DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

# Magnetic susceptibility and density determinations for plutonic and metamorphic rocks of the Glacier Peak Wilderness and vicinity, northern Cascades, Washington

by

Arthur B. Ford[1], R.M. Senterfit[2] and Vincent J. Flanigan[2]

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[1]Menlo Park, California
[2]Denver, Colorado

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## ILLUSTRATIONS

## INTRODUCTION

This preliminary report provides data on magnetic susceptibility and density measurements of rock samples from most of the plutons, major gneiss units, and some schist units of the Glacier Peak Wilderness and vicinity, northern Cascades, Washington (fig. 1). The study is an outgrowth of the U.S. Geological Survey's geological (Ford and others, 1985) and geophysical (Flanigan and others, 1983; Sherrard and Flanigan, 1983; and Flanigan and Sherrard, 1985) investigations that were made as part of an assessment of the mineral-resource potential of the wilderness (Church and others, 1984).

The data were obtained to aid interpretation of the aeromagnetic map (Flanigan and Sherrard, 1985) and Bouguer gravity anomaly map (Sherrard and Flanigan, 1983) of the Glacier Peak Wilderness and vicinity and because no previous data have been published on magnetic susceptibilities of rocks from this general area of the northern Cascades.

The data in this report are for 282 rock samples from 38 plutons and gneiss and schist units of a nearly 3,000 sq km study area that transects a major central part of the northern Cascades immediately south of the North Cascades National Park: an area that extends from near Darrington on the west to Lake Chelan (fig. 1).

The physical properties listed in the data tables (tables 2-30) were determined to aid the interpretation of geophysical maps of the area: rock densities for the Bouguer gravity anomaly map (Sherrard and Flanigan, 1983), and rock magnetic susceptibilities for the aeromagnetic map (Flanigan and Sherrard, 1985).

Locations of plutons and gneiss units sampled in this study are shown (capitalized symbols) on the geologic sketch map of figure 2. A complete discussion of the geology of the area is beyond the scope of this preliminary data report. The abundant earlier work of others is referenced in Ford (1983a). Petrographic (modal) data and sketch geologic maps of the units of this study are in Ford and others (1985). Flanigan and others (1983) provide a preliminary geologic interpretation of the aeromagneitc map of the area, and subdivide the area into three broad magnetic provinces (fig. 3) characterized by different overall forms of anomaly patterns that in many areas rather closely reflect patterns of bedrock geology.

## ACKNOWLEDGMENTS

We appreciate much assistance in sample collecting and other field studies by the following participants in the 1980-82 fieldwork on the Glacier Peak Wilderness project: W.H. Nelson, R.A. Loney, R.A. Sonnevil, R.A. Haugerud, S.L. Garwin, and the late Carl Huie. We especially thank helicopter pilots Anthony Reece (Darrington, Wash.) and Gary Lott (San Jose, Calif.) for skills in getting us to samples sites in this terrain of unusually rugged alpine character and inclement weather.

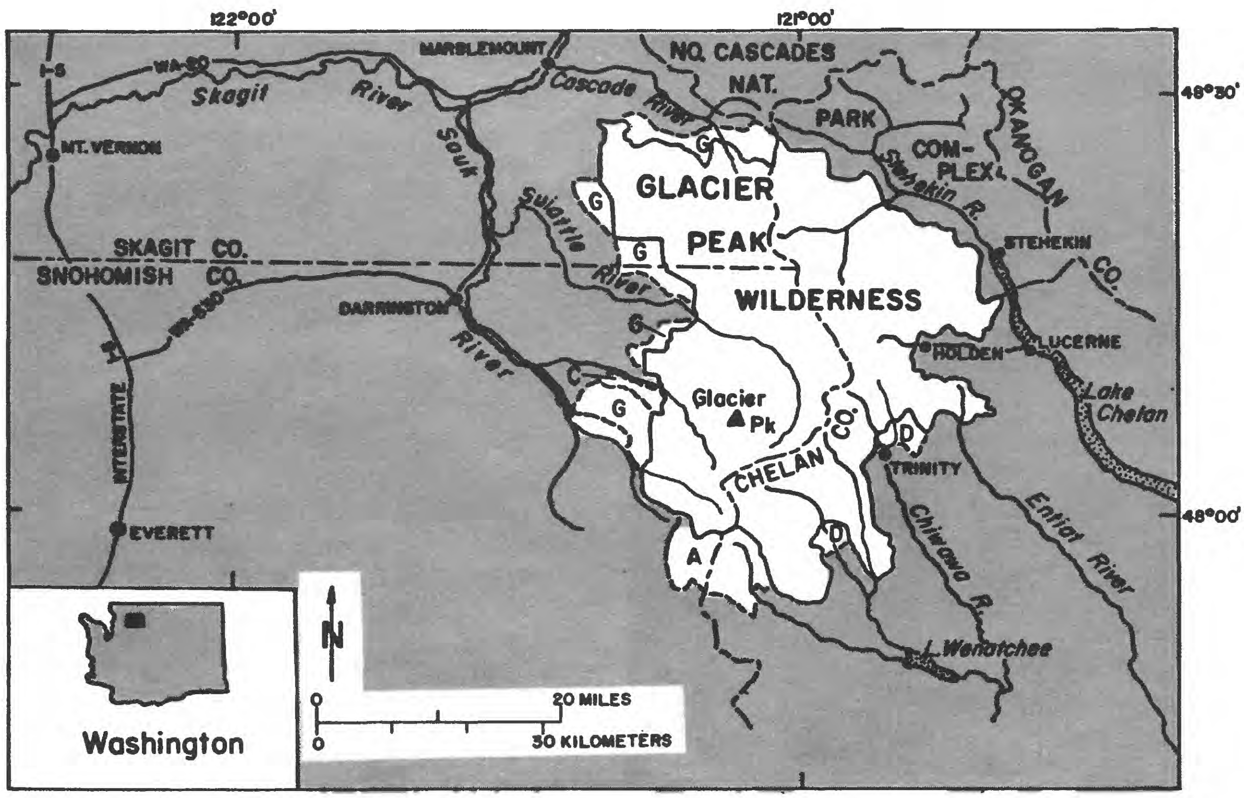


Figure 1.---Index map showing location of the Glacier Peak Wilderness and principal access routes. Areas A, C, D, and G are proposed wilderness additions (see Church and others, 1984).

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). TE includes area (TEw) mapped as White Mountain plutons by Cater and Crowder (1967). Unit abbrevations used in this report are as follows:

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

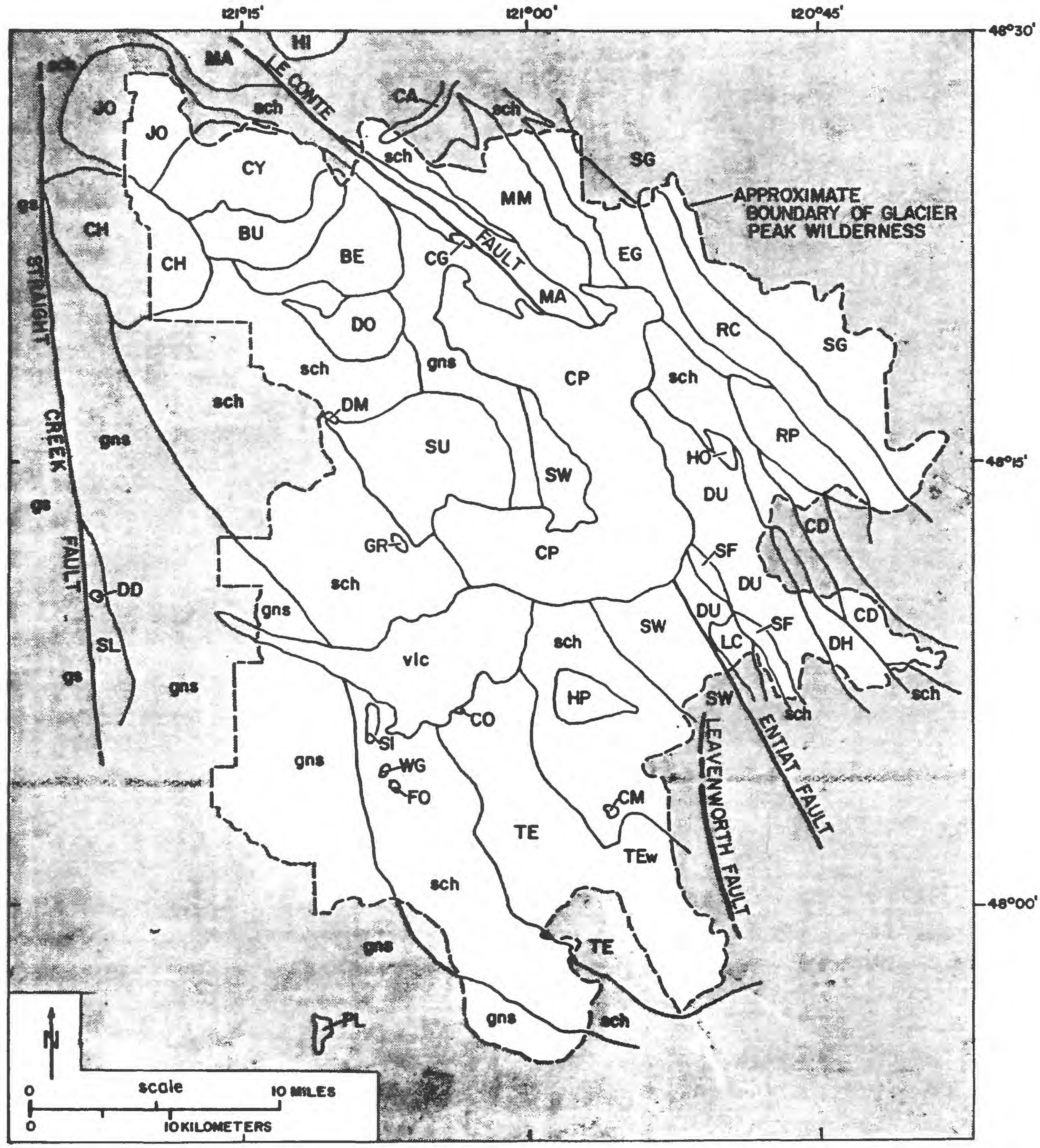


Figure 2.---(Caption on previous page)

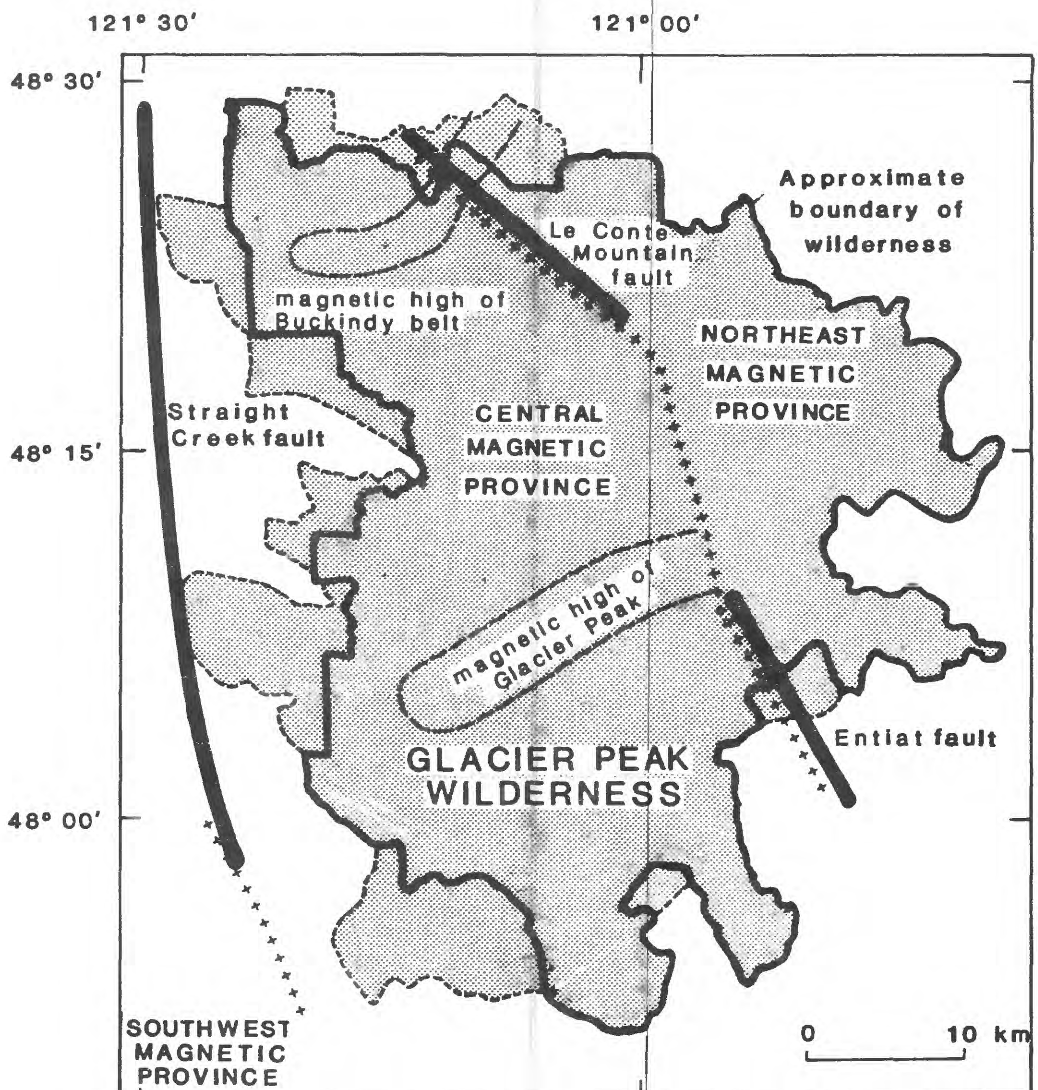


Figure 3.---Magnetic provinces of Glacier Peak Wilderness and vicinity, from Flanigan and others (1983).

