645	1.7	73.3	18.1	6.8	m	tr	tr	tr	tr	s	tr (ap)
81F269A		TOf	2.659	.2	71.2	19.3	9.4	m	tr	0	s	s	tr	tr (ap)
81N105D		TOf	nd	.2	65.2	28.0	6.6	m	0	0	tr	s	tr	tr (ap,z)
81S16B		TOf	nd	.9	71.4	18.6	9.1	--	--	--	--	--	--	--
81S18G		Gqd	2.715	1.3	68.8	14.1	15.9	--	--	--	--	--	--	--
71S24C		QDf	nd	2.2	67.9	14.7	15.2	--	--	--	--	--	--	--
82F52A		QDf	2.737	0	77.5	10.5	12.1	m >	m	tr	s	tr	s	tr (ap,al)
82S13A		TOf	2.617	.9	71.5	25.2	2.4	s	0	0	tr	s	tr	tr (ap,z)
82S13B		TO	2.655	.1	70.6	26.3	3.0	s	0	tr	tr	tr	s	tr (ap,z)
Average			2.680	3.2	66.4	20.7	9.8	7.6	1.3	tr	.7	.4	.1	tr
Standard dev.			.031	6.4	10.2	6.7	4.4	3.9	2.3	--	.8	.2	.2	--
n			22	26 →				17 →						

