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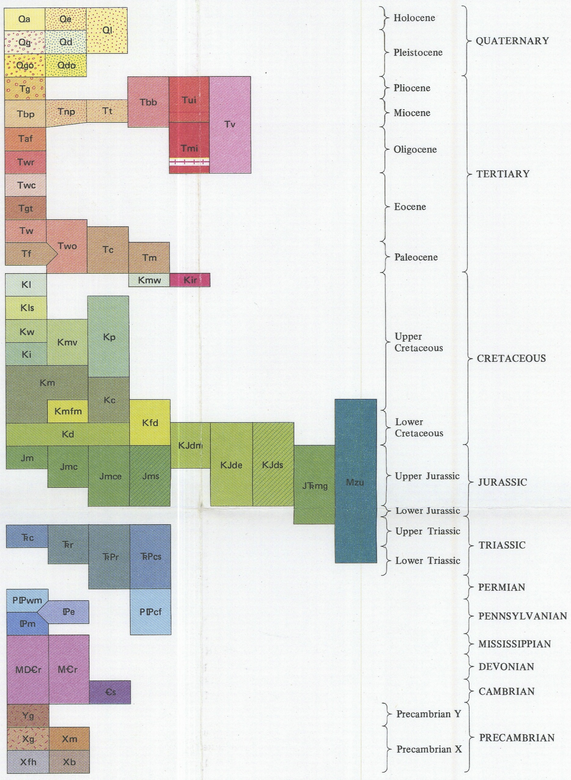
## CORRELATION OF MAP UNITS




Contact

Fault – Dotted where concealed. Bar and ball on downthrown side

Thrust fault – Dotted where concealed. Sawteeth on upper plate

Precambrian shear zone

Crest of anticline – Dotted where concealed

Trough of syncline – Dotted where concealed

Overturned syncline

Line of steep dip in monocline – Dotted where concealed

## DESCRIPTION OF MAP UNITS

(Where no map symbol is shown the formation is included elsewhere with other stratigraphic units)

UNCONSOLIDATED HOLOCENE DEPOSITS

**Qa** Alluvium – Gravel, sand, silt, and clay in stream valleys and alluvial fans

**Qe** Eolian deposits – Windblown sand and silt

**Ql** LANDSLIDE DEPOSITS (HOLOCENE AND PLEISTOCENE) – Shaly material with or without boulders of sandstone and basalt. Extensive areas of landslide in Elkhead Mountains are not shown

UNCONSOLIDATED PLEISTOCENE DEPOSITS

**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 alluvium (pre-Bull Lake) – Terrace, outwash, alluvial-fan, and pediment gravels

**Qdo** Old glacial drift (pre-Bull Lake) – Unsorted bouldery glacial deposits (till) and associated gravels

**Tg** PREGLACIAL GRAVEL (PLIOCENE) – Coarse unconsolidated gravel

**Tbp** BROWNS PARK FORMATION (MIOCENE) – Fluvial siltstone, claystone, and conglomerate, loosely consolidated eolian sandstone, and volcanic ash. Bouldery in places; conglomerate at base. Maximum thickness 2,000 ft (610 m)

**Tnp** NORTH PARK FORMATION (MIOCENE) – Fluvial ashy sandstone, conglomeratic sandstone, limestone, claystone, and volcanic ash. Loosely consolidated. Maximum thickness about 1,800 ft (550 m)

**Tt** TROUBLESOME FORMATION (MIOCENE) – Chiefly siltstone; contains many beds of volcanic ash and some of sandstone and conglomerate. Maximum thickness 1,500 ft (457 m)

**Tbb** BASALT OF BIMODAL VOLCANIC SUITE (PLIOCENE AND MIOCENE) – Dense black hard resistant lava rock. Boulders derived from it are scattered over extensive areas

* Volcanic neck

**Tui** UPPER TERTIARY INTRUSIVE ROCKS (PLIOCENE AND MIOCENE–<20 m.y.) – Mainly porphyries of intermediate and basaltic compositions. Mainly in Elkhead Mountains

Dike or sill

**Tv** VOLCANIC ROCKS (PLIOCENE, MIOCENE, AND OLIGOCENE) – Principally of intermediate compositions; include some basalt, light-colored tuffs, and bouldery volcanic breccia

