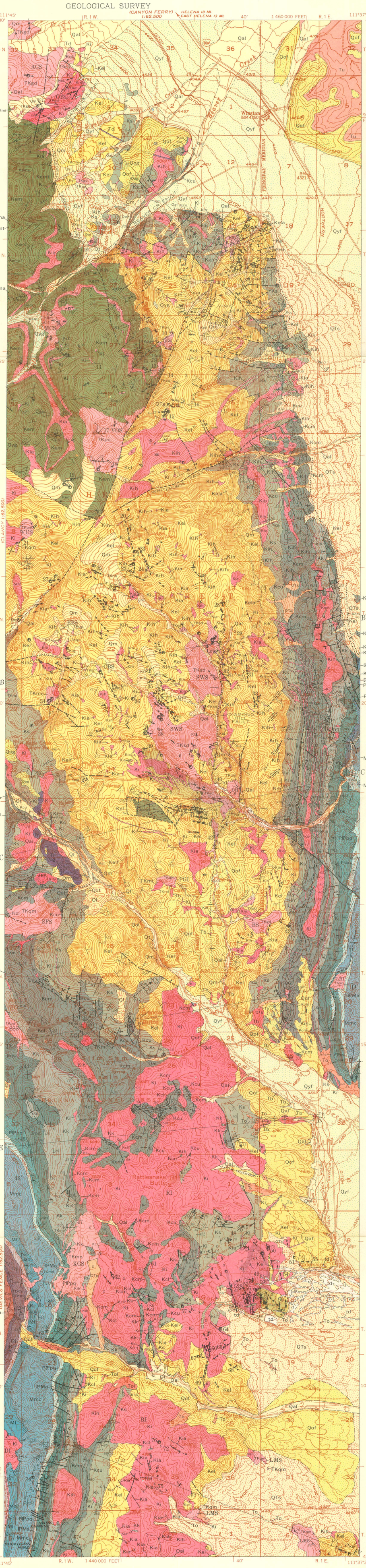


Base from U.S. Geological Survey, 1:62,500: Townsend, 1950; Radersburg, 1949

10,000-foot grid based on Montana coordinate system, south zone

TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1971

Geology mapped in 1949–53

GEOLOGIC MAP AND STRUCTURE SECTIONS OF THE EAST FLANK OF THE ELKHORN MOUNTAINS, BROADWATER COUNTY, MONTANA

SCALE 1:48 000

1 ½ 0 1 2 3 MILES

1 .5 0 1 2 3 KILOMETERS

CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL

EXPLANATION

QUATERNARY

Pleistocene or Holocene

Qal — Alluvium

Qm — Deposits resulting from mass wasting

Ql — Landslide deposits

Pleistocene

Qyg — Younger glacial deposits

Qt — Terrace deposits

Qyf — Younger outwash fan deposits

Qog — Older glacial deposits

Qof — Older outwash fan deposits

QTs — Fan deposits and mantle

TERTIARY(?) OR QUATERNARY(?)

Pliocene(?) or Pleistocene(?)

Upper Pliocene(?) or lower Pleistocene(?)

QTg — Gravel deposits

UNCONFORMITY; MINOR FOLDING, FAULTING, AND RECURRENT UPLIFT

TERTIARY

Miocene or Pliocene

Upper Miocene or lower Pliocene

Tb — Basalt flows

Scattered remnants of rhyolite flow mapped with basalt along Crow Creek near Jenkins Gulch. Pattern shows areas of paleosol development on basalt

Oligocene

To — Rhyolite sedimentary tuff with lenses of conglomerate

Tol — Calcareous tufa

Tu — Sedimentary tuff, partly bentonitic, or bentonite and conglomerate of Oligocene or younger age

Eocene(?)

Tr — Quartz latite flow

Td — Quartz latite porphyry dikes

MAJOR ANGULAR UNCONFORMITY AND EROSION INTERVAL

CRETACEOUS AND TERTIARY

Upper Cretaceous and Paleocene

TKgd, TKsd, TKmo, TKqm, TKpq, TKgp, TKqp — Felsic intrusive rocks

TKgd, *granodiorite; grades to:*
TKsd, *syenodiorite*
TKmo, *monzonite*
TKqm, *quartz monzonite*
TKpq, *porphyritic quartz monzonite*
TKgp, *granite porphyry*
TKqp, *quartz monzonite porphyry*

