

EXPLANATION

Quaternary
Tertiary
Precambrian

Relative age not known
Relative age between groups not known
Relative age uncertain
Order does not reflect age

Quaternary
Alluvium, talus, solifluction debris, and morainal deposits
Qa
Tb
Tb_{am}
Tb_{cm}
Tb_{dm}
Tb_{em}
Tb_{fm}
Tb_{gm}
Tb_{hm}
Tb_{im}
Tb_{jm}
Tb_{km}
Tb_{lm}
Tb_{mm}
Tb_{nm}
Tb_{om}
Tb_{pm}
Tb_{qm}
Tb_{rm}
Tb_{sm}
Tb_{tm}
Tb_{um}
Tb_{vm}
Tb_{wm}
Tb_{xm}
Tb_{ym}
Tb_{zm}

Intrusive rocks
Bostonite porphyry
Pale-blue, gray, or red; groundmass has trachytic to basaltic texture; contains rare to abundant phenocrysts of feldspar
Sanidine porphyry
Light to gray; composed mostly of sanidine; contains altered feldspar phenocrysts
Biotite quartz monzonite porphyry
Yellowish-gray; granular to aphanitic groundmass; phenocrysts of plagioclase, sanidine, quartz, and biotite
Intrusion breccia
Altered fragments of Silver Plume Granite and lacustrine monzonite
Monzonite group
Dark to light-gray rocks that contain little or no quartz, and commonly contain abundant hornblende or pyroxene
Tm, lacustrine monzonite; light-gray variety porphyritic rock composed primarily of oligoclase and microperthite
Tmq, hornblende-pyroxene monzonite; variety porphyritic phenocrysts showing flow layering and altered ferromagnesian phenocrysts
Tm_q, quartz-bearing monzonite porphyry with aphanitic to fine-grained granular groundmass
Tm_p, monzonite porphyry unaltered; very fine grained highly altered dike rocks
Tm_r, porphyritic hornblende-pyroxene monzonite
Tm_s, hornblende-pyroxene monzonite; variety porphyritic phenocrysts commonly showing flow layering and altered ferromagnesian phenocrysts
Tm_t, feldspathoidal hornblende-pyroxene monzonite; contains nepheline and sodalite
Granodiorite group
Porphyritic rocks variable in color, rich in quartz, and have granular groundmass
Tg, granodiorite porphyry unaltered; intensely altered dike rocks
Tga, hornblende granodiorite porphyry
Tgb, biotite granodiorite porphyry
Pegmatite
P
Silver Plume Granite
Sp, gray or pink fine- to medium-grained weakly foliated quartz monzonite. Fine-grained phase is equigranular; medium-grained phase is variate porphyritic
Sp_{gm}, migmatitic mixture of Silver Plume Granite and biotite gneiss
Granite porphyry
Medium-gray dike rocks having distinct porphyritic texture
Hdi
Hornblende diorite
Fine-grained dark rocks of variable composition forming small dikes and sills
Qdh
Quartz diorite and hornblende
Black or mottled black-and-white medium- to coarse-grained rocks
Bcg
Boulder Creek Granite
Gray medium-grained nearly equigranular rock. Dominantly foliated, but interior parts of larger bodies are nearly massive. Includes some pegmatite
Qai
Quartz diorite of St. Marys Lake
Dark-gray fine to very fine grained massive rock
Dominantly Metasedimentary Rocks
Hornblende gneiss and amphibolite
Dark-gray or black medium-grained rocks containing hornblende, andesine, and quartz. Includes both massive and layered varieties. Locally is interbedded with calc-silicate gneiss
Gm
Microcline gneiss
Light- or yellowish-gray microcline-quartz-plagioclase-biotite gneiss that generally has well-defined layering and a granitic appearance
Gmc
Calc-silicate gneiss
Green, brown, white, and red medium- to coarse-grained layered rocks of variable composition. Composed mostly of garnet, oligoclase, epidote, feldspar, quartz, amphibole, and scapolite
Gnc
Biotite gneiss
Gray medium-grained migmatitic biotite gneiss; includes interbedded biotite-quartz-plagioclase gneiss, biotite-quartz-plagioclase-microcline gneiss, sillimanite-biotite-quartz-plagioclase-microcline gneiss, and garnetiferous varieties. Includes much pegmatite as discrete bodies and thin layers
Gnb

Contact
Dashed where approximately located; short dashed where inferred

Fault, showing dip
Dashed where approximately located; short dashed where inferred; dotted where concealed; queried where probable

Anticline Syncline Monocline

Overtured anticline Overtured syncline

Folds
Showing trace of axial plane and bearing and plunge of axis. Dashed where approximately located; short dashed where inferred; dotted where concealed

Anticline Syncline Recumbent

Bearing and plunge of small folds

Bearing and plunge of asymmetric fold
Showing trace of foliation on horizontal plane. May be combined with foliation symbols