**Tmi** MIDDLE TERTIARY INTRUSIVE ROCKS (MIOCENE AND OLIGOCENE–20–35 m.y.) – Porphyries of intermediate compositions. Mainly in Rabbit Ears Range

Dike or sill

**Taf** ASH-FLOW TUFF (OLIGOCENE) – Dense light-colored silicic welded tuff

**Twr** WHITE RIVER FORMATION (OLIGOCENE) – Light-gray to white soft tuffaceous siltstone and claystone. Thickness <200 ft (60 m)

WASATCH FORMATION (EOCENE)

**Twc** Cathedral Bluffs Tongue – Variegated fluvial claystone, mudstone, and sandstone. Thickness 1,000–1,500 ft (300–450 m)

**Tw** Main body – Gray and pink fluvial arkosic sandstone, mudstone, and conglomerate. Maximum thickness about 5,000 ft (1,525 m)

**Tgt** TIPTON TONGUE OF GREEN RIVER FORMATION (EOCENE) – Brown to gray lacustrine sandstone and papery carbonaceous shale. Thickness <50–300 ft (15–90 m)

**Tf** FORT UNION FORMATION (PALEOCENE) – Drab, brown, and gray sandstone and shale; contains coal beds. Thickness about 1,500 ft (457 m)

OHIO CREEK FORMATION (PALEOCENE) – Coarse-grained white sandstone and conglomeratic sandstone. Thickness <50 ft (15 m)

**Two** WASATCH AND OHIO CREEK FORMATIONS

**Tc** COALMONT FORMATION (EOCENE AND PALEOCENE) – Sandstone, conglomerate, and carbonaceous shale; contains coal beds. Estimated maximum thickness 11,000 ft (3,355 m). Name is used in North Park. Largely equivalent strata in Middle Park are assigned to Middle Park Formation

MIDDLE PARK FORMATION

**Tm** Upper part (Paleocene) – Arkosic grit, sandstone, conglomerate, and mudstone; contains abundant andesitic volcanic debris in lower part. Estimated maximum thickness 7,000 ft (2,135 m). Name applied in Middle Park to strata largely equivalent to Coalmont Formation

**Kmw** Windy Gap Member (Upper Cretaceous?) – Dark andesitic volcanic breccia and volcanic conglomerate. Maximum thickness 1,100 ft (335 m)

**Kir** UPPER CRETACEOUS INTRUSIVE ROCKS – Dark porphyritic augite syenite

**Kl** LANCE FORMATION (UPPER CRETACEOUS) – Gray shale, light-brown sandstone, and a few coal beds. Thickness 1,000–1,500 ft (305–457 m)

**Kls** LEWIS SHALE (UPPER CRETACEOUS) – Dark-gray homogeneous marine shale. Thickness 1,500–1,900 ft (457–580 m)

**Kmv** MESAVERDE GROUP UNDIVIDED (UPPER CRETACEOUS)

**Kw** Williams Fork Formation – Light-brown to white sandstone, gray shale, and coal beds. Thickness 1,100–2,000 ft (335–610 m)

**Ki** Iles Formation – Massive beds of light-brown to white sandstone and interbedded gray shale and coal. Thickness 1,500 ft (457 m)

**Kp** PIERRE SHALE (UPPER CRETACEOUS) – Dark-gray marine shale and a few thick beds of fine-grained sandstone. Maximum preserved thickness beneath pre-Coalmont or pre-Middle Park unconformity in North and Middle Parks 5,300 ft (1,615 m)

**Km** MANCOS SHALE (UPPER AND LOWER CRETACEOUS) – Gray to dark-gray marine shale. Sandstone beds near top; calcareous sandstone of Upper Cretaceous Frontier Member 300–400 ft (90–120 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 about 5,000 ft (1,525 m)

**Kmfm** Frontier Sandstone and Mowry Shale Members and intervening shale – Distinguished only locally on west side of Park Range. On east side, equivalent units are in Benton Shale of Colorado Group. 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 (dark bentonitic shale; calcareous sandstone and siliceous shale near base). Thickness 1,000–1,300 ft (305–395 m)

**Kd** DAKOTA SANDSTONE (LOWER CRETACEOUS) – Light-gray and tan sandstone or quartzite; some interbedded dark shale and shaly sandstone. Thickness 100–250 ft (30–75 m). Resistant, widely exposed unit but too thin to show separately at map scale in many areas