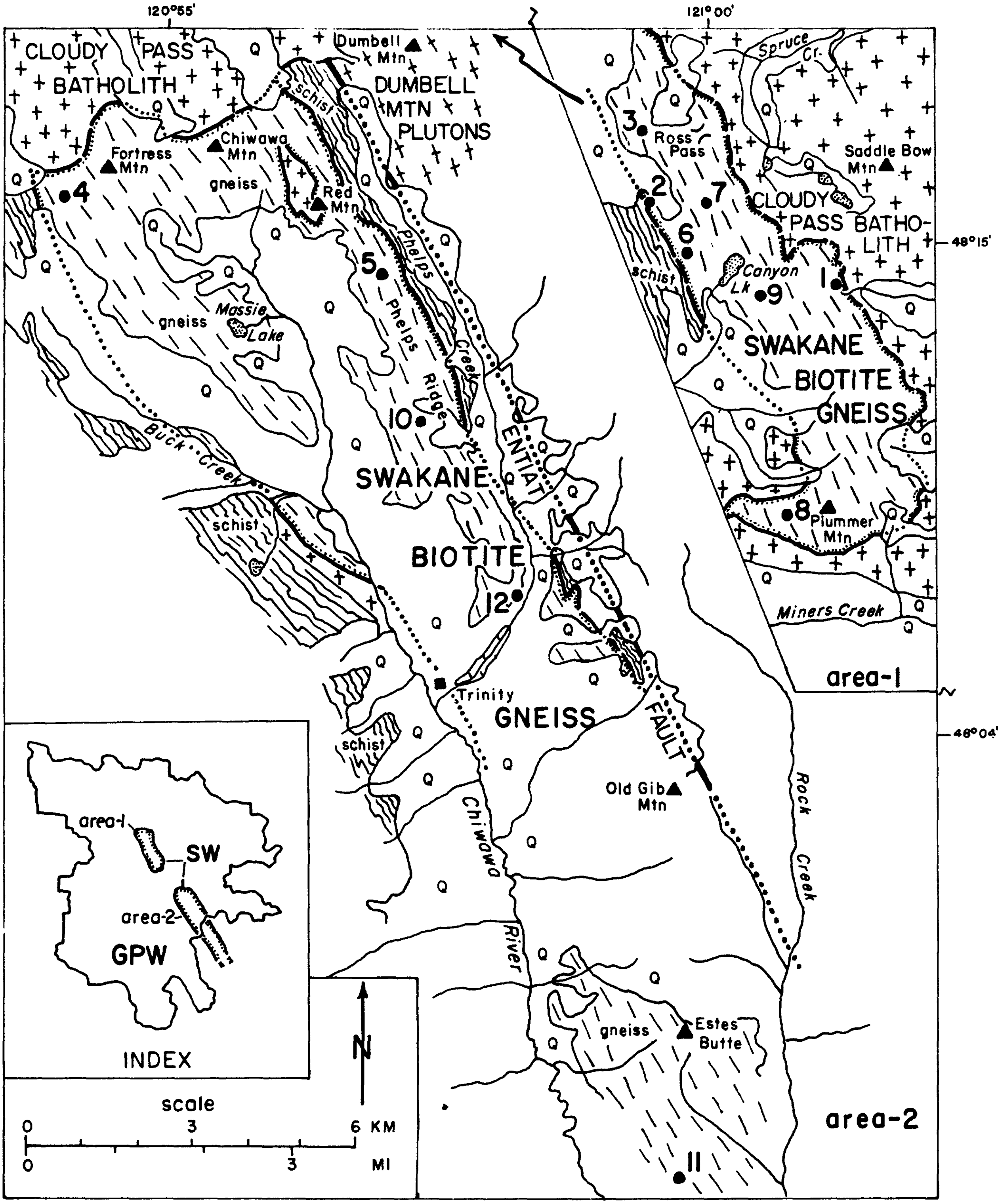
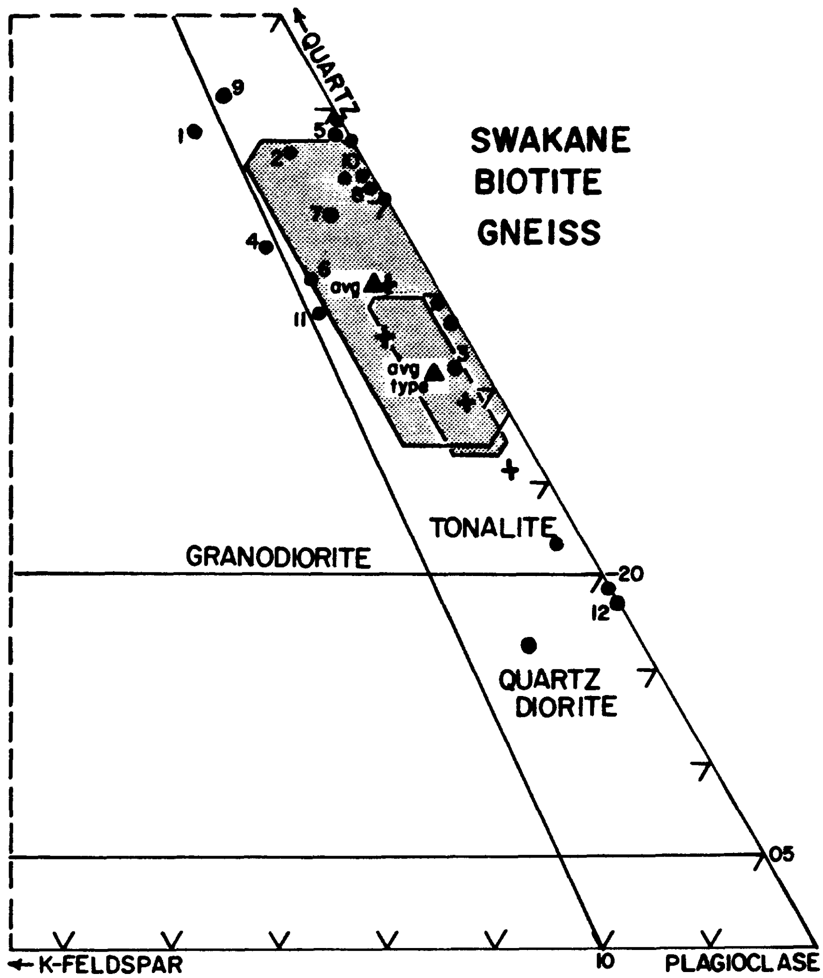


Figure 72.--Geologic sketch map of part of the Swakane Biotite Gneiss, showing approximate sample sites. Main map (area 2) from Cater and Crowder (1967). South end of inset map (area 1) is about 3 km north of main map area.



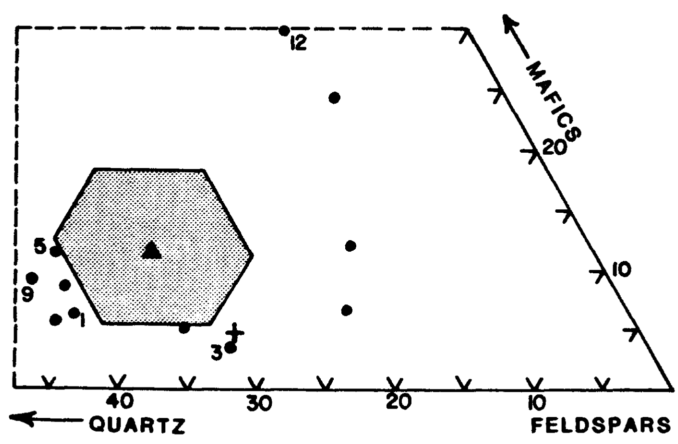


Figure 73.--Proportions of modal minerals in samples from the Swakane Biotite Gneiss, showing rock classification in upper diagram. "+" shows samples from type area near the Columbia River (average only in lower diagram).