## PRESENT STUDIES

### Samples and locations

The total of 282 rock samples of this study were selected on the basis of obtaining a broad lithologic and geographic representation of most of the units shown in figure 2. Figures 4-7 show summary plots (averages for units) of the petrographic data of Ford and others (1985). Sample sites except for schist units are shown approximately on geologic sketch maps of each unit (Ford and others, 1985); and locations of the sites are shown more exactly on a 1:100,000-scale topographic base (Ford, 1983b).

### Methods

Density. Densities were determined on whole rocks of generally fist size or larger by two different methods that yielded somewhat different results:

(1) using the relation,

$$\frac{\text{Weight of dry sample (g)}}{\text{Volume of sample (cm}^3\text{)}} = \text{Density (g/cm}^3\text{)}$$

where Volume of sample ($cm^3$) = Weight of sample in beaker of water - Weight of beaker of water; and

(2) using a direct-reading beam balance, by first balancing a dry sample in air and then rebalancing in water after a sufficient immersion period to allow all possible escape of air bubbles from cracks and adhering to surfaces (Ford and others, 1985).

Densities of 93 samples measured by method (1) are shown without asterisk (*) in tables 2-30, and those using method (2) for other samples are indicated by asterisk. We have not evaluated relative accuracies of the two methods, but in order to compare results, all samples were measured by method (2), which, for the 93 samples, yielded a mean difference of +0.040 g/$cm^3$ (one standard deviation = 0.022). In addition, rock densities calculated from mineral modes of Ford and others (1985), using assumed mineral densities, yielded a mean difference of +0.03 g/$cm^3$ compared to results by method (2).

Susceptibility determinations were made by use of a magnetic susceptibility bridge designed and built by Princeton Applied Research[1]

Susceptibility readings were obtained by measuring the same rock samples used for density measurement. Each sample was placed inside a coil and a reading was taken, then multiplied by a coil calibration, yielding the rock susceptibility in emu (electromagnetic unit, in cgs system). Volume susceptibility was calculated by dividing the result by the volume of the sample as determined in the density measurement procedure.

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[1]Use of brand names in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

## DATA SUMMARY

### Density

Average densities of units range from a high of 2.89 g/cm$^3$ for the gabbroic Riddle Peaks pluton to a low of about 2.65 g/cm$^3$ for several plutons and gneiss unit of leucocratic rock; and many units show a wide range of values (table 1). The densities show a close correlation (r = +0.94) with average total content of mafic minerals (fig. 9, in Ford and others (1985)).

### Magnetic susceptibility

Magnetic susceptibilities are widely variable within and between units (tables 2-30). Averages for units range from a high of 6.0x10$^{-3}$ emu/cm$^3$ for the Riddle Peaks pluton to lows of about 3x10$^{-5}$emu/cm$^3$ for several plutons (Cyclone Lake, Downey Creek, and Grassy Point) of leucocratic granitic rock and alaskite (table 1).

Preliminary study of available but incomplete major- and minor-element chemical data for the samples suggests that susceptibilities are probably best correlated with CIPW normative magnetite (mt) calculated from the chemical analyses, for which the covariation between mean values for the units has a coefficient of linear correlation, _r_, of +0.87 (n = 37). The covariation is shown graphically in figure 4.

Based on distributions shown in figure 4, the units can be grouped into four somewhat arbitrary classes of relative susceptibility:

(1) _very high_ (emu/cm$^3$; x10$^{-3}$=> 2.5)---Riddle Peaks and White Chuck Glacier plutons, the latter of very small size;

(2) _high_ (emu/cm$^3$; x 10$^{-3}$ = 2.5 - 0.5)---numerous bodies, of which larger ones that might influence the aeromagnetic map features include the Mount Buckindy, Cascade Pass, Cardinal Peak, Seven-fingered Jack (and Entiat), and Dumbell Mountain plutons; the Cloudy Pass batholith; Magic Mountain Gneiss, Eldorado Orthogneiss; and the Marblemount Meta Quartz Diorite;

(3) _low_ (emu/cm$^3$; x 10$^{-3}$ = 0.5 - 0.035)---numerous bodies, of which larger ones that might influence the aeromagneitc map features include the Leroy Creek, Duncan Hill, Sloan Creek, Tenpeak, Mount Chaval, Railroad Creek, Sulphur Mountain, Jordan Lakes, and High Pass plutons; the Swakane Biotite Gneiss; Skagit Gneiss; and tonalite of Bench Lake;

(4) _very low_ (emu/cm$^3$; x 10$^{-3}$ =< 0.035)---Cyclone Lake pluton and Downey Mountain and Grassy Point stocks, the last of very small sive.

The four groups are distributed widely through the range of lithologies of the rock units (figs.5-6), and they show little apparent relation with total content of mafic minerals and relative amount of biotite and hornblende (fig. 7).

The geographic distribution of the four susceptibility groups is shown on the map of figure 8. Schist units are queried on the map due to insufficient coverage of data, but based on data obtained (table 30) they probably belong to the low-susceptibility group. The mean susceptibility of schists from northern areas (n = 5) is 0.09 emu/cm$^3$, x $10^{-3}$ (table 30A), and from southern areas (n = 7) is 0.02 emu/cm$^3$. x $10^{-3}$ (table 30B).

Studies by Criss and Champion (1984) demonstrate that significant magnetic susceptibility differences occur between different plutons, parts of plutons, and lithologies of the Idaho batholith; and even between rocks of similar lithologies, probably owing to variable degrees of hydrothermal alteration as evidenced in part by lowering of original $\delta^{18}O$ values and by presence of abundant secondary minerals such as chlorite and epidote.

Similarly, plutons and metamorphic units of the present study area have large susceptibility differences within units (tables 2-30), between units (table 1, figs. 4-5), and between units of similar lithologies (figs. 5-6) and mafic mineral contents (fig. 7).

Oxygen isotopic compositions for many of the susceptibility samples are reported by White and others (1986). The covariation between $\delta^{18}O$ and magnetic susceptibility for four bodies with relatively large sample populations is shown in figures 9-10, for comparison with results of Criss and Champion (1984): two are Tertiary plutons averaging granodioritic composition (fig. 9); and two are probable Late Cretaceous plutons that are the most mafic major units of the area (fig. 10).

Rocks of the Cloudy Pass batholith (Miocene) and Railroad Creek pluton (Eocene) have markedly different susceptibility distributions in a generally similar range of $\delta^{18}O$ values (fig. 9). The Cloudy Pass batholith contains areas of hydrothermal porphyry copper-molybdenum mineralization (Church and others, 1984), but most samples with low susceptibilities ($<0.2$ emu/cm$^3$, x $10^{-3}$) are from other areas. Samples from the area (Miners Ridge) of widespread hydrothermal alteration (plot numbers 2, 28, 29) have higher susceptibilities that may be related (Criss and Champion, 1984) to hydrothermal formation of magnetite.

The Mount Chaval pluton of quartz gabbro, diorite, and quartz diorite and the Riddle Peaks pluton of layered and nonlayered gabbro, the two most mafic plutons of the area (Ford and others, 1985), also show markedly different distributions, in both susceptibility and $\delta^{18}O$ values (fig. 10).

TABLE 1.---Summary of physical properties of Glacier Peak Wilderness study samples. Map unit symbols explained in figure 2. Listed in order of tables 2-30. Units (BU, JO, CH, etc.) shown in fig. 2

| Map unit | No. of samples | Susceptibility (emu/cm$^3$;x10$^{-3}$) | | | Density (g/cm$^3$) | | | Aeromagnetic map characteristics |
|---|---|---|---|---|---|---|---|---|
| | | Range | Mean | St. dev. | Range | Mean | St. dev. | |
| BU | 9 | 0.05-2.64 | 1.67 | 1.14 | 2.625-2.720 | 2.685 | 0.032 | NE-trending belt of magnetic highs transverse to regional structures. |
| CA | 2 | .07-1.48 | .77 | 1.00 | 2.664-2.702 | 2.683 | ... | Part of BU transverse magnetic belt. |
| CP | 23 | .01-2.40 | .90 | .69 | 2.619-2.724 | 2.679 | .045 | Arcuate belt of magnetic highs. |
| CG | 4 | .04-0.09 | .06 | .01 | 2.628-2.727 | 2.686 | .044 | Note 1. |
| RC | 13 | .03-0.15 | .07 | .04 | 2.657-2.748 | 2.748 | .028 | NW-trending relative magnetic low. |
| DU | 5 | .06-0.13 | .10 | .03 | 2.683-2.750 | 2.723 | .026 | NW-trending relative magnetic low. |
| CM | 3 | .04-0.10 | .07 | .03 | 2.723-2.750 | 2.738 | .014 | Note 1. |
| HP | 6 | .00-0.10 | .04 | .04 | 2.657-2.691 | 2.669 | .012 | Note 2. |
| CY | 5 | .02-0.04 | .03 | .01 | 2.650-2.675 | 2.661 | .009 | Relative magnetic low. See JO & CH. |
| DO | 5 | .02-0.04 | .03 | .01 | 2.627-2.657 | 2.641 | .011 | Note 2. |
| BE | 12 | .01-0.07 | .04 | .02 | 2.617-2.717 | 2.675 | .003 | Magnetic low. |
| SU | 11 | .02-5.19 | .06 | .02 | 2.621-2.691 | 2.648 | .024 | Note 2. |
| JO | 9 | .01-0.07 | .05 | .02 | 2.611-2.729 | 2.664 | .039 | Relative magnetic low similar in character to those of CH & CY. |
| SL | 9 | .03-0.14 | .09 | .04 | 2.805-2.706 | 2.751 | .028 | Circular magnetic high. |
| TE | 22 | .05-0.16 | .10 | .03 | 2.733-2.903 | 2.809 | .043 | Note 2. |
| SF | 5 | .04-1.42 | .53 | .61 | 2.735-2.823 | 2.775 | .035 | Note 2. |

(Continued next page)