Bearing and plunge Horizontal

Lincation
May be combined with foliation symbols

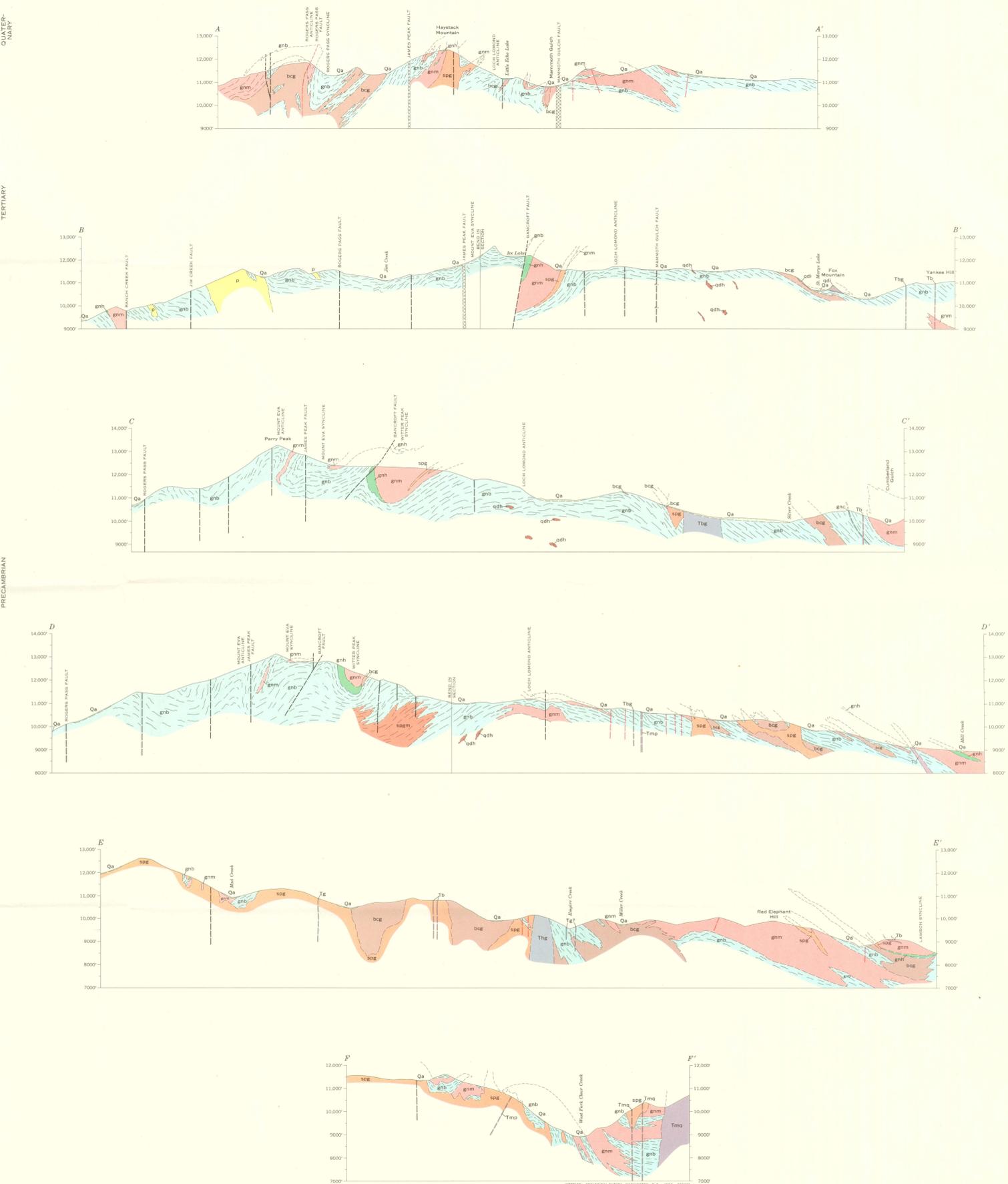
Horizontal Vertical Inclined Folded, showing symmetry Tightly folded, showing mean strike and bearing and plunge of fold axes

Foliation
Foliation within inclusions in intrusive rocks

Strike and dip of slip cleavage

Vein, showing dip
Dashed where approximately located; short dashed where inferred; dotted where concealed

Area of intense hydrothermal alteration



Base by U.S. Geological Survey, 1958

SCALE 1:24 000

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

INDEX TO GEOLOGIC MAPS

Geology by W. A. Braddock, 1959-62, assisted by Melvin Harper and Frederick Fries. Geology by C. C. Hawley and F. B. Moore, 1952-54

**GEOLOGIC MAP AND SECTIONS OF THE EMPIRE QUADRANGLE
GRAND, GILPIN, AND CLEAR CREEK COUNTIES, COLORADO**