TKmi — Mafic intrusive rocks

FOLDING AND FAULTING DURING AND AFTER VOLCANISM

CRETACEOUS

Upper Cretaceous

Kem, Kema, Kemt, Kelt, Kelf, Kela, Kel — Elkhorn Mountains Volcanics

Kem, *middle member: mainly trachyandesitic tuff and lapilli tuff, and rhyolitic welded tuff. About 3,000 feet preserved; top eroded*
Kemt, *local unit of tuff and lapilli tuff*
Kema, *local unit of welded tuff*
Kel, *lower member: dominantly trachyandesite and rhyodacite volcanic rocks including breccias; tuffs, volcanic conglomerate, welded tuffs, and flows. 2,500 to 5,000 feet thick*
Kelt, *local unit of tuff*
Kelf, *flow*
Kela, *local unit of welded tuff*

Ki, Kih, Kia, Kio — Intrusive rocks related to Elkhorn Mountains Volcanics

Rhyodacite and trachyandesite in dikes, sills, and in small irregular bodies, grading to syenodiorite, granodiorite, and diorite porphyry in larger partly concordant bodies
Ki, *undivided*
Kih, *with conspicuous phenocrysts of hornblende*
Kia, *with conspicuous phenocrysts of augite*
Kio, *with conspicuous phenocrysts of olivine*

CONFORMITY, DISCONFORMITY, AND ANGULAR UNCONFORMITY AT DIFFERENT PLACES

Lower Cretaceous

Ks — Slim Sam Formation

Upper part: mainly greenish-gray medium- to thick-bedded tuff and sedimentary tuff
Lower part: thin- to medium-bedded sandstone and thin interbeds of dark shale
A few hundred feet to about 1,200 feet thick

Kcu, Kcm, Kcl — Colorado Formation

Kcu, *upper black shale unit: black shale with thin sandstone and siltstone beds*
Kcm, *middle mudstone and sandstone unit: mainly quartz-chert sandstone and siliceous mudstone*
Kcl, *lower black shale unit: dark-gray carbonaceous sandstone underlain by black shale*
1,000 to 1,600 feet thick, thinning northward

DISCONFORMITY(?)

Lower Cretaceous

Kk — Kootenai Formation

Upper part: drab mudstone underlain by gastropod-bearing limestone
Middle part: red and green mudstone and shale with limestone lentils and concretions
Lower part: crossbedded "salt-and-pepper" sandstone with shale and mudstone; grades into Morrison Formation
About 500 feet thick

DISCONFORMITY(?)

JURASSIC

Upper Jurassic

Jms — Morrison and Swift Formations

Morrison Formation: varicolored nonmarine shale, mudstone, and siltstone, with thin beds of limestone and sandstone, and commonly near the top unit of black shale. Upper 50 to 80 feet locally contains thick, lenticular beds of speckled chert quartz sandstone. About 500 feet thick
Swift Formation: grayish-brown punky calcareous marine sandstone, with a basal chert-pebble conglomerate. 20 to 30 feet thick

DISCONFORMITY

PENNSYLVANIAN PERMIAN

PIPpq, Pp, IPq — Phosphoria Formation and related strata and Quadrant Formation

Pp, *Phosphoria Formation and related strata: brown and gray chert and sandstone, in part phosphatic; locally contains one or two thin beds of phosphate rocks. About 50 feet thick*
IPq, *Quadrant Formation: light-colored quartzitic sandstone and interbedded light-gray sugary-textured sandy dolomite. About 325 feet thick*

MISSISSIPPIAN CARBONIFEROUS

Upper Mississippian

IPMa — Amsden Formation and Big Snowy Group

Red to grayish-red siltstone, mudstone, and shale, with subordinate carbonate rock and gray, brown, or yellow argillaceous sandstone in upper and lower parts; generally poorly exposed; middle part is medium- to dark-gray limestone and dolomite. Upper part is Amsden Formation; middle and lower parts are Big Snowy Group. About 250 feet thick

DISCONFORMITY

Lower Mississippian

Madison Group

Mmc — Mission Canyon Limestone

Medium- to light-gray thickly and indistinctly bedded limestone with sparse gray chert nodules and lentils in upper half and a few thin siliceous layers in lower 200 feet. Collapse breccia common in upper part. Grades into Lodgepole Limestone through a 150- to 200-foot zone. About 1,000 feet thick

Ml — Lodgepole Limestone

Upper part: medium-gray limestone in distinct beds as much as 3 feet thick alternating with zones of much thinner beds containing sparse mudstone partings
Lower part: medium-gray limestone in beds 1 inch to 1 foot thick with partings and interbeds of yellow to red calcareous mudstone
About 700 feet thick

DEVONIAN

Upper Devonian

MDt — Three Forks Shale

Greenish-gray and brown shale with subordinate interbedded sandstone. Carbonatic siltstone at top; fossiliferous blue-gray limestone about 100 feet below top; poorly exposed. About 300 feet thick

Dj — Jefferson Dolomite

Dark-gray granular-weathering fetid well-bedded dolomite with subordinate dark-gray limestone and light-gray dolomite. About 500 feet thick