TABLE 1.---Continued

| Map unit | No. of samples | Susceptibility (emu/cm$^3$;x10$^{-3}$) | | | Density (g/cm$^3$) | | | Aeromagnetic map characteristics |
|---|---|---|---|---|---|---|---|---|
| | | Range | Mean | St. dev. | Range | Mean | St. dev. | |
| HO | 4 | 0.10-0.14 | 0.11 | 0.02 | 2.806-2.870 | 2.839 | 0.031 | Note 1. |
| CD | 6 | .40-1.90 | 1.07 | .71 | 2.658-2.760 | 2.695 | .036 | NW-trending relative magnetic high. |
| CH | 14 | .01-3.63 | .08 | .03 | 2.692-2.988 | 2.829 | .058 | See JO comment. |
| RP | 23 | .03-20.0 | 6.0 | 5.2 | 2.721-3.012 | 2.889 | .093 | NW-trending strong magnetic high. |
| MA | 15 | .04-2.27 | .54 | .71 | 2.722-3.023 | 2.835 | .084 | Complex NW-trending pattern of magnetic highs. |
| DUh | 5 | .03-2.68 | .84 | 1.10 | 2.710-2.830 | 2.784 | .054 | Complex NW-trending zone of mostly magnetic highs; includes DUa & DUq. |
| DUa | 7 | .07-3.46 | 1.53 | 1.45 | 2.662-2.826 | 2.725 | .055 | See DUh comment. |
| DUq | 2 | .10-2.95 | ... | ... | 2.637-2.867 | ... | ... | See DUh comment. |
| MM | 9 | .12-3.47 | 1.0 | 1.1 | 2.635-2.727 | 2.667 | .031 | Complex magnetic high; indistinguishable from that of MA. |
| LC | 3 | .21-0.23 | .21 | .01 | 2.633-2.671 | 2.655 | .020 | Note 3. |
| EG | 7 | .12-1.47 | .73 | .52 | 2.612-2.700 | 2.671 | .028 | Magnetic low; indistinguishable from that of SG. |
| SG | 10 | .03-0.08 | .06 | .02 | 2.616-2.716 | 2.656 | .034 | Moderate magnetic expression compared with adjacent RC. See EG note. |
| SW | 4 | .04-0.07 | .05 | .01 | 2.641-2.667 | 2.652 | .012 | Note 2. |
| SI | 1 | 1.40 | ... | ... | 2.789 | ... | ... | Note 1. |
| WG | 1 | 2.80 | ... | ... | 2.740 | ... | ... | Note 1. |

(Continued next page)

TABLE 1.---Continued

| Map unit | No. of samples | Susceptibility (emu/cm$^3$;x10$^{-3}$) | | | Density (g/cm$^3$) | | | Aeromagnetic map characteristics |
|---|---|---|---|---|---|---|---|---|
| | | Range | Mean | St. dev. | Range | Mean | St. dev. | |
| CO | 1 | 1.10 | ... | ... | 2.693 | ... | ... | Note 1. |
| DD | 3 | 0.44-1.1 | .95 | .45 | 2.779-2.789 | 2.784 | .005 | Note 1. |
| FO | 1 | 0.04 | ... | ... | 2.713 | ... | ... | Note 1. |
| DM | 2 | .04-0.04 | .04 | ... | 2.662-2.723 | 2.693 | ... | Note 1. |
| GR | 2 | .03-0.04 | .03 | ... | 2.662-2.670 | 2.666 | ... | Note 1. |
| HI | 2 | .08-0.12 | .10 | ... | 2.673-2.688 | 2.681 | ... | Note 1. |
| PL | 4 | .06-0.29 | .14 | .11 | 2.659-2.719 | 2.685 | .026 | Note 2. |
| schist, Casc. R. | 6 | .06-10.0 | .09 | .04 | 2.46 -2.80 | 2.63 | .14 | Generally low magnetic expression. |
| schist, Chiwkm | 7 | .08-0.33 | .18 | .11 | 2.59 -3.02 | 2.74 | .14 | Similar to schist of Cascade River. |

Notes.---
1. Body too small to show significant effects on aeromagnetic map of Flanigan and Sherrard (1985).
2. Magnetic character of body indistinguishable from surrounding rocks.
3. Data coverage of body area is inadequate.

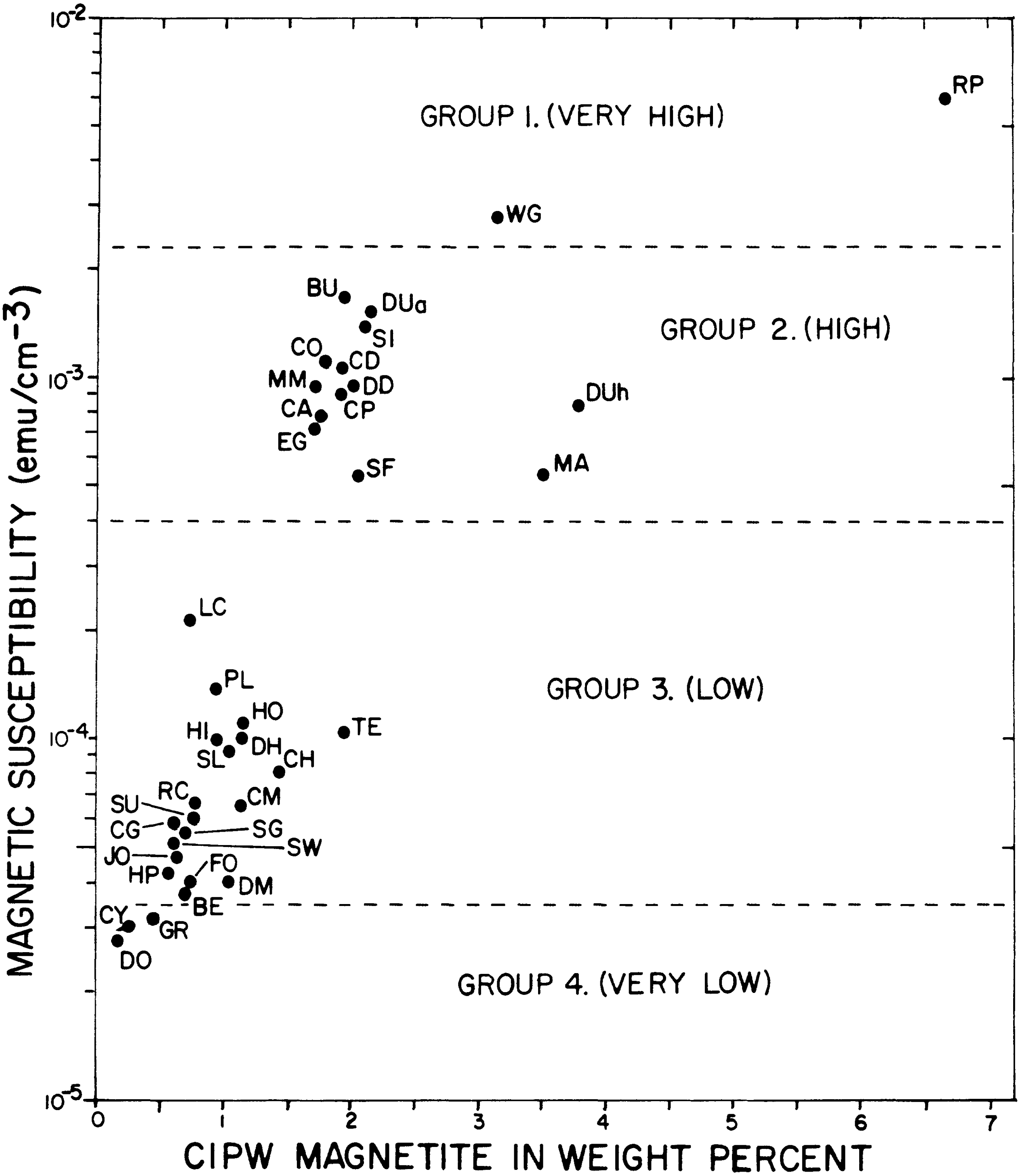


Figure 4.---Variation on semilogarithmic scale of mean magnetic susceptibility and CIPW normative magnetite content for plutons and gneiss units of the Glacier Peak Wilderness and vicinity, showing suscepti-group rankings (see text). Unit symbols explained in fig. 2, plus DUa = map unit dag and DUh = map unit dhg of Cater and Crowder (1967).

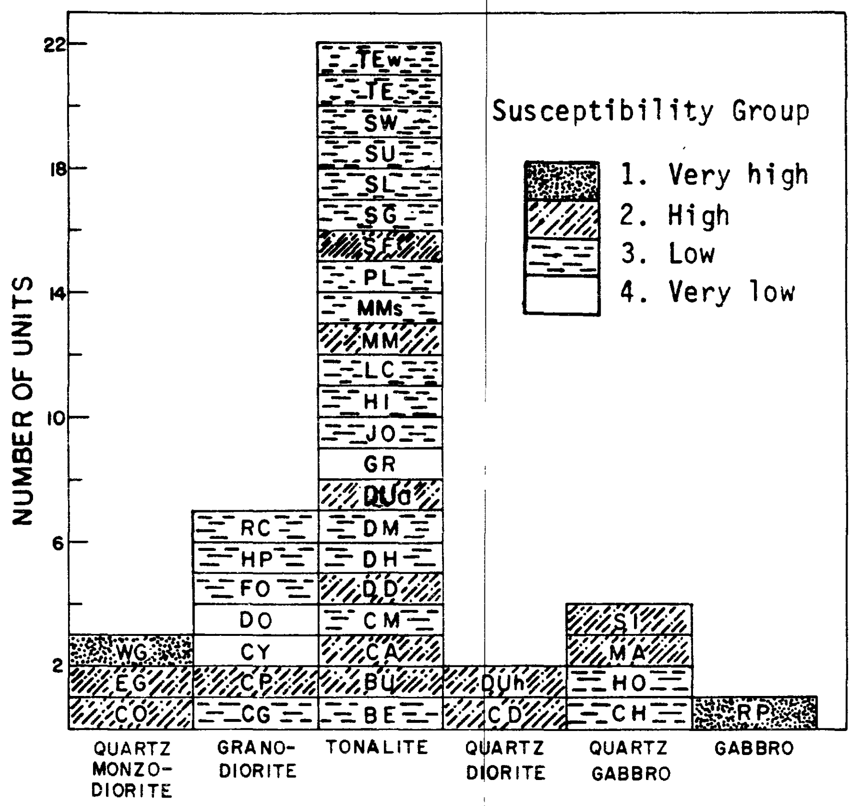


Figure 5.---Histogram of average rock types of plutons and gneiss units of the Glacier Peak Wilderness and vicinity, from Ford and others (1985), showing magnetic susceptibility groups of units (see fig. 4 and text).

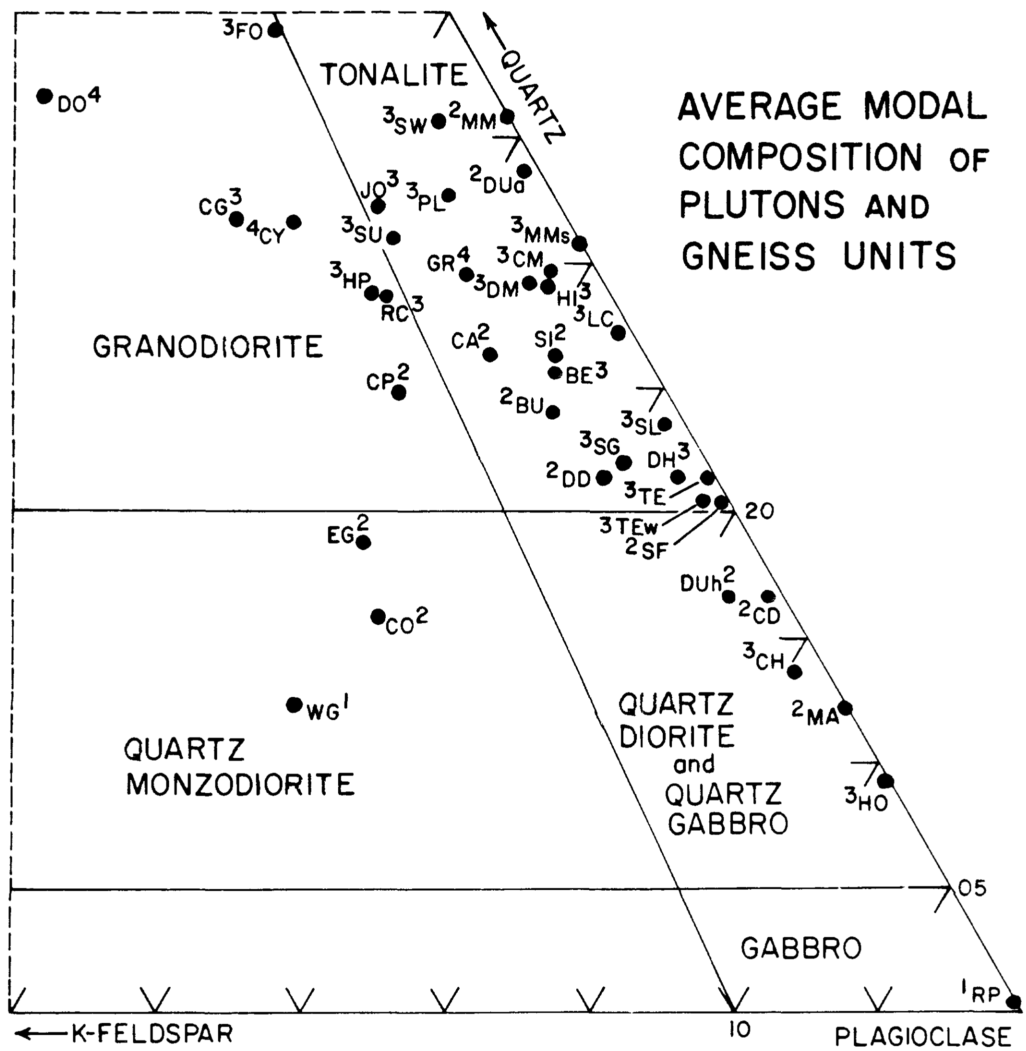


Figure 6.---Rock classification of plutons and gneiss units of the Glacier Peak Wilderness based on proportions of average modal quartz, K-feldspar and plagioclase (Ford and others, 1985), showing by superscript number the magnetic susceptibility group of units (figs. 4 and 5). Unit symbols explained in fig. 2.