**Jm** MORRISON FORMATION (UPPER JURASSIC) – Variegated shale and mudstone, light-gray sandstone, and beds of fine-grained gray limestone. Locally conglomeratic near base. Thickness 300–500 ft (90–152 m)

CURTIS FORMATION (UPPER JURASSIC) – Yellowish-gray to pale-green glauconitic and oolitic marine limestone and sandstone. Thickness <100 ft (30 m); wedges out in places in Park Range. Equivalent unit in east part of map area is in Sundance Formation

SUNDANCE FORMATION (UPPER JURASSIC) – Yellowish-gray to pale-green glauconitic and oolitic marine limestone and sandstone and crossbedded light-gray to orange sandstone containing local intervening red and yellow siltstone beds. Thickness 100–300 ft (30–90 m)

ENTRADA SANDSTONE (UPPER JURASSIC) – Crossbedded light-gray to orange sandstone. Thickness generally 75–175 ft (23–53 m) but wedges out in places in Park Range. Equivalent unit in east part of map area is in Sundance Formation

GLEN CANYON SANDSTONE (LOWER JURASSIC AND UPPER TRIASSIC) – Crossbedded light-brown to light-gray sandstone that closely resembles the overlying Entrada, from which it is separated by a subtle unconformity. Maximum thickness about 100 ft (30 m)

**Mzu** MESOZOIC ROCKS UNDIVIDED – Mainly of units below Pierre and Mancos Shales. Shown only in small areas of complex structure

**Kfd** Frontier Sandstone and Mowry Shale Members of Mancos Shale, and Dakota Sandstone

**KJdm** Dakota and Morrison Formations

**KJde** Dakota, Morrison, Curtis, and Entrada Formations

**KJds** Dakota, Morrison, and Sundance Formations

**Jmc** Morrison and Curtis Formations

**Jmce** Morrison, Curtis, and Entrada Formations

**Jms** Morrison and Sundance Formations

**JTkmg** Morrison, Curtis, Entrada, and Glen Canyon Formations

**Ꞧc** CHINLE FORMATION (UPPER TRIASSIC) – Brownish- and purplish-red calcareous siltstone, mudstone, and sandstone; limestone-pellet conglomerate in lower part; Gartra Sandstone Member present at base in most places (grayish-purple to white coarse-grained sandstone and conglomeratic sandstone 25 ft, or 8 m, thick). Thickness 600 ft (183 m) in west part of area; thins eastward beneath pre-Entrada unconformity to zero in places along Park Range. Equivalent strata near State line and northward are in Popo Agie and Jelm Formations

BELL SPRINGS MEMBER OF NUGGET SANDSTONE (UPPER TRIASSIC?) – Reddish-brown sandstone and siltstone. Thickness about 50 ft (15 m)

POPO AGIE FORMATION (UPPER TRIASSIC) – In Chugwater Group. Purplish-red siltstone, sandstone, and claystone. Thickness about 120 ft (36 m)

JELM FORMATION (UPPER TRIASSIC) – In Chugwater Group. Grayish-red to purple fine-grained micaceous sandstone. Thickness about 100 ft (30 m)

RED PEAK FORMATION (LOWER TRIASSIC) – In Chugwater Group. Red calcareous siltstone and fine-grained sandstone. Thickness <100 ft (30 m)

CHUGWATER FORMATION (TRIASSIC) – Red and gray sandstone, siltstone, shale, and conglomerate. Thickness in northern North Park 800 ft (244 m); thins to zero southward along Park Range

**Ꞧr** CHINLE AND CHUGWATER FORMATIONS – On west flank of Park Range and northwestern Middle Park; Chugwater Formation in North Park

GOOSE EGG FORMATION (LOWER TRIASSIC AND PERMIAN) – Thin red siltstone and gray limestone near base is only part present in quadrangle

Forelle Limestone Member (Permian) – Gray limestone. Thickness <20 ft (6 m)

STATE BRIDGE FORMATION (LOWER TRIASSIC AND PERMIAN) – Orange-red and red-brown siltstone and sandstone. Maximum thickness 500 ft (152 m); thins to zero in places along Park Range. In Meeker area, rocks of State Bridge are assigned by some geologists to Moenkopi (Lower Triassic) and Park City (Permian) Formations

SATANKA SHALE (PERMIAN) – Red shale. Maximum thickness 135 ft (40 m)

