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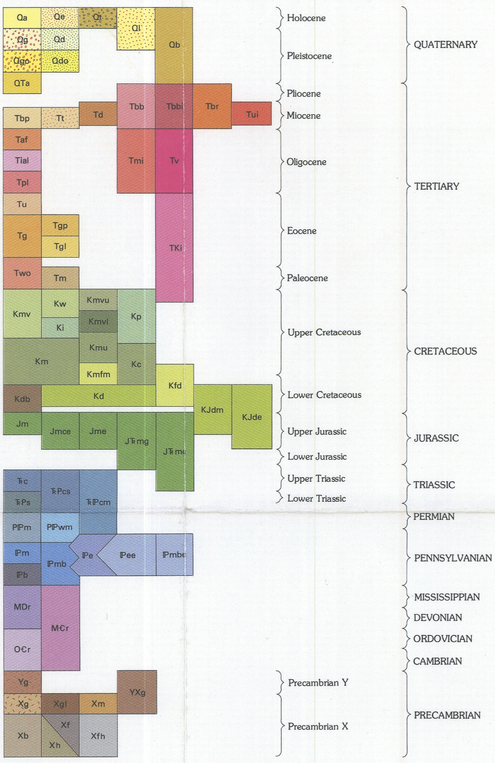
CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Formations for which no map symbol is shown are grouped with other stratigraphic units to form map units

UNCONSOLIDATED DEPOSITS (HOLOCENE):

Qa Alluvium—Gravel, sand, and silt in stream valleys and alluvial fans

Qe Eolian deposits—Windblown sand and silt

Qt Talus deposits and rock glaciers

Ql LANDSLIDE DEPOSITS (HOLOCENE AND PLEISTOCENE)—On Grand and Battlement Mesas (southwestern corner of quadrangle), consist principally of large slump blocks of basalt irregularly veneered with young (Pinedale) glacial drift. Elsewhere, include mudflow and some talus deposits. Many small bodies not mapped

Qb YOUNG BASALT (HOLOCENE AND PLEISTOCENE)—In Roaring Fork valley north of Aspen, 1.5 m.y. (million years) old; along Rock Creek north of McCoy, 0.64 m.y. old (Larson and others, 1975, p. 166). Near Dotsero, 4,150 years old (Giegengack, 1962)

* Volcanic cinder cone or crater

UNCONSOLIDATED DEPOSITS (PLEISTOCENE):

Qg Young gravels (Bull Lake and younger)—Stream, terrace, and outwash gravels

Qd Young glacial drift (Bull Lake and younger)—Unsorted bouldery glacial deposits (till) and associated sand and gravel deposits

Qgo Old gravels and alluviums (pre-Bull Lake)—Terrace, outwash, and pediment gravels

Qdo Old glacial drift (pre-Bull Lake)—Unsorted bouldery glacial deposits (till); morainal form subdued or lacking

QTa HIGH-LEVEL ALLUVIUM (PLEISTOCENE AND/OR PLIOCENE)—Fine-grained to bouldery alluvial deposits and gravels; preserved mainly on ridge tops; may not all be of same age; in southwest part of quadrangle, characterized by abundant basalt boulders and in places has been mapped previously as basalt

Tbp BROWNS PARK FORMATION (MIOCENE)—Fluvial ashy siltstone, claystone, sandstone, conglomerate, and thin beds of air-fall ash; loosely consolidated; conglomerate at base. Locally interbedded with basalt (Tbb unit). Thickness >1,000 ft (305 m) south of State Bridge

Tt TROUBLESOME FORMATION (MIOCENE)—Chiefly siltstone; contains many beds of volcanic ash and some of sandstone and conglomerate. Thickness >500 ft (152 m) in Williams Fork valley. Term is used in Middle Park for Miocene rocks largely equivalent to Browns Park Formation west of the Gore Range

Td DRY UNION FORMATION [PLIOCENE AND MIOCENE)—Light-brown sandy siltstone and interbedded friable sandstone, conglomerate, and volcanic ash. Thickness >3,000 ft (915 m) in Arkansas River valley southwest of Leadville