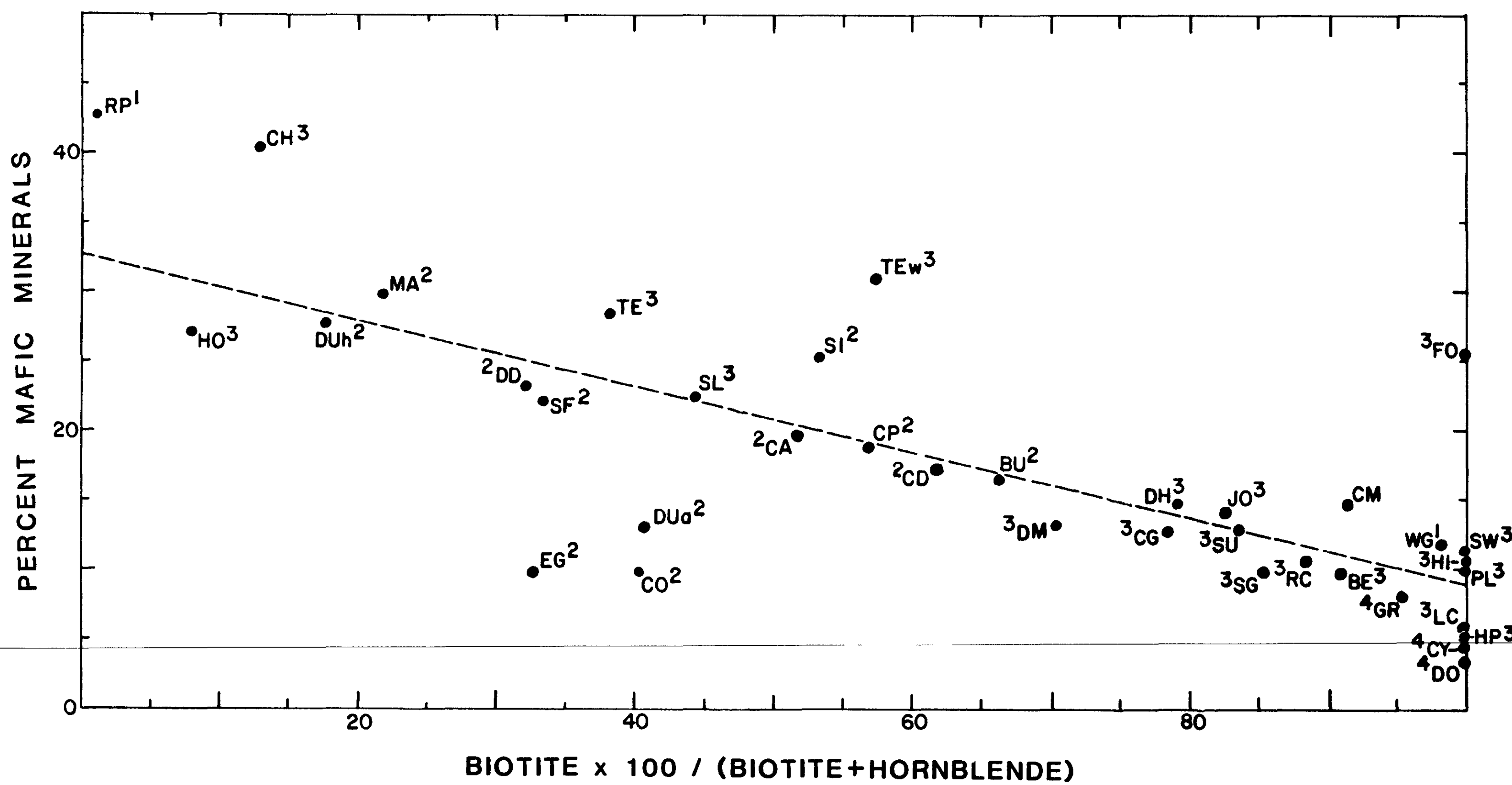


Figure 7.---Covariation of average biotite and hornblende relations with total content of mafic minerals in plutons and gneiss units of the Glacier Peak Wilderness, showing by superscript number the magnetic susceptibility group of units (figs. 4 and 5). Unit symbols explained in figs. 2 and 4. Dashed line from least squares calculation.

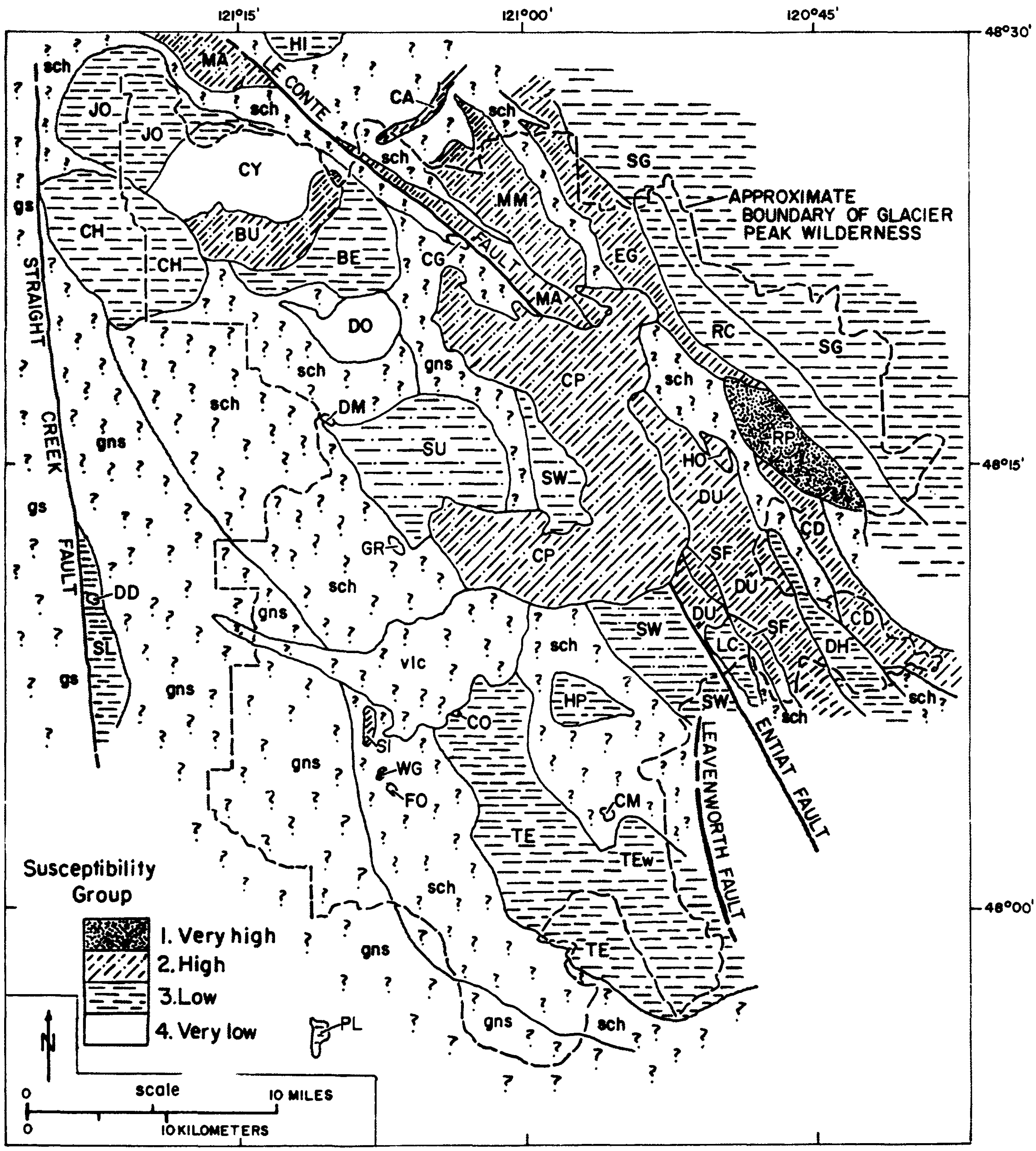


Figure 8.---Variation in magnetic susceptibility of geological units shown in fig. 2, according to groups shown in figs. 4 and 5 and discussed in text. Queries indicate lack of data.

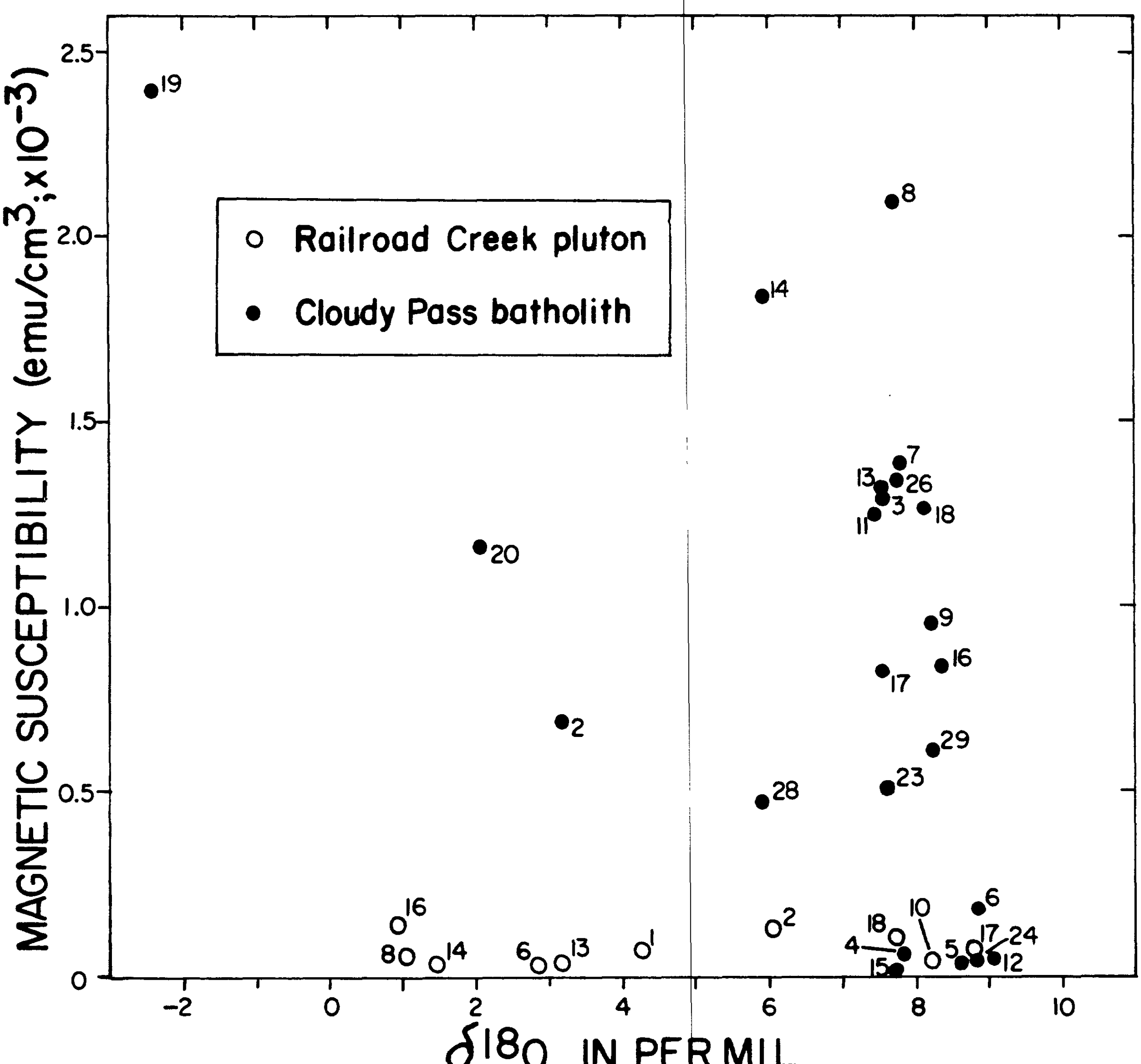


Figure 9.---Covariation between magnetic susceptibility and $\delta^{18}O$ in the Cloudy Pass batholith (table 4) and the Railroad Creek pluton (table 6). Plot numbers from tables. Oxygen isotopic data from White and others (1986).