Table 27A.--Modes (volume percent) and specific gravities of samples from the Swakane Biotite Gneiss of type area near Columbia River

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
82SW-1	1	Gto	2.669	3.7	60.0	31.2	5.2	tr	tr	3.8	.5	tr	.9 (m,c)
82SW-2	2	Gto	2.692	2.7	59.4	33.6	4.3	4.1	tr	.1	.1	tr	tr (ap)
82SW-3	3	Gto	2.727	1.3	66.4	23.3	9.0	7.9	.1	.3	.7	.1	0
82SW-4	4	Gto	2.670	1.9	68.1	29.2	.8	.7	tr	tr	tr	tr	tr (sec)
Average			2.690	2.4	63.5	29.4	4.8	3.2	tr	1.0	.3	tr	.2
Standard dev.			.027	1.0	4.4	4.4	3.4	3.6	--	1.8	.3	--	.4
n			4										

Table 27B.--Modes (volume percent) and specific gravities of samples from the Swakane Biotite Gneiss of the Glacier Peak Wilderness

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Muscovite	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
81F71A	1	Gqd	2.680	6.8	45.8	41.0	6.3	5.9	0	0	.1	.2	.1	tr	tr (ap,g)
81F81A	2	Gto	2.683	2.9	46.6	36.7	13.8	13.0	0	0	tr	.5	.3	tr	tr (ap)
81F83A	3	Gto	2.650	1.7	64.6	30.1	3.5	3.2	0	0	0	.2	.1	tr	tr (ap)
81F271A	4	Gqd	2.674	6.4	50.4	34.2	9.0	7.5	0	tr	0	.2	.3	.1	.9 (sec)
81F276A	5	Gto	2.687	.6	48.9	38.8	11.6	9.5	0	tr	.1	1.1	.4	tr	.5 (sec)
81L44A	6	Gto	2.685	5.4	54.8	33.7	6.1	5.6	0	s	.2	.1	.1	tr	.2 (sec)
81L46A	7	Gto	2.705	2.6	49.0	33.6	14.8	14.1	0	0	.1	.1	.2	0	.2 (sec, g,ap)
81N98A	8	Gto	2.664	.6	51.5	35.9	12.0	11.0	0	0	.1	.6	.2	0	.2(sec,ap)
81N102A	9	Gto	2.680	4.5	44.8	41.6	9.0	8.1	0	0	tr	.2	.1	0	.5(sec,ap)
82G23A	10	Gto	2.668	.4	53.3	37.8	8.5	7.9	0	0	tr	.3	.2	0	.1 (sec)
82G24A	11	Gto	2.646	5.4	49.6	28.2	16.8	16.0	0	0	.1	.4	.2	tr	.1 (sec,g)
82S22A	12	Gqd	2.835	0	56.9	13.1	30.0	16.5	0	s	tr	1.2	2.5	0	9.9 (g,k)
81F40B		Gto	2.675	1.2	72.1	20.1	6.6	m	0	0	tr	tr	s	0	tr (ap,z)
81F80A		Gqd	2.785	4.0	59.2	12.3	24.5	--	--	--	--	--	--	--	--
81F273A		Gto	2.663	.3	52.2	41.6	5.9	0	0	0	s	s	s	tr	tr (ap)
81L45A		Gto	2.698	1.4	48.8	34.9	14.8	m	0	tr	s	tr	s	0	tr (ap)
81N99A		Gqd	2.700	0	70.6	17.3	12.1	m	s	0	tr	s	tr	s	tr (ap,z)
82F30A		Gto	2.670	0	55.2	37.3	7.5	m	0	s	tr	tr	s	0	s (g)
82G60A		Gto	2.642	0	51.8	39.5	8.7	m	0	m	0	tr	s	0	tr (ap)
82S21A		Gto	2.652	.3	61.6	32.8	5.3	m	0	m	s	s	s	0	m (g,k,ap)
82S21B		Gto	2.752	.1	56.8	28.9	14.2	m >	m	0	tr	s	s	0	tr (ap,sf)
Average			2.690	2.1	54.5	31.9	11.5	9.9	tr	tr	tr	.4	.4	tr	1.1
Standard dev.			.047	2.3	7.6	9.0	6.5	4.3	--	--	--	.4	.7	--	2.8
n			21 →					12 →							