Tbb BASALT OF BIMODAL SUITE (PLIOCENE AND MIOCENE)—Dense black resistant alkali basalt in lava-flow layers 5–200 ft (1.6–61 m) thick, and interbedded tuffs and volcanic conglomerates. Greatest preserved thicknesses are 900 ft (275 m) on White River Plateau and 800 ft (244 m) on Grand Mesa. Ages determined from several localities range from 8 to 23 m.y. (Larson and others, 1975)

Tbbi BASALTIC DIKES AND PLUGS (PLIOCENE AND MIOCENE)—Probable feeders of basalt flows of Tbb unit; also intrusive into the flows

Tbbi Dike

Tbr RHYOLITIC ROCKS OF BIMODAL SUITE (PLIOCENE AND MIOCENE)—In plugs, dikes, and small flows

Tbr Dike

Tui UPPER TERTIARY INTRUSIVE ROCKS (MIOCENE)—Sodic granite of Treasure Mountain south of Marble, and satellitic plugs and dikes. About 12.5 m.y. in age (Obradovich and others, 1969)

Taf ASH-FLOW TUFF (OLIGOCENE)—Dense silicic welded tuff and vitrophyre; principally in Grizzly caldera south of Independence Pass in Sawatch Range

Tial INTER-ASH FLOW ANDESITIC LAVAS AND BRECCIAS (OLIGOCENE)—Mapped only at Buffalo Peaks in southeast corner of quadrangle

Tpl PRE-ASH FLOW ANDESITIC LAVAS AND BRECCIAS (OLIGOCENE)—Mapped only in Grizzly caldera area south of Independence Pass in Sawatch Range

Tmi MIDDLE TERTIARY INTRUSIVE ROCKS (OLIGOCENE; 26–38 m.y.)—Granodiorite and quartz monzonite; generally porphyritic but equigranular in some large bodies; in stocks, dikes, sills, and irregular bodies

Tmi Dike or sill

Tv VOLCANIC ROCKS OF GREEN MOUNTAIN AREA (OLIGOCENE)—Trachytic lavas related to Green Mountain intrusive and volcanic center in Blue River valley dated by fission-track method at 30 m.y. (Naeser and others, 1973)

Tu UINTA FORMATION (EOCENE)—Siltstone, sandstone, and marlstone. Maximum preserved thickness on Battlement Mesa about 1,000 ft (305 m)

Tg GREEN RIVER FORMATION (EOCENE)—Marlstone, oil shale, siltstone, and sandstone. Undivided unit mapped only at depositional edge of formation in southwest corner of quadrangle

Tgp Parachute Creek Member—Oil shale and marlstone. Thickness 1,200 ft (365 m) on Roan Plateau northwest of Rifle; thins southward to wedge edge near south boundary of quadrangle

Tgl Lower part of Green River Formation—Shale, sandstone, and marlstone in the Anvil Points, Garden Gulch, and Douglas Creek Members. Thickness >2,000 ft (610 m) on Roan Plateau northwest of Rifle; thins southward to wedge edge near south boundary of quadrangle

Two WASATCH AND OHIO CREEK FORMATIONS:
Wasatch Formation (Eocene and Paleocene)—Variegated claystone, siltstone, sandstone, and conglomerate; carbonaceous shale and lignite near base. Maximum thickness about 5,800 ft (1,770 m)
Ohio Creek Formation (Paleocene)—Sandstone and conglomerate. Thickness 400 ft (122 m) near south boundary of quadrangle; thins northward to about 50 ft (15 m) along Grand Hogback north of Rifle

Tm MIDDLE PARK FORMATION-UPPER PART (PALEOCENE)—Arkosic grit, conglomerate, sandstone, and mudstone; contains abundant volcanic detritus. Preserved thickness at northeast corner of quadrangle >2,000 ft (610 m)

TKi LARAMIDE INTRUSIVE ROCKS (EOCENE, PALEOCENE, AND UPPER CRETACEOUS; 40–72(?) m.y.)—Quartz monzonite, granodiorite, and quartz diorite porphyries in stocks, sills, and dikes

TKi Dike or sill

Kmv MESAVERDE GROUP UNDIVIDED OR MESAVERDE FORMATION (UPPER CRETACEOUS)

Kw Williams Fork Formation—Light-brown to white sandstone, gray to black shale, and coal beds. Maximum thickness along Grand Hogback north of Rifle is 4,500 ft (1,372 m)