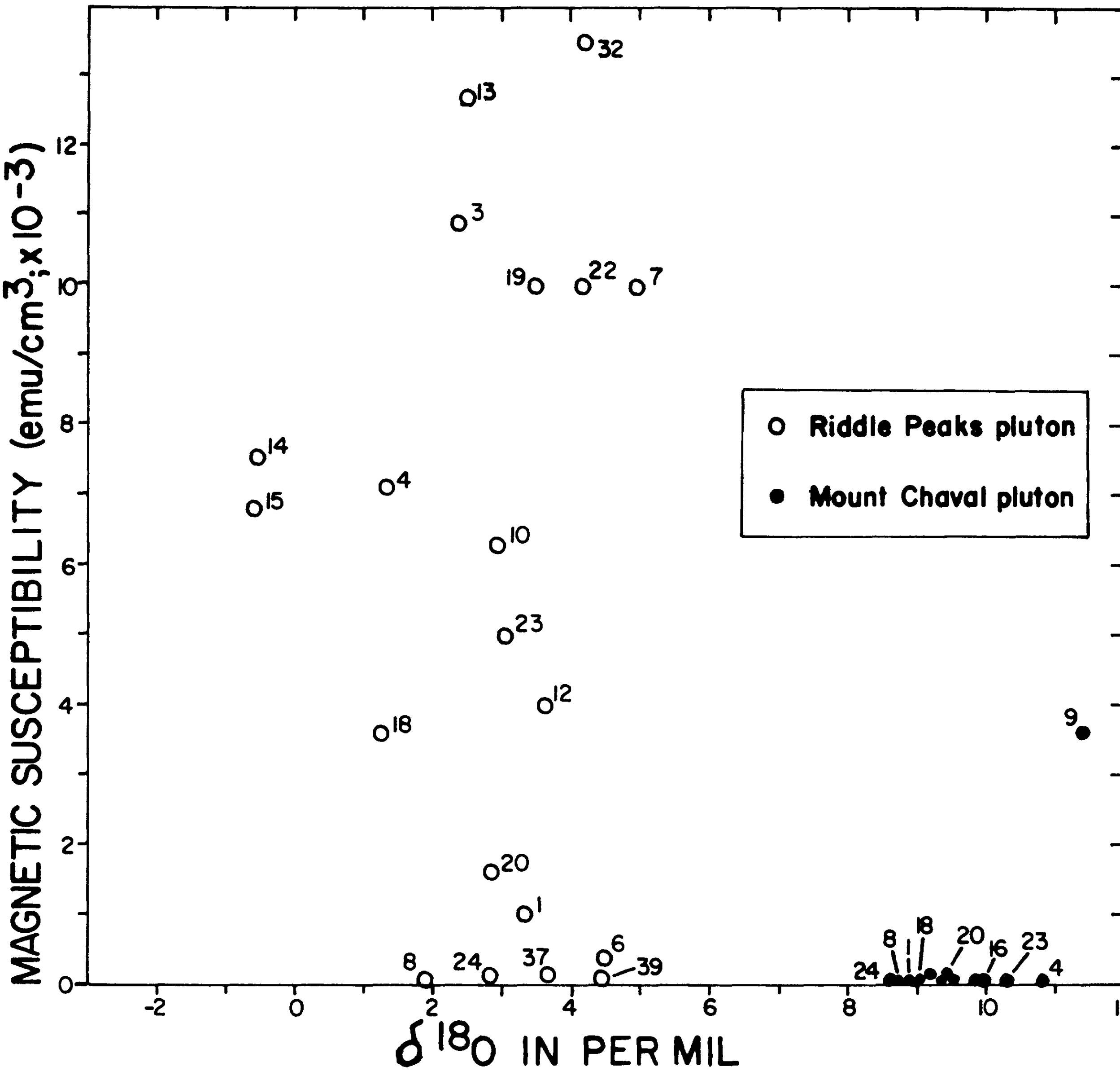


Figure 10.---Covariation between magnetic susceptibility and $\delta^{18}O$ in the Mount Chaval pluton (table 20) and the Riddle Peaks pluton (table 21). Plot numbers from tables. Oxygen isotopic data from White and others (1986).

## DATA REPORTS

### Symbols used in tables

Sample plot numbers in tables 2-29 are those used to show sample localities on sketch geologic maps and plots of modal data of the units (Ford and others, 1985). Rock names and mineral data are from Ford and others (1985). CIPW mt is normative magnetite calculated from XRF major-element chemical analyses

Rock names are indicated by the following symbols:

| | | | | | |
|---|---|---|---|---|---|
| AL | alaskite | GD | granodiorite | QG | quartz gabbro |
| G | gneiss | GR | granite | QM | quartz monzodiorite |
| GA | gabbro | MQ | metaquartz diorite | SC | schist |
| GAM | melagabbro | QD | quartz diorite | TO | tonalite |

Letters preceeding rock-name symbols indicate the following principal auxiliary minerals present, with modal amount given in subscript:

| | | | | | |
|---|---|---|---|---|---|
| b | biotite | e | epidote | o | iron-titanium oxides |
| c | chlorite | h | hornblende | p | pyroxenes |

For some rocks (alaskite and gneiss), a compositional rock name based on proportions of quartz and feldspars (fig. 6) is also given, as in "bAlto," a biotite-bearing alaskite of tonalitic composition.

TABLE 2.---Data for samples from the Mount Buckindy pluton (BU)

| Field no. | Plot no. | Rock type | Susceptibility (emu/cm$^3$;x10$^{-3}$) | Density (g/cm$^3$) | CIPW mt (wt. %) |
|---|---|---|---|---|---|
| 80L19B | 4 | $o_1h_6b_8$TO | 2.35 | 2.625 | 2.48 |
| 81F107A | 5 | $o_1h_3b_8$TO | 2.64 | 2.655 | 2.38 |
| 81F169B | 6 | $o_1h_6b_{10}$TO | 2.20 | 2.685 | 2.55 |
| 82F157A | 10 | $o_1h_2b_7$GD | 2.40 | 2.659 | 2.40 |
| 82F310A | 11 | $o_1h_6b_9$TO | 2.52 | 2.720* | 2.28 |
| 82S80A | 12 | b-hQM | .07 | 2.691* | .86 |
| 82S97A | 13 | $o_1h_5b_9$TO | 2.43 | 2.711* | 2.14 |
| 82S102A | 14 | $o_1b_2h_{10}$QD | .05 | 2.710* | 1.20 |
| 82S112A | 15 | $o_1c_2h_4b_{17}$TO | .37 | 2.709* | 1.06 |

TABLE 3.---Data for samples from the Cascade Pass pluton (CA)
(Headings as in table 2.)

| | | | | | |
|---|---|---|---|---|---|
| 81F218B | 2 | $o_{tr}c_4h_4b_9$GD | 0.07 | 2.664 | 0.73 |
| 82F151A | 4 | $o_1b_{10}h_{14}$TO | 1.48 | 2.702 | nd |

TABLE 4. ---Data for samples from the Cloudy Pass batholith (CP)

| Field no. | Plot no. | Rock type | Susceptibility (emu/cm$^3$;x10$^{-3}$) | Density (g/cm$^3$) | CIPW mt (wt. %) |
|---|---|---|---|---|---|
| 80S60A | 2 | $o_{tr}c_2h_5b_8$GD | 0.69 | 2.619 | 2.00 |
| 81F5A | 3 | $o_1h_9b_{13}$TO | 1.31 | 2.684 | 2.39 |
| 81F8A | 4 | $o_{tr}c_1h_{11}b_{13}$TO | 0.07 | 2.656 | 1.52 |
| 81F37A | 5 | $c_2h_4b_6$GD | .04 | 2.643 | .59 |
| 81F41B | 6 | $o_{tr}c_1b_{11}h_{12}$GD | .19 | 2.684 | 1.21 |
| 81F66A | 7 | $o_1c_1p_1b_8h_9$GD | 1.39 | 2.696 | 2.29 |
| 81F68A | 8 | $o_1c_2b_9h_9$GD | 2.10 | 2.683 | 2.67 |
| 81F72A | 9 | $o_{tr}c_1h_5b_{20}$TO | .95 | 2.714 | 1.84 |
| 81F118A | 11 | $o_1c_2h_7b_{14}$TO | 1.25 | 2.709 | 2.37 |
| 81F119A | 12 | $c_1h_9b_{10}$TO | .05 | 2.724 | 1.11 |
| 81F148A | 13 | $o_1c_1h_8b_{13}$TO | 1.32 | 2.728 | 2.22 |
| 81F184C | 14 | $c_1o_2b_6h_{17}$QD | 1.84 | 2.722 | 3.12 |
| 81F214A | 15 | $o_{tr}c_3h_{10}b_{12}$TO | .01 | 2.707 | 2.17 |
| 81F217A | 16 | $o_{tr}c_1h_5b_{13}$TO | .84 | 2.696 | 1.69 |
| 81L19A | 17 | $o_{tr}c_1h_6b_{13}$TO | .73 | 2.685 | 1.95 |
| 81L35A | 18 | $o_1c_1p_1h_8b_9$QD | 1.27 | 2.694 | 2.30 |
| 81L36A | 19 | $o_2b_5h_{10}$QM | 2.40 | 2.660 | 3.12 |
| 81L38A | 20 | $o_1c_3h_3$ GR | 1.17 | 2.538 | 1.78 |
| 81N69A | 23 | $o_{tr}c_3b_8h_8$TO | .51 | 2.673 | 1.95 |
| 81N84A | 24 | $o_{tr}p_1h_6b_{11}$GD | .05 | 2.694 | .85 |
| 81N124A | 26 | $o_1c_4h_{10}b_{13}$TO | 1.35 | 2.716 | 2.29 |
| 81S29A | 28 | $o_1h_1b_7$GR | .48 | 2.592 | 1.63 |
| 81S31A | 29 | $o_1h_6c_7b_{12}$GD | .62 | 2.689 | 2.41 |

TABLE 5.---Data for samples from the South Cascade Glacier stock. (CG)

| Field no. | Plot no. | Rock type | Susceptibility (emu/cm$^3$;x10$^{-3}$) | Density (g/cm$^3$) | CIPW mt (wt. %) |
|---|---|---|---|---|---|
| 81F112A | 1 | $o_{tr}c_6b_7$GD | 0.04 | 2.677* | 0.75 |
| 81F113A | 2 | $o_{tr}h_2c_4b_8$TO | .09 | 2.710* | .65 |
| 81F134A | 3 | $o_1c_6h_6b_{12}$QD | .07 | 2.727* | .76 |
| 81F135A | 4 | $o_{tr}b_{tr}c_3$ALgr | .06 | 2.628* | .27 |