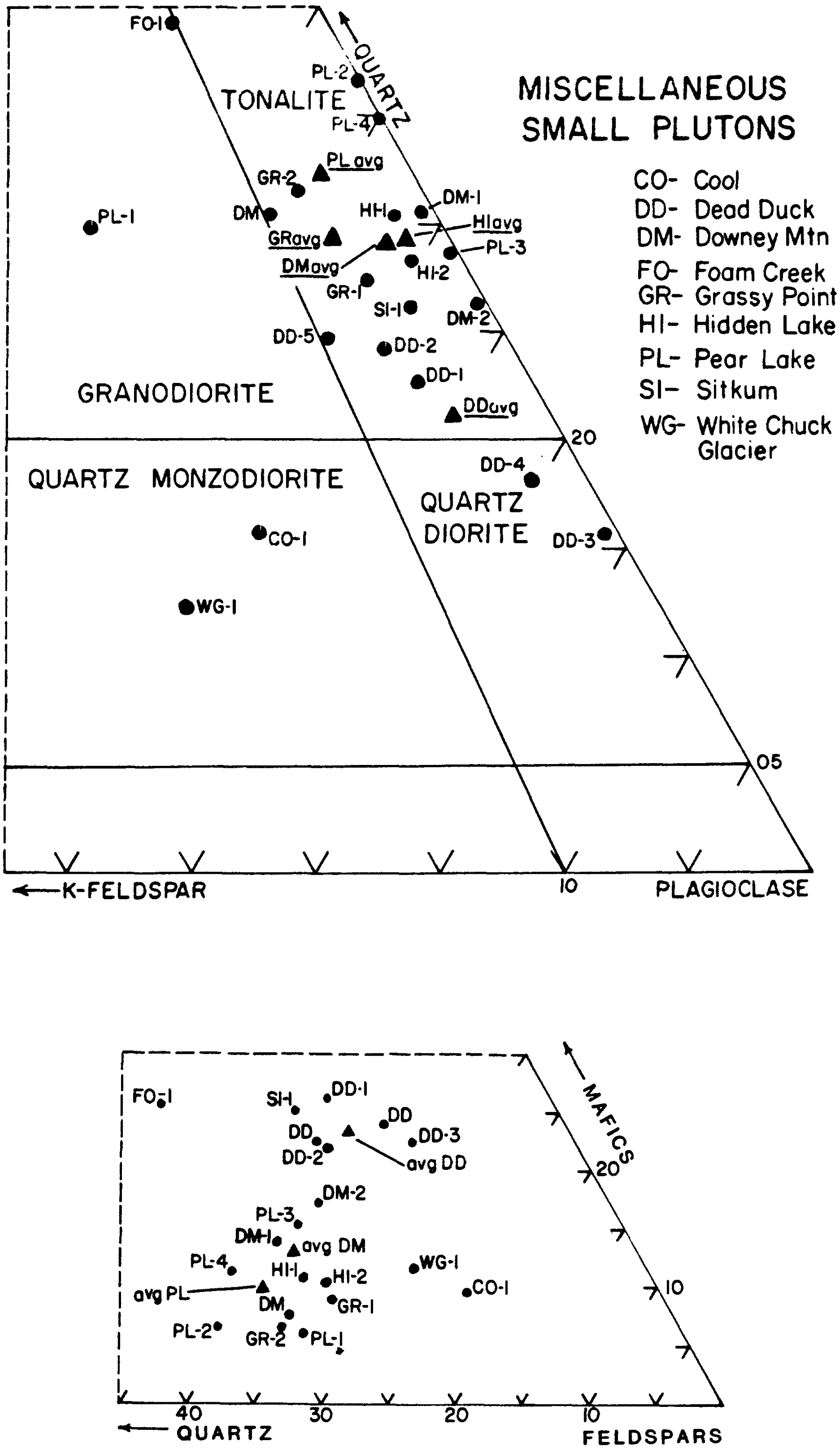


Figure 74.--Proportions of modal minerals in samples from miscellaneous small plutons, showing rock classification in upper diagram. See figure 2 for locations of units.

