

69-254

Quaternary

Pleistocene(?) and Holocene

Qa, alluvium
Qc, colluvium; includes some alluvium, bog deposits, and bouldery deposits in upland valleys. May include some glacial outwash
Qls, landslide deposit north of Bull Run Creek

Pleistocene

Qg
Glacial outwash terrace gravels

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Miocene and Pliocene

Ts
Intermontane basin deposits
Lakes beds of Weed (1912) and local use. Unconsolidated and poorly consolidated stream and lake deposits of tuffaceous conglomerate, sandy, silt, and clay, and local beds of ash

Miocene(?)

Tr, undivided
Trf, flows and flow breccia
Trv, vitrophyre lava
Trt, bedded breccia and tuff
Tri, dikes related to the lava flows

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QUATERNARY

Contact
Dashed where approximately located; dotted where concealed; queried where uncertain

Fault, showing dip
Dashed where approximately located; dotted where concealed; queried where uncertain. U, upthrown side; D, downthrown side

Inclined Horizontal
Strike and dip of beds and of eutaxitic structure in welded tuff

Inclined Inclined, with Vertical Contorted
range in dip
Strike and dip of flow banding in lavas and intrusives

Chalcedony veins and zones of silicified rock
Occur only on ridge east of Sheep Creek

Metalliferous quartz veins
tourm-qtz, tourmaline-bearing veins

Shaft Caved or flooded shaft
Adit Caved or flooded adit

Eocene

Lowland Creek Volcanics

Second eruptive cycle

Tlu
Upper lava unit
Red, pink, brown, and gray porphyritic lava; groundmass mostly aphanitic but basal parts of some flows are glassy. Breccia zones are widely distributed; highly contorted flow banding is conspicuous. Propylitic alteration is slight and is mostly restricted to the brecciated parts of flows. Locally includes small bodies of related intrusive rocks whose boundaries could not be determined

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Tlv
Vitrophyre unit
Gray and yellowish-gray crystal-rich perlitic vitrophyre; probably a single sheet of lava

ANGULAR UNCONFORMITY

Tll
Lower lava unit
Gray, brown, purple, red, and greenish-black quartz latite lava flows with well-developed brecciated upper part and a thin lower part with well-developed planar flow layering; a basal breccia zone is present in some flows. Phenocrysts of plagioclase, clinopyroxene, hornblende, quartz, and sparse sanidine and biotite are set in an aphanitic groundmass of devitrified glass. Propylitic alteration is widespread, generally more pronounced in the upper brecciated parts of each flow; groundmass is pervaded by chalcedony or opal, and brecciated parts are cut by ramified network of silica veinlets

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Tlb
Breccia unit
Varicolored and heterogeneous breccia and tuff breccia with lesser amounts of tuff and conglomerate and sandstone derived from reworked quartz latite. Mainly vent agglomerate and mudflow breccia

First eruptive cycle

Tlw
Welded tuff unit
Chalky white, gray, yellowish-gray, and olive welded tuff in sheets as much as 300 feet thick. Conspicuous eutaxitic structure is marked by collapsed lapilli which are etched out on weathered surfaces leaving cavities resembling streaked-out vesicles. Rock locally is glassy. Unit includes many thin nonwelded ashflow tuffs and local intercalations of tuffaceous sandstone

Tlt
Basal unit
Varicolored tuff, siltstone, sandstone, and conglomerate; upper part consists largely or wholly of quartz latite detritus; lower part contains abundant prevolcanic detritus; locally contains abundant macerated plant debris in thin-bedded tuffaceous siltstone members

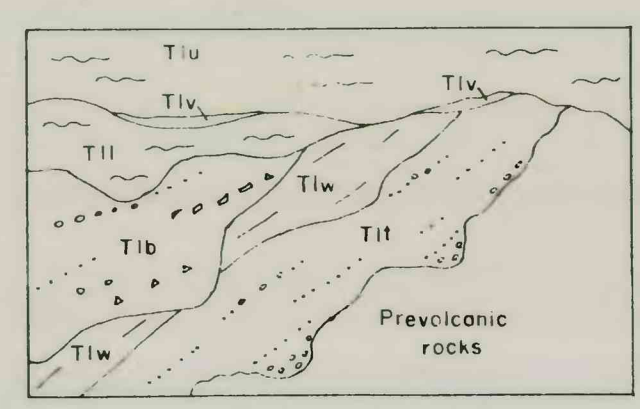
TERTIARY

Dark dike rocks
Lamprophyre and related porphyritic dike rocks cutting rocks as young as the upper lava unit of the Lowland Creek Volcanics. Upper age limit unknown