TABLE 6.---Data for samples from the Railroad Creek pluton. (RC)
(Headings as in table 5)

| Field no. | Plot no. | Rock type | Susceptibility (emu/cm$^3$;x10$^{-3}$) | Density (g/cm$^3$) | CIPW mt (wt. %) |
|---|---|---|---|---|---|
| 81F45A | 1 | $o_{tr}c_1h_1b_7$GD | 0.08 | 2.665* | 0.75 |
| 81F48A | 2 | $o_1b_9$GD | .13 | 2.667* | .70 |
| 81F52A | 5 | $o_{tr}c_1h_2b_9$TO | .03 | 2.692* | .95 |
| 81F176A | 6 | $o_{tr}c_1h_3b_{10}$TO | .04 | 2.726* | .79 |
| 81F245A | 7 | $o_{tr}h_{tr}b_{12}$GD | .04 | 2.659* | .66 |
| 81F246A | 8 | $o_{tr}c_1h_1b_{14}$TO | .06 | 2.720* | 1.14 |
| 81F295A | 10 | $o_{tr}c_1h_1b_7$GD | .05 | 2.679* | .47 |
| 81N30A | 11 | $o_{tr}c_{tr}h_1b_7$GD | .04 | 2.670* | .59 |
| 81N149A | 13 | $o_{tr}c_1h_3b_{13}$QD | .05 | 2.748* | .96 |
| 81S16A | 14 | $o_{tr}c_2b_7$TO | .04 | 2.670* | .50 |
| 81S25A | 16 | $o_{tr}h_1c_2b_7$TO | .15 | 2.687* | 1.39 |
| 82F50A | 17 | $o_{tr}c_{tr}h_1b_7$GD | .06 | 2.657* | .80 |
| 82F54A | 18 | $o_{tr}c_1h_1b_8$GD | .11 | 2.675* | .61 |

TABLE 7.---Data for samples from the Duncan Hill pluton. (DH)

| Field no. | Plot no. | Rock type | Susceptibility (emu/cm$^3$;x10$^{-3}$) | Density (g/cm$^3$) | CIPW mt (wt. %) |
|---|---|---|---|---|---|
| 82F41A | 1 | $o_{tr}c_{tr}h_{tr}b_{10}$TO | 0.10 | 2.718* | 0.82 |
| 82G34A | 2 | $o_2c_4h_5b_5$QD | .12 | 2.724* | 1.30 |
| 82S3A | 3 | $o_{tr}c_{tr}h_3b_{18}$TO | .10 | 2.742* | 1.36 |
| 82S4A | 4 | $o_{tr}c_{tr}h_2b_{14}$QD | .13 | 2.750* | 1.89 |
| 82S8A | 7 | $o_1c_1b_5$TO | .06 | 2.683* | .54 |

TABLE 8.---Data for samples from the Clark Mountain stocks. (CM)
(Headings as in table 7)

| | | | | | |
|---|---|---|---|---|---|
| 82F101A | 1 | $o_{tr}b_{10}$TO | 0.10 | 2.750* | 0.88 |
| 82F103A | 2 | $o_{tr}h_2b_9$QD | .06 | 2.742* | 1.39 |
| 82G56A | 3 | $o_{tr}b_5$TO | .04 | 2.723* | 1.16 |

TABLE 9.---Data for samples from the High Pass pluton. (HP)
(Headings as in table 7 )

| | | | | | |
|---|---|---|---|---|---|
| 82F10A | 1 | $c_{tr}b_4$GD | 0.10 | 2.673* | 0.91 |
| 82F11A | 2 | $o_{tr}c_{tr}b_5$GD | .00 | 2.657* | .39 |
| 82F23A | 3 | $c_{tr}b_4$ALgd | .06 | 2.671* | .31 |
| 82G4A | 4 | $o_{tr}b_5$TO | .03 | 2.691* | .84 |
| 82G58A | 5 | $c_{tr}b_5$TO | .01 | 2.661* | .52 |
| 82S40A | 6 | $o_{tr}c_{tr}b_4$ALgd | .06 | 2.663* | .54 |

TABLE 10.---Data for samples from the Cyclone Lake pluton. (CY)

| Field no. | Plot no. | Rock type | Susceptibility ($emu/cm^3$;$x10^{-3}$) | Density ($g/cm^3$) | CIPW mt (wt. %) |
|---|---|---|---|---|---|
| 81F17A | 1 | $o_{tr}c_{tr}b_3$ALto | 0.04 | 2.650* | 0.31 |
| 81F18A | 2 | $o_{tr}c_{tr}b_3$ALto | .02 | 2.663* | .28 |
| 81F21A | 5 | $o_{tr}c_{tr}b_4$GD | .03 | 2.655* | .18 |
| 81F28A | 6 | $o_{tr}c_{tr}b_8$TO | .03 | 2.675* | .32 |
| 81F32A | 7 | $o_{tr}c_{tr}b_3$ALgd | .03 | 2.660* | .21 |

TABLE 11.---Data for samples from the Downey Creek pluton. (DO)
(Headings as in table 10)

| | | | | | |
|---|---|---|---|---|---|
| 80F91B | 1 | $o_{tr}c_{tr}b_2$ALgd | 0.04 | 2.643* | 0.45 |
| 80F93A | 2 | $o_{tr}c_{tr}b_1$ALgr | .02 | 2.643* | .19 |
| 80F106A | 3 | $o_{tr}c_{tr}b_5$TO | .03 | 2.657* | .13 |
| 80F137A | 4 | $o_{tr}c_{tr}b_2$ALgr | .03 | 2.627* | .07 |
| 81N74A | 6 | $c_{tr}b_1$ALgr | .03 | 2.637* | .06 |

TABLE 12.---Data for samples from the tonalite of Bench Lake. (BE)
(Headings as in table 10)

| | | | | | |
|---|---|---|---|---|---|
| 80F36A | 1 | $o_{tr}c_{tr}b_{14}$TO | 0.01 | 2.653 | 1.20 |
| 80F65A | 2 | $o_{tr}c_{tr}h_6b_9$QD | .07 | 2.717 | 1.11 |
| 80N33D | 4 | $o_{tr}c_{tr}h_5b_{11}$QD | .02 | 2.734 | 1.15 |
| 81F27A | 6 | $o_{tr}c_{tr}h_3b_8$TO | .02 | 2.661 | 1.24 |
| 81F171A | 7 | $o_{tr}c_1b_{10}$TO | .06 | 2.617 | .53 |
| 81F222A | 9 | $o_{tr}c_1b_8$TO | .05 | 2.692 | .40 |
| 81F224A | 10 | $o_{tr}c_{tr}h_{tr}b_{10}$TO | .04 | 2.648 | .37 |
| 81L25A | 11 | $o_{tr}c_1b_7$GD | .03 | 2.665* | .24 |
| 81L26A | 12 | $o_{tr}c_{tr}p_1b_9$GD | .05 | 2.673* | 1.07 |
| 81L27A | 13 | $o_{tr}c_{tr}b_{10}$TO | .03 | 2.690* | .38 |
| 81L30C | 14 | $o_{tr}c_{tr}b_{13}$TO | .04 | 2.695* | .47 |
| 82F320A | 19 | $o_{tr}c_{tr}b_4$TO | .04 | 2.657* | .34 |

TABLE 13.---Data for samples from the Sulphur Mountain pluton. (SU)

| Field no. | Plot no. | Rock type | Susceptibility (emu/cm$^3$;x10$^{-3}$) | Density (g/cm$^3$) | CIPW mt (wt. %) |
|---|---|---|---|---|---|
| 80H133A | 1 | $p_{tr}h_{tr}c_1b_8$GD | 0.02 | 2.686 | 0.80 |
| 80R117A[1] | 3 | $p_1c_1b_{11}$GD | 5.19 | 2.628 | .77 |
| 80R124A | 4 | $c_1p_1b_{11}$GD | .05 | 2.627 | .68 |
| 80R129A | 6 | $o_{tr}c_{tr}b_7h_7$TO | .11 | 2.633 | .98 |
| 80R131A | 7 | $c_{tr}h_1b_{10}$TO | .06 | 2.691 | .99 |
| 81F2A | 8 | $o_{tr}c_{tr}p_{tr}h_2b_{10}$GD | .05 | 2.647 | .73 |
| 81F143A | 12 | $o_{tr}c_7p_1h_1b_2$GD | .06 | 2.645 | .74 |
| 81F144A | 13 | $c_{tr}h_5b_{10}$GD | .06 | 2.654 | .71 |
| 81F145A | 14 | $o_{tr}c_{tr}h_{tr}b_9$TO | .06 | 2.648 | .65 |
| 81F163A | 15 | $c_3h_{tr}b_7$TO | .05 | 2.621 | .94 |
| 81F164A | 16 | $c_1h_1b_6$GD | .08 | 2.630 | .66 |

1- Sample not used in average

TABLE 14.---Data for samples from the Jordan Lakes pluton. (JO)
(Headings as in table 13)

| | | | | | |
|---|---|---|---|---|---|
| 80L4A | 1 | $o_{tr}c_3b_2h_3$GD | 0.04 | 2.611 | 0.52 |
| 81F24A | 3 | $c_{tr}h_2b_{14}$TO | .06 | 2.685 | .65 |
| 81F30A | 4 | $h_{tr}b_{12}$TO | .04 | 2.636 | .74 |
| 81F110A | 6 | $h_{tr}b_{14}$TO | .07 | 2.674 | .68 |
| 81N1A | 8 | $c_{tr}h_2b_{12}$GD | .05 | 2.647 | .44 |
| 81N3A | 9 | $c_1h_5b_{10}$TO | .01 | 2.616 | .94 |
| 81N15A | 10 | $h_3b_{14}$TO | .06 | 2.729* | .73 |
| 82F152A | 11 | $h_{tr}b_9$TO | .07 | 2.686* | .57 |
| 82F153A | 12 | $b_6$GD | .03 | 2.692* | .39 |

TABLE 15.---Data for samples from the Sloan Creek plutons. (SL)

| Field no. | Plot no. | Rock type | Susceptibility (emu/cm$^3$;x10$^{-3}$) | Density (g/cm$^3$) | CIPW mt (wt. %) |
|---|---|---|---|---|---|
| 80F104E | 1 | $o_1c_8b_{tr}h_{12}$TO | 0.10 | 2.753* | 0.85 |
| 80R122A | 2 | $o_{tr}c_1h_5b_{10}$TO | .12 | 2.706* | .64 |
| 80R136A | 3 | $o_{tr}c_4b_8h_{11}$TO | .08 | 2.737* | 1.32 |
| 80R138A | 4 | $o_{tr}c_1b_{11}h_{12}$TO | .03 | 2.721* | 1.15 |
| 81F312A | 6 | $o_1c_5h_{11}b_{13}$TO | .06 | 2.805* | 1.01 |
| 81S48A | 7 | $o_1c_2b_3h_{22}$QD | .12 | 2.760* | 1.45 |
| 82F160A | 8 | $o_{tr}c_{tr}b_{13}h_{13}$TO | .07 | 2.762* | 1.01 |
| 82F162A | 9 | $o_1b_{13}h_{20}$TO | .13 | 2.760* | 1.15 |
| 82F272A | 10 | $o_{tr}c_{tr}h_8b_{16}$TO | .14 | 2.758* | .93 |

TABLE 16A.---Data for samples from the Tenpeak pluton: western area. (TE)
(Headings as in table 15)

| | | | | | |
|---|---|---|---|---|---|
| 81F300A | 1 | $o_1c_1b_4h_{33}$QD | 0.14 | 2.902* | 2.71 |
| 81F302A | 2 | $o_1c_1b_5h_{41}$QD | .13 | 2.903* | 2.29 |
| 81F332A | 3 | $o_{tr}c_1h_5b_7$TO | .05 | 2.760* | 1.49 |
| 81F334A | 4 | $o_1c_1b_7h_{14}$TO | .11 | 2.798* | 1.59 |
| 81F340A | 5 | $o_{tr}c_1b_9h_{10}$TO | .06 | 2.803* | 1.34 |
| 82F13A | 6 | $o_1c_4h_{11}$QD | .10 | 2.874* | 2.98 |
| 82F14A | 7 | $o_{tr}c_3b_9h_{17}$TO | .07 | 2.832* | 1.81 |
| 82F15A | 8 | $o_{tr}c_5b_4h_{11}$TO | .07 | 2.820* | 2.49 |
| 82F109A | 9 | $o_{tr}c_1h_3b_{20}$TO | .10 | 2.783* | 2.30 |
| 82F110A | 10 | $o_1c_{tr}b_{10}h_{14}$TO | .09 | 2.818* | 1.62 |
| 82F111A | 11 | $o_1c_{tr}h_8b_{10}$TO | .12 | 2.780* | 1.48 |
| 82F115A | 12 | $o_1b_8h_{12}$TO | .11 | 2.798* | 2.17 |
| 82F139A | 13 | $O_{tr}c_1h_8b_{10}$TO | .12 | 2.775* | 1.23 |
| 82G61A | 14 | $o_{tr}c_{tr}b_{12}h_{27}$QD | .14 | 2.838* | 1.33 |
| 82G89A | 15 | $o_{tr}c_{tr}h_4b_{19}$TO | .11 | 2.782* | 1.42 |