Table 28.--Modes (volume percent) and specific gravities of samples from miscellaneous small plutons

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Pyroxene	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
Sitkum stock															
81F307A	1	TO	2.789	2.3	53.0	19.6	25.1	10.1	8.9	4.8	.1	.1	1.0	0	tr (ap)
White Chuck Glacier stock															
81F326A	1	QM	2.740	10.7	60.3	17.1	11.9	4.7	.1	5.8	tr	0	1.3	0	tr (ap)
Cool stock															
81F345A	1	QM	2.693	13.0	63.0	14.4	9.6	2.9	4.3	tr	.2	.8	1.0	tr	.3 (ap,sf)
Dead Duck pluton															
81F319A	1	TO	2.789	3.5	53.6	16.8	26.1	7.4	17.2	.5	.1	0	.8	tr	.1 (sec,ap)
81F321A	2	TO	2.783	4.0	55.2	18.8	22.0	5.2	9.5	5.6	.5	0	1.2	tr	tr (ap)
82F158A	3	QD	2.779	.3	65.2	12.2	22.4	6.8	14.8	.1	0	.1	.6	tr	tr (ap)
81F320A	4	QD	2.786	2.0	60.2	13.7	24.1	m ≈	m	s	tr	0	s	tr	tr (ap,z)
81F322A	5	TO	2.728	5.7	52.4	19.3	22.6	s	m	s	tr	0	s	tr	tr (ap)
Average			2.773	3.1	57.3	16.2	23.4	6.5	13.8	2.1	.2	tr	.9	tr	tr
Standard dev.			.025	2.1	5.3	3.1	1.7	1.1	3.9	3.1	.3	--	.3	--	--
n			5 →				→	3 →							→
Foam Creek stock															
81F329A	1	GDf	2.713	4.7	40.6	29.2	25.6	24.2	0	0	.5	.1	0	.8	s (m,ap)
Downey Mountain stock															
80F120A	1	TO	2.662	.5	59.2	26.3	14.0	10.6	2.3	0	tr	.4	.2	.1	.5 (sec,ap)
81F258A	2	TO	2.723	.4	60.6	21.8	17.2	9.6	6.3	0	tr	.4	.4	tr	.5 (g).
80F139A		GD	2.658	6.4	57.6	28.1	7.8	m	0	0	s	tr	tr	s	tr (ap,z)
Average			2.681	2.4	59.1	25.4	13.0	10.1	4.3	0	tr	.4	.3	tr	.5
Standard dev.			.036	3.4	1.5	3.2	4.8	.7	2.8	--	--	.0	.1	--	.0

Table 28.--Continued

Sample No.	Plot No.	Rock type	Specific gravity	Potassium feldspar	Plagioclase	Quartz	Total mafics	Biotite	Hornblende	Pyroxene	Epidote	Chlorite	Fe-Ti oxides	Sphene	Others
Grassy Point stock															
80F110A	1	TO	2.670	4.1	62.0	24.9	9.0	4.5	.4	0	1.2	1.2	.4	.7	.7 (sec, m,p)
80F111A	2	TO	2.662	4.7	59.0	29.6	6.7	3.9	0	0	.8	.8	.1	.7	.5 (sec,m, p,c)
Average			2.666	4.4	60.5	27.3	7.9	4.2	.2	0	1.0	1.0	.3	.7	.6
Standard dev.			.006	.4	2.1	3.3	1.6	.4	.3	--	.3	.3	.2	.0	.1
Hidden Lake stock															
82F155A	1	TO	2.673	1.6	58.3	25.9	11.9	8.6	0	0	2.4	.3	.1	.6	2.3 (m)
82F156A	2	TO	2.688	1.8	61.1	24.6	10.4	8.4	0	0	1.5	.2	tr	.3	2.1 (m)
Average			2.681	1.7	59.7	25.3	11.2	8.5	0	0	2.0	.3	tr	.5	2.2
Standard dev.			.011	.1	2.0	.9	1.1	.1	--	--	.6	.1	--	.2	.1
Pear Lake pluton															
82F176A	1	GDf	2.659	13.6	52.2	28.1	6.1	5.8	0	0	tr	.1	.2	0	tr (ap,z)
82F179A	2	TOf	2.672	0	59.1	34.1	6.8	6.5	tr	0	tr	.1	.1	.1	tr (z)
82F184A	3	TO	2.719	.4	60.2	24.0	15.4	12.9	.1	1.0	.3	.2	.3	.1	.5 (p,sec)
82F186A	4	TOf	2.689	0	57.5	31.0	11.5	10.4	0	0	tr	.1	.9	0	tr (m,z)
Average			2.685	3.5	57.3	29.3	10.0	8.9	tr	.3	.1	.1	.4	tr	tr
Standard dev.			.026	6.7	3.5	4.3	4.4	3.4	--	.5	.2	.1	.4	--	--

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