Middle and Upper Devonian

DISCONFORMITY **D€mr** — Maywood and Red Lion Formations

Varicolored, generally in shades of red and yellowish brown, argillaceous, dolomitic, and calcareous rocks; poorly exposed. Maywood is about 40 feet thick; Red Lion is about 90 feet thick

CAMBRIAN

Upper Cambrian

€pi — Pilgrim Dolomite

Upper part: light-gray thick-bedded dolomite commonly mottled medium gray near base
Middle part: light- to medium-gray limestone irregularly ribboned with yellowish-gray silty dolomite
Lower part: mottled light- and dark-gray dolomite and limestone
About 500 feet thick

Middle Cambrian

€pa — Park Shale

Olive-gray, gray, and light-brown shale with a few thin beds of argillaceous limestone, siltstone, and sandstone; poorly exposed. About 200 feet thick

Contact, showing dip
Long dashed where approximately located; short dashed where inferred or indefinitely located; dotted where concealed; queried where doubtful

Gradational contact

Fault, showing dip
Long dashed where approximately located; short dashed where inferred or indefinitely located; dotted where concealed; queried where doubtful. Bar and ball on downthrown side. Arrows indicate relative lateral displacement

Anticline
Showing crestline and direction and amount of plunge of axis. Long dashed where approximately located; short dashed where inferred; dotted where concealed

Syncline
Showing troughline and direction and amount of plunge of axis. Long dashed where approximately located; short dashed where inferred; dotted where concealed

Horizontal; Inclined; Vertical; Overturned
Strike and dip of beds

Inclined; Vertical
Strike and dip of joint

Strike and dips of two joint sets having same strike but different dip

Strikes and dips of joint sets

Thermally metamorphosed rocks
Mapped north of Beaver Creek only

Hydrothermally altered rock
Stippled area, strongly pyritic rock, bleached and limonite stained in zone of oxidation
S, *intensely silicified rock*
Shaded area, greenish-gray chloritic, epidotic, and pyritic rock

Vein, showing dip
Long dashed where approximately located; short dashed where inferred; queried where doubtful