Ki Iles Formation—Massive beds of light-brown to white sandstone and interbedded shale and coal. Trout Creek Sandstone Member at top. Maximum thickness along Grand Hogback north of Rifle is 1,600 ft (488 m)

Kmvu Upper part of Mesaverde Formation—Sandstone, shale, and minor coal beds. Maximum thickness along Grand Hogback south of Colorado River is 2,700 ft (823 m)

Kmvl Lower part of Mesaverde Formation—Sandstone, shale, and coal. Unit thins southward by wedging of lower sandstone beds into Mancos Shale. Thickness near Colorado River is 2,400 ft (732 m); near Carbondale, where Rollins Sandstone Member is at base, 1,400 ft (427 m)

Kp PIERRE SHALE (UPPER CRETACEOUS)—Dark-gray marine shale containing a few thick beds of fine-grained sandstone. Maximum preserved thickness 5,000–6,000 ft (1,525–1,830 m)

Km MANCOS SHALE (UPPER AND LOWER CRETACEOUS)—Gray to dark-gray marine shale. Sandstone beds near the top. Calcareous sandstone of Upper Cretaceous Frontier Sandstone Member 300–400 ft (90–122 m) above base, overlain by calcareous shale zone equivalent to Niobrara Formation. Silver-gray siliceous shale of Lower Cretaceous Mowry Shale Member at base. Thickness north of Colorado River about 5,000 ft (1,525 m); south of river, >6,000 ft (1,820 m)

Kmu Upper unit of Mancos Shale (Upper Cretaceous)—Mancos Shale above the Frontier Sandstone Member

Kmfm Frontier Sandstone and Mowry Shale Members and intervening shale zone (Upper and Lower Cretaceous)—Thickness about 500 ft (152 m)

Kc COLORADO GROUP (UPPER AND LOWER CRETACEOUS)—Consists of Upper Cretaceous Niobrara Formation (calcareous shale and marly limestone) and Upper and Lower Cretaceous Benton Shale, which has calcareous sandstone equivalent to Frontier Sandstone Member of Mancos Shale at top and siliceous shale equivalent to Mowry Shale Member at base. Thickness 800–1,000 ft (244–305 m)

Kd DAKOTA SANDSTONE (LOWER CRETACEOUS)—Light-gray and tan sandstone or quartzite; some interbedded dark shale and shaly sandstone. Resistant, widely exposed unit but too thin to show separately at map scale in many areas. Thickness 125–225 ft (37–68 m)

Kdb DAKOTA SANDSTONE AND BURRO CANYON FORMATION (LOWER CRETACEOUS)—Mapped only in Aspen-Basalt area
Burro Canyon Formation—Yellow sandstone and green claystone. Maximum thickness 225 ft (68 m)

Kfd FRONTIER SANDSTONE AND MOWRY SHALE MEMBERS OF MANCOS SHALE AND DAKOTA SANDSTONE

Jm MORRISON FORMATION (UPPER JURASSIC)—Variegated shale and mudstone, light-gray sandstone, and local beds of gray and green-gray limestone. Locally conglomeratic near base. Thickness about 500 ft (152 m) along Grand Hogback and along Colorado River near Burns; thins eastward and southeastward to <200 ft (60 m) in Blue River valley
CURTIS FORMATION (UPPER JURASSIC)—Yellowish-gray to pale-green glauconitic sandstone and oolitic limestone. Thickness <100 ft (30 m)
ENTRADA SANDSTONE (UPPER JURASSIC)—Light-gray to orange crossbedded sandstone. Thickness 75–150 ft (23–46 m) in northwest and central parts of quadrangle; wedges out southward in Aspen area and eastward at Gore Range

KJdm DAKOTA FORMATION AND MORRISON FORMATION

KJde DAKOTA, MORRISON, CURTIS, AND ENTRADA FORMATIONS ALONG COLORADO RIVER NEAR BURNS AND STATE BRIDGE; ELSEWHERE, DAKOTA, MORRISON, AND ENTRADA FORMATIONS

Jmce MORRISON, CURTIS, AND ENTRADA FORMATIONS

Jme MORRISON AND ENTRADA FORMATIONS

GLEN CANYON SANDSTONE (LOWER JURASSIC AND UPPER TRIASSIC)—Light-brown to light-gray crossbedded sandstone that closely resembles the overlying Entrada Sandstone, from which it is separated by a subtle unconformity. Maximum thickness 75 ft (23 m)