TABLE 16B.---Data for samples from the Tenpeak pluton: eastern area (White Mts). (TEw)

| Field no. | Plot no. | Rock type | Susceptibility (emu/cm$^3$;x10$^{-3}$) | Density (g/cm$^3$) | CIPW mt (wt. %) |
|---|---|---|---|---|---|
| 81F338A | w-1 | $o_{tr}h_8b_{16}QD$ | 0.08 | 2.789* | 2.39 |
| 81F339A | w-2 | $o_1c_2b_{12}h_{18}QD$ | .12 | 2.834* | 3.03 |
| 82F1A | w-3 | $o_1c_2h_8b_{10}TO$ | .16 | 2.778* | 1.13 |
| 82F3A | w-4 | $o_{tr}h_4b_9TO$ | .06 | 2.733* | 1.29 |
| 82F16A | w-5 | $o_{tr}h_9b_{15}TO$ | .09 | 2.820* | 2.53 |
| 82F210A | w-6 | $o_{tr}c_{tr}b_{13}h_{15}QD$ | .16 | 2.813* | 1.77 |
| 82G12A | w-7 | $o_{tr}h_8b_{20}QD$ | .09 | 2.767* | 2.68 |

TABLE 17.---Data for samples from the Seven-fingered Jack and Entiat plutons. (SF) (Headings as in table 16B )

| | | | | | |
|---|---|---|---|---|---|
| 81F282A | 1 | $o_{tr}c_1h_1b_8TO$ | 0.04 | 2.735* | 1.80 |
| 81F283A | 2 | $o_1c_{12}h_{10}QD$ | .17 | 2.762* | 1.68 |
| 81N154A | 3 | $o_1c_9b_2h_7TO$ | .92 | 2.756* | 2.41 |
| 82F37A | 4 | $o_1c_1b_{12}h_{14}QD$ | 1.42 | 2.823* | 2.42 |
| 82G30A | 5 | $o_1c_1b_7h_{26}TO$ | .11 | 2.798* | 2.02 |

TABLE 18.---Data for samples from the Holden Lake pluton. (HO) (Headings as in table 16B)

| | | | | | |
|---|---|---|---|---|---|
| 81F262B | 1 | $o_1c_1p_1b_3h_{29}QG$ | 0.10 | 2.818* | 1.28 |
| 81F263A | 2 | $o_{tr}c_1p_{tr}b_2h_{21}QG$ | .10 | 2.806* | 1.08 |
| 81F264A | 3 | $o_5c_5b_1h_{23}QG$ | .14 | 2.870* | 1.00 |
| 82F56A | 4 | $o_4c_1b_2h_{19}GA$ | .11 | 2.861* | 1.26 |

TABLE 19.---Data for samples from the Cardinal Peak pluton. (CD)

| Field no. | Plot no. | Rock type | Susceptibility (emu/cm$^3$;x10$^{-3}$) | Density (g/cm$^3$) | CIPW mt (wt. %) |
|---|---|---|---|---|---|
| 82F47A | 1 | $o_1c_{tr}b_9$TO | 1.50 | 2.710* | 2.09 |
| 82F48A | 2 | $o_1c_2h_1b_3$TO | .40 | 2.658* | 1.17 |
| 82G39A | 3 | $o_1c_1h_{tr}b_7$TO | .14 | 2.678* | 1.46 |
| 82G48A | 4 | $o_2c_1b_7h_{18}$QD | 1.90 | 2.760* | 2.93 |
| 82S10A | 5 | $o_{tr}c_1b_2$TO | 1.62 | 2.683* | 1.90 |
| 82S11A | 6 | $o_1c_1b_4$TO | .87 | 2.679* | 2.08 |

TABLE 20.---Data for samples from the
(Headings as in table 19)

| Field no. | Plot no. | Rock type | Susceptibility (emu/cm$^3$;x10$^{-3}$) | Density (g/cm$^3$) | CIPW mt (wt. %) |
|---|---|---|---|---|---|
| 80F71A | 1 | $o_1c_{14}b_3$TO | 0.07 | 2.692 | 1.84 |
| 80H130A | 4 | $o_1c_3b_5h_{50}$QG | .07 | 2.882 | 1.20 |
| 80L36A | 5 | $o_1c_3b_{tr}h_{46}$QG | .09 | 2.895 | 1.06 |
| 80N41A | 8 | $o_2b_1h_{61}$GA | .10 | 2.900 | 1.63 |
| 80R113B[1] | 9 | $o_3c_3b_{tr}h_{51}$GA | 3.63 | 2.988 | 2.27 |
| 80R147A | 11 | $o_1c_6b_4h_{25}$QG | .12 | 2.843 | 1.09 |
| 80R151A | 13 | $o_1c_{tr}p_1b_6h_{33}$QG | .06 | 2.846 | .86 |
| 81F101A | 16 | $o_{tr}c_1b_{10}h_{16}$TO | .01 | 2.774 | 1.58 |
| 81F104A | 18 | $o_1c_7h_{32}$QG | .07 | 2.844 | .85 |
| 81F128A | 20 | $o_2c_3b_{tr}h_{35}$QG | .14 | 2.822 | 1.20 |
| 81F129A | 21 | $o_2c_{tr}b_4h_{40}$GA | .08 | 2.835 | 1.88 |
| 81F132A | 22 | $o_{tr}c_1b_{16}h_{25}$QG | .08 | 2.759 | 1.36 |
| 81F167A | 23 | $o_1c_{tr}b_4h_{30}$QG | .07 | 2.835 | 1.74 |
| 81F168A | 24 | $o_1c_6h_{39}$QG | .08 | 2.851 | 1.61 |

TABLE 21.---Data for samples from the Riddle Peaks pluton. (RP)

| Field no. | Plot no. | Rock type | Susceptibility (emu/cm$^3$;x10$^{-3}$) | Density (g/cm$^3$) | CIPW mt (wt. %) |
|---|---|---|---|---|---|
| 80H37B | 1 | $o_6c_1p_{tr}h_{48}$GAM | 1.06 | 3.043 | 12.64 |
| 80H70A | 3 | $o_6c_2b_{tr}h_{23}$GA | 10.9 | 2.976 | 10.66 |
| 80H72A | 4 | $o_3c_{tr}h_{41}$GA | 7.15 | 2.880 | 6.38 |
| 80H97A | 6 | $o_2c_{tr}h_{68}$GAM | .40 | 3.001* | 4.88 |
| 80H98A | 7 | $o_{10}c_1h_{31}$GA | 10.0 | 3.012* | 9.98 |
| 80H127A | 8 | $o_5c_7b_8h_{24}$GA | .03 | 2.940 | 7.45 |
| 80R32A | 10 | $o_5c_3h_{23}$GA | 6.37 | 2.889 | 7.22 |
| 80R40A | 12 | $o_3c_3b_2h_5$GA | 4.01 | 2.743* | 3.49 |
| 80R83A | 13 | $o_6c_{tr}h_{29}$GA | 12.7 | 2.931 | 8.88 |
| 81F178A | 14 | $o_7c_{tr}h_{32}$GA | 7.59 | 2.910 | 8.94 |
| 81F178B | 15 | $o_8c_3h_{33}$GA | 6.84 | 2.874 | 9.12 |
| 81F179A | 18 | $o_4c_{tr}h_{51}$GA | 3.66 | 2.920 | 4.21 |
| 81N32A | 19 | $o_{10}c_2h_{19}$GA | 10.0 | 2.836 | 7.26 |
| 81N144A | 20 | $o_2c_1b_{tr}h_{37}$GA | 1.67 | 2.797 | 4.06 |
| 82F60A | 22 | $o_{11}c_1h_{45}$GA | 10.0 | 2.994* | 11.20 |
| 82F64A | 23 | $o_4c_4h_{18}$QG | 4.96 | 2.777* | 5.23 |
| 82F65A | 24 | $o_2c_7h_{24}$QG | .14 | 2.805* | 2.25 |
| 82F71A | 25 | $o_5c_1h_{20}$GA | 10.0 | 2.870* | 7.06 |
| 82F73A | 26 | $o_8c_1h_{32}$GA | .78 | 2.825* | 2.83 |
| 82F76A | 27 | $o_3p_{tr}b_2h_{17}$GA | 10.0 | 2.779* | 3.88 |
| 82F79A | 32 | $o_8h_{32}$GA | 20.0 | 3.012* | 11.27 |
| 82F96A | 37 | $o_1c_3b_5h_{13}$QG | .19 | 2.721 | 2.49 |
| 82G46A | 39 | $o_1c_2b_{tr}h_{44}$GA | .10 | 2.902 | 2.66 |

TABLE 22.---Data for samples from the Marblemount Meta Quartz Diorite. (MA)

| Field no. | Plot no. | Rock type | Susceptibility (emu/cm$^3$;x10$^{-3}$) | Density (g/cm$^3$) | CIPW mt (wt. %) |
|---|---|---|---|---|---|
| 80N62D | 1 | $o_1c_{tr}b_2h_{12}$MQ | 0.04 | 2.803* | 3.42 |
| 81F85A | 2 | $o_3c_{12}h_{tr}$MQ | .12 | 2.816* | 3.79 |
| 81F86A | 3 | $o_2c_6h_{14}$MQ | .12 | 2.953* | 4.39 |
| 81F87A | 4 | $o_2c_7h_{tr}$MQ | .09 | 2.802* | 3.65 |
| 81F90A | 5 | $o_1c_6h_{22}$MQ | .21 | 2.875* | 3.71 |
| 81F91A | 6 | $o_1c_{13}b_2h_2$MQ | .15 | 2.875* | 4.98 |
| 81F139A | 7 | $o_1c_1b_2h_8$MQ | 1.27 | 2.804* | 3.67 |
| 81F140A | 8 | $o_3c_7h_{11}$MQ | 1.70 | 2.828* | 3.92 |
| 81F231A | 9 | $o_2c_1h_{37}$MQ | .11 | 3.023* | 3.59 |
| 81L20A | 10 | $o_2c_{13}h_1$MQ | .14 | 2.722* | 3.58 |
| 81L29A | 11 | $o_2c_2b_{12}h_{12}$MQ | .48 | 2.773* | 2.26 |
| 81L55A | 12 | $o_2c_9$MQ | .12 | 2.757* | 2.65 |
| 81N126A | 13 | $o_3c_2h_{tr}b_{20}$MQ | 1.12 | 2.727* | 1.94 |
| 81S9A | 14 | $o_1c_8b_{tr}h_{21}$MQ | .14 | 2.920* | 3.80 |
| 81S40E | 15 | $o_1b_7h_{18}$MQ | 2.27 | 2.845* | 3.34 |

TABLE 23.---Data for samples from the Dumbell Mountain plutons. (DU) Unit designations from geologic map of Cater and Crowder (1967) (Other headings as in table 22): DUh = dhg; DUa = dag; DUq = dqg

| | | | | | | Unit |
|---|---|---|---|---|---|---|
| 81F279A | 1 | $o_1c_3b_4h_{14}$Gqd | 0.12 | 2.824* | 3.55 | DUh |
| 81F280A | 2 | $o_2c_6$Gqd | 2.68 | 2.710* | 5.67 | DUh |
| 81F281A | 3 | $o_1c_8h_{14}$Gqd | .03 | 2.744* | 3.07 | DUh |
| 82F36A | 4 | $o_2c_1b_3h_{26}$Gqd | 1.25 | 2.830* | 3.55 | DUh |
| 82F58A | 5 | $o_{tr}c_2b_8h_{16}$Gto | .12 | 2.811* | 3.18 | DUh |

(Continued next page)