Mine
Type of workings unspecified

Prospect pit or small underground workings

Shaft

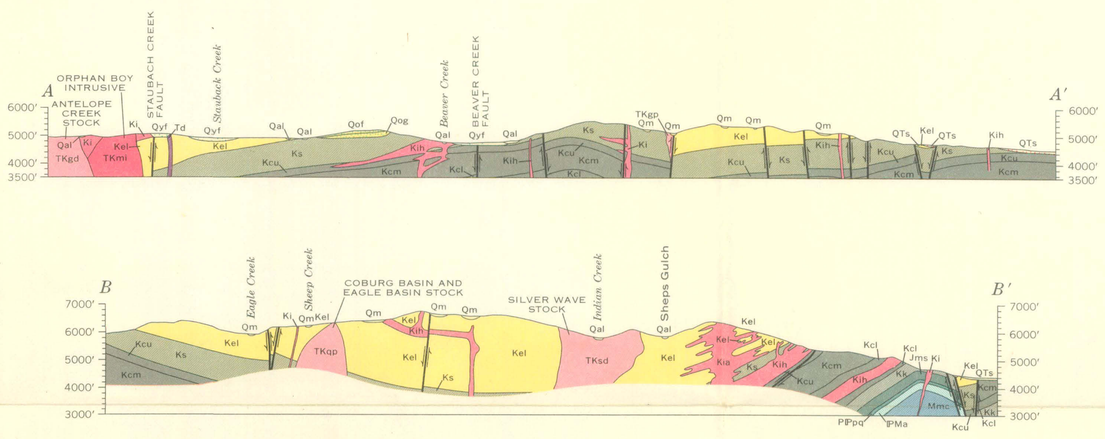
Adit

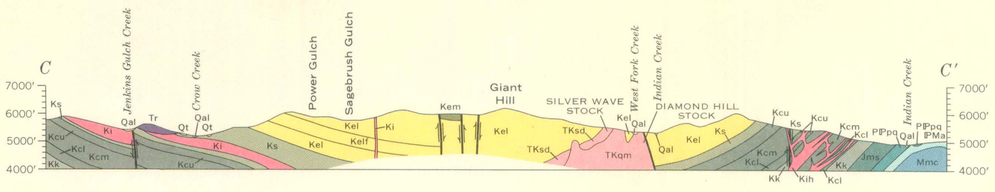
Trench

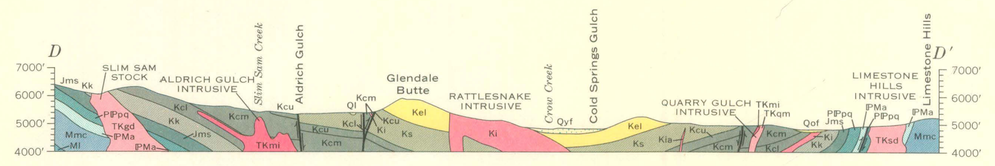
Caved shaft

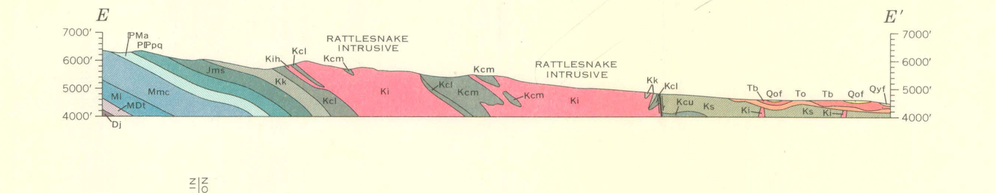
Caved adit

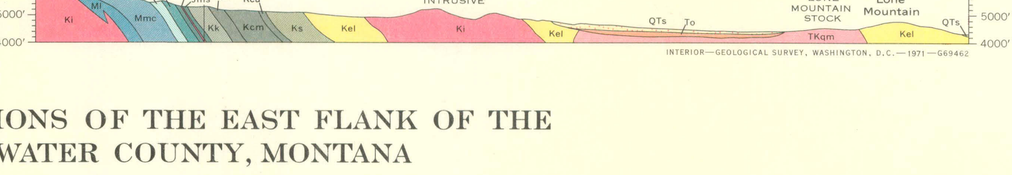
td — Tailings and dumps
Includes gold placer tailings











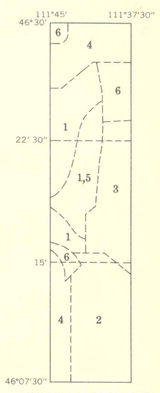
INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1971—G69462

LIST OF MINES SHOWN ON MAP

1. Orphan Boy
2. Gold Bug
3. Custer
4. Edna No. 2
5. Hyantha
6. Iron Age
7. Maine
8. Sunshine
9. Monte Cristo
10. Freiburg
11. Silver Saddle
12. East Pacific
13. January
14. Sunrise
15. Stray Horse
16. Little Bonanza
17. Vosburg
18. Kleinschmidt (Little Olga)
19. Champion
20. Big Chief
21. Vulture
22. Marietta
23. Bullion King
24. Little Annie
25. Jawbone
26. Park
27. Parker
28. Shep
29. Buckeye
30. Phoenix
31. Iron Mask
32. John L
33. Lookout
34. Mammoth
35. St. Louis
36. Queen Bee
37. Silver Wave
38. Central
39. Spring Hill
40. Diamond Hill
41. Little Giant
42. Blacksmith
43. Bluebird
44. Monarch
45. Quartzite
46. Horn Silver
47. Rothfus
48. Iron Cross
49. Jebro
50. Rena
51. North Butte
52. Black Bear
53. Beauty
54. Surprise
55. Delome
56. Hidden Treasure
57. Greenhorn
58. Ohio-Keating
59. Keating
60. Etta
61. Hard Cash
62. Kahoka
63. North Home
64. Congress
65. Iron Age (Allen)
66. Black Friday
67. Bluebird
68. Gopher
69. Cyclone
70. Jo Jo
71. Jo Dandy
72. Gold Cross
73. Santa Anita
74. Ruby
75. Monterey
76. Ralls

LIST OF STOCKS AND INTRUSIVES SHOWN ON MAP

ACS–Antelope Creek stock
AGI–Aldrich Gulch intrusive
BS–Bluebird stock
CBS–Coburg Basin stock
DHS–Diamond Hill stock
DI–Dutchman intrusive
EBS–Eagle Basin stock
ES–Edna stock
FS–Freiburg stock
ICI–Indian Creek intrusive
JRS–Jenkins Ridge stock
JS–January stock
KGS–Keating Gulch stock
LHI–Limestone Hills intrusive
LMS–Lone Mountain stock
MCS–Monte Cristo stock
OBI–Orphan Boy intrusive
PGI–Power Gulch intrusive
QGI–Quarry Gulch intrusive
RI–Rattlesnake intrusive
SFS–South Fork stock
SSS–Slim Sam stock
SWS–Silver Wave stock
VOS–Vosburg stock
VUS–Vulture stock



INDEX TO GEOLOGIC MAPPING

1. R. A. Weeks
2. V. L. Freeman
3. E. T. Ruppel
4. M. R. Klepper
5. E. J. Lyons
6. H. W. Smedes