JTRmg MORRISON, ENTRADA, AND GLEN CANYON FORMATIONS

TRc CHINLE FORMATION (UPPER TRIASSIC)—Brownish- and purplish-red calcareous siltstone, mudstone, and sandstone; limestone-pellet conglomerate in lower part; Gartra Sandstone Member at base (pale-purple to white pebbly sandstone 25 ft or 8 m thick). Thickness 1,200 ft (365 m) near Brush Creek south of Eagle; thins from there in all directions; wedges out beneath pre-Entrada unconformity along west side of Gore Range and in Elk Mountains southwest of Aspen

JTRmc MORRISON, ENTRADA, AND CHINLE FORMATIONS—Along Grand Hogback south of T. 6 S., Chinle is represented only by the Gartra Member

TRPs STATE BRIDGE FORMATION (LOWER TRIASSIC AND PERMIAN)—Orange-red to red-brown siltstone and sandstone. Thickness at least 5,000 ft (1,525 m) in local depositional basin in Hardscrabble Mountain area south of Eagle. To the north, unit is 500 ft (152 m) thick and thins eastward to wedge out along west flank of Gore Range. To the southwest, unit is 2,400 ft (732 m) thick along Fryingpan River east of Basalt but absent beneath pre-Chinle and pre-Entrada unconformities at Grand Hogback and in Elk Mountains

TRPcs CHINLE AND STATE BRIDGE FORMATIONS

PIPm MAROON FORMATION (PERMIAN AND PENNSYLVANIAN)—Maroon and grayish-red sandstone, conglomerate, and mudstone; lower part intertongues with Eagle Valley Formation or Evaporite which underlies the Maroon in places. Thickness >9,500 ft (2,900 m) in area southwest of Aspen; thins northeastward to depositional margin along west flank of Gore Range; thinning also due to pre-State Bridge unconformity
WEBER SANDSTONE (PERMIAN AND PENNSYLVANIAN)—Yellow-gray sandstone. Thickness about 100 ft (30 m) near northwest corner of quadrangle; thins toward depositional margin to south and east; present margin south of Glenwood Springs, east of Eagle, and east of Burns results in part from truncation beneath pre-State Bridge unconformity

PIPwm WEBER SANDSTONE AND MAROON FORMATION

TRPcm CHINLE, STATE BRIDGE, AND MAROON FORMATIONS

PIPm MINTURN FORMATION (PENNSYLVANIAN)—Gray, pale-yellow, and red sandstone, grit, conglomerate, and shale, and scattered beds and reefs of carbonate rocks. Includes rocks of Gothic Formation of Langenheim (1952). Thickness near Minturn >6,000 ft (1,830 m); thins abruptly eastward toward depositional margin along west flank of Gore Range and at Breckenridge. Thins westward and intertongues with Eagle Valley Evaporite in Eagle basin. Thickness on western side of basin, in Elk Mountains, about 3,000 ft (915 m). East and north of Sawatch Range, contact with overlying Maroon Formation is placed at top of highest marine limestone; west of Sawatch Range and White River Plateau, contact is at color change from predominantly gray (Minturn) below to predominantly red (Maroon) above

PIPb BELDEN FORMATION (PENNSYLVANIAN)—Dark-gray to black shale, carbonate rocks, and sandstone. Map unit includes local thin lenses of Molas Formation (Pennsylvanian) at base. Maximum thickness in Elk Mountains and White River Plateau area about 900 ft (275 m); thins eastward to depositional margin along Gore Range and near Hoosier Pass

PIPmb MINTURN AND BELDEN FORMATIONS

PIPmbe Evaporite-bearing facies of Minturn and Belden Formations—Mapped only in South Park, in southeast corner of quadrangle

PIPe EAGLE VALLEY FORMATION (PENNSYLVANIAN)—Gray and reddish-gray siltstone, shale, sandstone, carbonate rocks, and local lenses of gypsum. Unit is transitional between the coarse clastic rocks of the Minturn and Maroon Formations and purely evaporitic rocks. Thickness variable, depending on intertonguing relations