Intrusive rocks correlated with upper lava unit
May also be equivalent to the vitrophyre unit. Breccia plug near head of Meadow Gulch shown by open triangles

Dike rocks correlated with the lower lava unit
May also be equivalent to the breccia unit

Dike rocks correlated with the second eruptive cycle of the Lowland Creek Volcanics



Diagrammatic section of Lowland Creek Volcanics
Unconformable relations of the units are due to intravolcanic episodes of faulting, tilting, and erosion. Because of this, each unit at places rests on each of the older units or on the prevolcanic rocks. More detailed descriptions of these rocks and their structural and stratigraphic relations are presented in the first four references listed above

Central part of the map area left blank because detailed mapping is incomplete. Work in progress indicates that bedrock there is almost entirely of complexly faulted Lowland Creek Volcanics.

H. H. Woodard assisted in mapping about 25 square miles in the southwest corner of the quadrangle and R. W. White assisted in mapping part of the northwest corner.

Veins and granite porphyry dikes in the Butte district (in a square area bounded on the north by Walkerville and on the west by Big Butte) based principally on projection from mine workings at shallow depth. Grateful acknowledgement is made to the Anaconda Company for their cooperation.

This map is preliminary and has not been edited or reviewed for conformity with U.S. Geological Survey standards and nomenclature.

Upper Cretaceous

Rocks of the Boulder batholith

SP
Granite porphyry
Rhyolite porphyry of Weed (1912)
Modoc porphyry and quartz porphyry of local use
Light-colored strikingly porphyritic rock with abundant phenocrysts of plagioclase, fewer round phenocrysts of glassy quartz, sparse large (1-1 inch) phenocrysts of microcline, and scattered generally ragged flakes of biotite, in a pale-gray, green, or white very fine grained groundmass of quartz and K-feldspar. Rock almost invariably is altered; most specimens contained scattered crystals of pyrite

Alaskite, aplite, and pegmatite
Light-colored rocks consisting of K-feldspar, quartz, and oligoclase, and locally small amounts of biotite, tourmaline, magnetite, pyrite, and allanite; in sheets, dikes, and irregular masses. Small bodies shown as solid line without letter symbol; abundant small unmapped bodies indicated by Butte Quartz Monzonite symbol and the notation "a"

vp
Highly porphyritic quartz monzonite
Fine- to coarse-grained pink rock with 30 to 50 conspicuous phenocrysts of K-feldspar per square foot of exposure

b, undivided
cl, coarse-grained, light-colored, nonporphyritic (less than 10 K-feldspar phenocrysts per square foot)
clp, coarse-grained, light-colored, porphyritic (10-20 K-feldspar phenocrysts per square foot)
clvp, coarse-grained, light-colored, very porphyritic (20-30 K-feldspar phenocrysts per square foot)
md, medium-grained, dark-colored, nonporphyritic
*a, areas where the rocks are cut by abundant unmapped dikes of alaskite, aplite, and pegmatite inclusions of dioritic rocks shown as black dots and irregular black patches. Many of these probably are metasedimentary and metavolcanic rocks

mo, monzonite
dior, diorite
gd, dark granodiorite

Kv
Elkhorn Mountains Volcanics
Thermally metamorphosed andesite and basalt fragmental rocks and related dike rocks, and rhyolite welded tuff. Remnants of the roof and walls of the Boulder batholith

CRETACEOUS

PENNSYLVANIAN

CARBONIFEROUS

Pq
Quadrant Quartzite
Pure quartz sandstone, argillaceous sandstone, and impure carbonate rocks metamorphosed to quartzite, calc-silicate hornfels, and granular rocks. Remnants of the roof and walls of the Boulder batholith. Complexly faulted and injected by aplite and quartz monzonite in large roof pendant at the head of Sand Creek. As mapped may include rocks of the upper part of the Asenden Formation of Pennsylvanian age

Pennsylvanian

Pq
Quadrant Quartzite
Pure quartz sandstone, argillaceous sandstone, and impure carbonate rocks metamorphosed to quartzite, calc-silicate hornfels, and granular rocks. Remnants of the roof and walls of the Boulder batholith. Complexly faulted and injected by aplite and quartz monzonite in large roof pendant at the head of Sand Creek. As mapped may include rocks of the upper part of the Asenden Formation of Pennsylvanian age