**ꞦPr** JELM AND RED PEAK FORMATIONS, FORELLE LIMESTONE MEMBER OF GOOSE EGG FORMATION, AND SATANKA SHALE IN LARAMIE BASIN; CHUGWATER FORMATION AND THIN UNITS OF FORELLE AND SATANKA IN NORTHEASTERN NORTH PARK; BELL SPRINGS MEMBER OF NUGGET SANDSTONE, POPO AGIE AND JELM FORMATIONS, AND REMNANTS OF RED PEAK FORMATION ON WEST SIDE OF PARK RANGE NEAR STATE LINE

**ꞦPcs** CHINLE AND STATE BRIDGE FORMATIONS – In southern part of quadrangle

**PIPwm** WEBER SANDSTONE AND MAROON FORMATION

WEBER SANDSTONE (PERMIAN AND PENNSYLVANIAN) – Yellow-gray sandstone. Thickness about 100 ft (30 m)

MAROON FORMATION (PERMIAN AND PENNSYLVANIAN) – Maroon, grayish-red, and red-brown sandstone, conglomerate, and mudstone; lower part intertongues with gypsum of Eagle Valley Evaporite. Thickness in west part of quadrangle is variable, depending on relations to gypsum, but in places is at least 2,000 ft (610 m); thins eastward to zero beneath pre-State Bridge unconformity

**IPm** MINTURN FORMATION (PENNSYLVANIAN) OR MORGAN FORMATION (PENNSYLVANIAN) IN WESTERN PART OF AREA – Gray and pastel-colored sandstone, grit, conglomerate, and shale; intertongues with gypsum of Eagle Valley Evaporite. Thickness in west >1,000 ft (305 m); thins eastward by onlap to zero on flank of Park Range

**IPe** EAGLE VALLEY EVAPORITE (PENNSYLVANIAN) – Gypsum or anhydrite and interbedded gray shale, siltstone, and thin carbonate beds. Thickness uncertain owing both to diapiric movements and to dissolution

**PIPcf** CASPER AND FOUNTAIN FORMATIONS – Mapped only in Laramie basin

CASPER FORMATION (PERMIAN AND PENNSYLVANIAN) – Buff sandstone. Thickness about 100 ft (30 m)

FOUNTAIN FORMATION (LOWER PART) (PENNSYLVANIAN) – Red sandstone, grit, conglomerate, and shale. Thickness 700 ft (213 m)

**MDꞒr** MISSISSIPPIAN, DEVONIAN, AND CAMBRIAN ROCKS – On west flank of Park Range at south edge of map, thin units of Leadville (Mississippian), Gilman (Mississippian or Devonian), Dyer (Mississippian? and Devonian), Parting (Devonian), and Sawatch (Cambrian) Formations preserved beneath pre-Minturn unconformity. Maximum total thickness <350 ft (107 m)

**MꞒr** MISSISSIPPIAN AND CAMBRIAN ROCKS – Small area at west edge of map only. Gray limestone referable either to Leadville Limestone or Madison Limestone (Mississippian), underlain by sandstone, quartzite, and shale referable either to Sawatch Quartzite or to Lodore Formation (Cambrian). Total thickness <500 ft (152 m)

**Ꞓs** SAWATCH QUARTZITE (CAMBRIAN) – Remnants <100 ft (30 m) thick

**Yg** GRANITIC ROCKS (PRECAMBRIAN Y–~1,400–m.y. AGE GROUP) – Includes Sherman Granite in northeast corner of area, rocks of Mount Ethel pluton in Park Range, and related rocks

ROCKS OF ~1,700–m.y. AGE GROUP (PRECAMBRIAN X)

**Xg** Granitic rocks – Quartz monzonite, granodiorite, and quartz diorite compositions; in part migmatitic and, in Medicine Bow Range, containing many small areas of gneisses

**Xm** Mafic intrusive rocks – Gabbro, diabase, and dark hornblende diorite

**Xfh** INTERLAYERED FELSIC AND HORNBLENDIC GNEISSES (PRECAMBRIAN X) – Probably mainly metavolcanic but includes some interlayers of pelitic biotite-sillimanite gneiss and schist and local pods of calc-silicate gneiss

**Xb** BIOTITIC GNEISSES AND MIGMATITE (PRECAMBRIAN X) – Probably mainly sedimentary

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