PIPee EAGLE VALLEY EVAPORITE (PENNSYLVANIAN)—Gypsum, anhydrite, and interbedded siltstone and minor dolomite; contains thick salt at depth in some places, as shown by wells drilled for oil and gas. Intertongues with Minturn, Belden, and Maroon Formations and grades into fine-grained clastic rocks of Eagle Valley Formation. Diapiric in structural configuration in many places, especially in large area in central part of quadrangle. Thickness indeterminate

MDr MISSISSIPPIAN AND DEVONIAN ROCKS—Includes rocks of, Leadville Limestone (or Dolomite) (Mississippian) and Chaffee Group (Mississippian? and Devonian). Leadville thickness variable beneath pre-Belden unconformity; maximum of about 275 ft (84 m) in Elk Mountains; truncated eastward along west flank of Gore Range and near Hoosier Pass. Chaffee Group consists of Gilman Sandstone (Mississippian or Devonian), Dyer Dolomite (Mississippian? and Devonian) and Parting Formation (Devonian). Maximum thickness of Chaffee Group 250 ft (76 m) in White River Plateau area; truncated beneath pre-Belden unconformity along west flank of Gore Range and near Hoosier Pass

OCr ORDOVICIAN AND CAMBRIAN ROCKS—Includes various combinations of: Fremont Limestone (Ordovician), Harding Sandstone (Ordovician), Manitou Dolomite (Ordovician), Dotsero Formation (Cambrian), Peerless Formation (Cambrian), and Sawatch Quartzite (Cambrian). Fremont is present beneath pre-Parting unconformity only in western Elk Mountains. Harding is present beneath pre-Parting and pre-Fremont unconformities only in western Elk Mountains and along Eagle River from Minturn area to Tennessee Pass. Manitou is widespread but in eastern part of quadrangle is absent beneath pre-Harding and younger unconformities from Pando and Breckenridge northward. Dotsero is mapped only in White River Plateau area. Peerless and Sawatch are widespread but are truncated beneath various unconformities along Gore Range and near Breckenridge. Maximum thickness of Ordovician and Cambrian rocks about 750 ft (230 m) in White River Plateau area

MCr MISSISSIPPIAN, DEVONIAN, ORDOVICIAN, AND CAMBRIAN ROCKS

Yg GRANITIC ROCKS (PRECAMBRIAN Y— 1,400 m.y. AGE GROUP)—Includes Silver Plume and St. Kevin Granites and equivalents

Xg GRANITIC ROCKS (PRECAMBRIAN X— 1,700 m.y. AGE GROUP)—Includes Cross Creek Granite of Gore and northern Sawatch Ranges, Denny Creek Granodiorite of central Sawatch Range, and equivalent rocks

Xgl LEUCOCRATIC GRANITIC ROCKS (PRECAMBRIAN X)—Includes trondhjemitic Kroenke Granodiorite in Sawatch Range, and granite at Taylor Pass southeast of Ashcroft Mountain in the Elk Mountains

YXg GRANITIC ROCKS UNDIVIDED (PRECAMBRIAN Y AND X)

Xm MAFIC INTRUSIVE ROCKS (PRECAMBRIAN X)—Noritic gabbro

Xb BIOTITIC GNEISSES AND MIGMATITE (PRECAMBRIAN X)—Unit contains minor interlayered hornblende gneiss and calc-silicate rocks. Parent materials mainly graywacke and shale

Xf FELSIC GNEISSES (PRECAMBRIAN X)—Parent materials probably igneous rocks of intermediate compositions

Xh HORNBLENDIC GNEISSES (PRECAMBRIAN X)—Parent materials probably mainly basaltic and andesitic igneous rocks; some of gneiss is closely associated with calc-silicate rocks and minor marble and probably is metasedimentary

Xfh INTERLAYERED FELSIC AND HORNBLENDIC GNEISSES (PRECAMBRIAN X)

CONTACT

FAULT—Dotted where concealed. Bar and ball on downthrown side

THRUST FAULT—Dotted where concealed. Sawteeth on upper plate

INFERRED FAULT IN VALLEY-FILL DEPOSITS—Largely concealed; location approximate or conjectural. Bar and ball on downthrown side

PRECAMBRIAN SHEAR ZONE—Dotted where concealed

ANTICLINE—Showing crestline; dotted where concealed

SYNCLINE—Showing troughline; dotted where concealed

MONOCLINE—Showing anticlinal crestline of steep dip; dotted where concealed

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