TABLE 23.---(Continued) Data for samples from the Dumbell Mountain plutons. Unit designations from geologic map of Cater and Crowder (1967)

| Field no. | Plot no. | Rock type | Susceptibility (emu/cm$^3$;x10$^{-3}$) | Density (g/cm$^3$) | CIPW mt (wt. %) | Unit |
|---|---|---|---|---|---|---|
| 81F287A | 1 | $o_1h_9$Gto | 2.61 | 2.749* | 3.12 | DUa |
| 81N159A | 2 | $o_1c_{tr}b_5h_7$Gto | 3.04 | 2.724* | 2.59 | DUa |
| 82F38A | 3 | $o_{tr}c_{tr}h_3$Gto | .78 | 2.674* | 1.36 | DUa |
| 82F42A | 4 | $o_1c_2h_1b_4$Gto | .17 | 2.713* | 1.86 | DUa |
| 82F43A | 5 | $o_{tr}b_8$Gto | .56 | 2.710* | 1.65 | DUa |
| 82F55A | 6 | $o_1c_1b_1h_{18}$Gto | 3.46 | 2.826* | 4.27 | DUa |
| 82G36A | 7 | $o_{tr}c_1b_9$Gto | .07 | 2.662* | .46 | DUa |
| 82S17A | 1 | $o_{tr}c_{tr}h_3$Gto | 2.95 | 2.637* | nd | DUq |
| 82S18A | 2 | $o_1c_1b_3h_{25}$Gqd | .10 | 2.867* | 3.08 | DUq |

TABLE 24.---Data for samples from the Magic Mountain Gneiss and possible correlatives (plot nos. s-1, s-2) south of Flat Creek. (MM, MMs) (Headings as in table 23)

| | | | | | |
|---|---|---|---|---|---|
| 81F95A | 1 | $o_2c_4$Gto | 3.47 | 2.662* | 2.03 |
| 81F96A | 2 | $o_2c_{tr}$Gal | .82 | 2.672* | 1.66 |
| 81F97A | 3 | $o_{tr}c_1$Gto | .13 | 2.727* | 2.65 |
| 81F100A | 4 | $o_1c_2$Gal | 1.4 | 2.638* | 1.56 |
| 81F201A | 5 | $o_{tr}c_1$Gal | .68 | 2.692* | 2.25 |
| 81L1A | 6 | $o_{tr}c_9$Gqd | .14 | 2.635* | .47 |
| 82F234A | 8 | $o_1c_3$Gal | 1.4 | 2.657* | 1.51 |
| 81F233B | s-1 | $o_2c_{tr}$Gal | 0.35 | 2.637* | 0.45 |
| 81F234A | s-2 | $o_2c_2b_2$Gto | .12 | 2.687* | 1.04 |

TABLE 25.---Data for samples from the Leroy Creek pluton. (LC) (Headings as in table 23)

| | | | | | |
|---|---|---|---|---|---|
| 81F277A | 1 | $o_{tr}c_1b_{tr}$ALto | 0.21 | 2.633* | 0.71 |
| 81F285A | 3 | $o_{tr}c_{tr}b_1$ALto | .21 | 2.671* | .74 |
| 82G26A | 4 | $o_1c_{tr}b_6$TO | .23 | 2.660* | .79 |

TABLE 26.---Data for samples from the Eldorado Orthogneiss. (EG)

| Field no. | Plot no. | Rock type | Susceptibility ($emu/cm^3; x10^{-3}$) | Density ($g/cm^3$) | CIPW mt (wt. %) |
|---|---|---|---|---|---|
| 81F63A | 1 | $o_1c_5h_6$Gqm | 0.58 | 2.670* | 1.61 |
| 81F174A | 2 | $o_1c_4h_6$Gqm | 1.17 | 2.683* | 2.35 |
| 81F175A | 3 | $o_1c_1b_2h_4$Gqm | .55 | 2.671* | 2.41 |
| 81F205A | 4 | $o_{tr}c_1h_4b_7$Gto | .18 | 2.700* | 1.38 |
| 81F229A | 5 | $o_1c_1h_{tr}b_3$Gto | 1.08 | 2.690* | 1.77 |
| 81F244A | 6 | $o_1c_2h_4$Gqm | 1.47 | 2.670* | 1.67 |
| 81N132A | 8 | $o_{tr}c_{tr}$Gqd | .12 | 2.612* | .80 |

TABLE 27.---Data for samples from the Skagit Gneiss. (SG)
(Headings as in table 26 )

| | | | | | |
|---|---|---|---|---|---|
| 81F57A | 1 | $o_1c_{tr}h_6b_{13}$Gqd | 0.06 | 2.716 | 0.80 |
| 81F289A | 2 | $o_{tr}c_{tr}h_1b_5$TO | .04 | 2.644 | 1.05 |
| 81F291A | 4 | $o_{tr}c_1b_8$TO | .07 | 2.622 | .47 |
| 81F292A | 5 | $o_1c_3b_1h_8$Gqd | .04 | 2.684 | .76 |
| 81F293A | 6 | $o_{tr}c_1b_{11}$TO | .06 | 2.634 | .95 |
| 81L49A | 7 | $o_1c_{tr}b_{11}$TO | .07 | 2.632 | .53 |
| 81N140A | 11 | $o_{tr}c_1b_5$GD | .03 | 2.616 | .13 |
| 81N163A | 12 | $o_{tr}c_1h_1b_{14}$Gto | .08 | 2.690* | .92 |
| 81S17A | 13 | $o_1c_2b_6$TO | .03 | 2.635 | .36 |
| 81S21A | 14 | $o_{tr}c_{tr}h_{tr}b_{14}$GD | .07 | 2.683 | 1.13 |

TABLE 28.---Data for samples from the Swakane Biotite Gneiss. (SW)
(Headings as in table 26)

| | | | | | |
|---|---|---|---|---|---|
| 81F71A | 1 | $o_{tr}c_{tr}b_6$Gqd | 0.04 | 2.644 | 0.25 |
| 81F271A | 4 | $o_{tr}c_{tr}b_8$Gqd | .04 | 2.641 | .47 |
| 81F276A | 5 | $o_{tr}c_1b_{10}$Gto | .07 | 2.654 | .62 |
| 81L44A | 6 | $o_{tr}c_{tr}b_6$Gto | .05 | 2.667 | .43 |

TABLE 29.--Data for samples from miscellaneous small plutons

| Field no. | Plot no. | Rock type | Susceptibility (emu/cm$^3$;x10$^{-3}$) | Density (g/cm$^3$) | CIPW mt (wt. %) |
|---|---|---|---|---|---|
| A. Sitkum stock (SI) | | | | | |
| 81F307A | 1 | $o_1c_{tr}p_5h_9b_{10}$TO | 1.40 | 2.789* | 2.12 |
| B. White Chuck Glacier stock (WG) | | | | | |
| 81F326A | 1 | $o_1p_6h_{tr}b_5$QM | 2.80 | 2.740* | 3.15 |
| C. Cool stock (CO) | | | | | |
| 81F345A | 1 | $o_1c_1p_{tr}b_3h_4$QM | 1.10 | 2.693* | 1.80 |
| D. Dead Duck pluton (DD) | | | | | |
| 81F319A | 1 | $o_1p_1b_7h_{17}$TO | 1.30 | 2.789* | 2.31 |
| 81F321A | 2 | $o_1p_6b_5h_{10}$TO | .44 | 2.783* | 1.60 |
| 82F158A | 3 | $o_1c_{tr}p_{tr}b_7h_{15}$QD | 1.10 | 2.779* | 2.16 |
| E. Foam Creek stock (FO) | | | | | |
| 81F329A | 1 | $c_{tr}b_{24}$GD | 0.04 | 2.713* | 0.76 |
| F. Downey Mountain stock (DM) | | | | | |
| 80F120A | 1 | $o_{tr}c_{tr}h_2b_{11}$TO | 0.04 | 2.662* | 1.16 |
| 81F258A | 2 | $o_{tr}c_{tr}h_6b_{10}$TO | .04 | 2.723* | .95 |
| G. Grassy Point stock (GR) | | | | | |
| 80F110A | 1 | $o_{tr}c_1h_{tr}b_5$TO | 0.04 | 2.670* | 0.48 |
| 80F111A | 2 | $o_{tr}c_1b_4$TO | .03 | 2.662* | .48 |
| H. Hidden Lake stock (HI) | | | | | |
| 82F155A | 1 | $o_{tr}c_{tr}b_9$TO | 0.12 | 2.673* | 1.01 |
| 82F156A | 2 | $o_{tr}c_{tr}b_8$TO | .08 | 2.688* | .90 |
| I. Pear Lake pluton (PL) | | | | | |
| 82F176A | 1 | $o_{tr}c_{tr}b_6$GD | 0.29 | 2.659* | 0.32 |
| 82F179A | 2 | $o_{tr}c_{tr}h_{tr}b_7$TO | .06 | 2.672* | .52 |
| 82F184A | 3 | $o_{tr}c_{tr}p_1h_{tr}b_{13}$TO | .07 | 2.719* | 2.02 |
| 82F186A | 4 | $o_1c_{tr}b_{10}$TO | .13 | 2.689* | .97 |

TABLE 30.---Data for samples from schist units.

| Field no. | Plot no. | Rock type | Susceptibility (emu/cm$^3$;x10$^{-3}$) | Density (g/cm$^3$) |
|---|---|---|---|---|
| A. Cascade River Schist | | | | |
| 80N28A[1] | | o-cSC | 10.0 | 2.80 |
| 80N29A | | o-cSC | .07 | 2.46 |
| 80N30C | | o-cSC | .10 | 2.75 |
| 81F194A | | bSC | .06 | 2.51 |
| 81F195A | | o-c-bSC | .08 | 2.76 |
| 81F202A | | o-b-cSC | .16 | 2.66 |
| B. Chiwaukum Schist | | | | |
| 82F26A | | o-hSC | 0.26 | 3.02 |
| 82F28A | | bSC | .33 | 2.70 |
| 82F142A | | c-bSC | .10 | 2.66 |
| 82F143A | | bSC | .29 | 2.72 |
| 82F145A | | bSC | .08 | 2.80 |
| 82F204A | | bSC | .12 | 2.72 |
| 82F233A | | h-bSC | .10 | 2.59 |

1- Sample not used in average

## REFERENCES CITED


Cater, F.W, and Crowder, D.F., 1967, Geologic map of the Holden quadrangle, Snohomish and Chelan counties, Washington (scale 1:62,500): U.S. Geological Survey Geologic Quadrangle Map GQ-646.

Church, S.E., Ford, A.B., Flanigan, V.J., and Stotelmeyer, R.B., 1984, Mineral resource potential map of the Glacier Peak Wilderness and adjacent areas, Chelan, Skagit, and Snohomish Counties, Washington (scale 1:100,000): U.S. Geological Survey Miscellaneous Field Studies Map MF-1652A.

Criss, R.E., and Champion, D.E., 1984, Magnetic properties of granitic rocks from the southern half of the Idaho batholith: influences of hydrothermal alteration and implications for aeromagnetic interpretation: Journal of Geophysical Research, v. 89, no. B8, p. 7061-7076.

Flanigan, V.J., Ford, A.B., and Sherrard, Mark, 1983, Geologic interpretation of aeromagnetic survey of Glacier Peak Wilderness, northern Cascades, Washington: U.S. Geological Survey Open-File Report OF 83-650, 22 p.

Ford, A.B., 1983a, Annotated guide to geologic reports and maps of the Glacier Peak Wilderness and adjacent areas, northern Cascades, Washington: U.S. Geological Survey Open-File Report OF 83-97, 34 p.

Ford, A.B., 1983b, Map of bedrock geologic data sites, Glacier Peak Wilderness study, Chelan, Skagit, and Snohomish Counties, Washington (scale 1:100,000): U.S. Geological Survey Open-File Report OF 83-454.

Ford, A.B., Drinkwater, J.L., and Garwin, S.L., 1985, Petrographic data for plutonic rocks and gneisses of the Glacier Peak Wilderness and vicinity, northern Cascades, Washington: U.S. Geological Survey Open-File Report 85-432, 121 p.

Sherrard, Mark, and Flanigan, V.J., 1983, Bouguer gravity anomaly map of the Glacier Peak Wilderness and vicinity; Chelan, Skagit, and Snohomish Counties, Washington (scale 1:100,000): U.S. Geological Survey Open-File Report OF 83-595, 23 p.

White, L.D., Maley, C.A., Barnes, Ivan, and Ford, A.B., 1986, Oxygen isotopic data for plutonic rocks and gneisses of the Glacier Peak Wilderness and vicinity, northern Cascades, Washington: U.S. Geological Survey Open-File Report OF 86-76.