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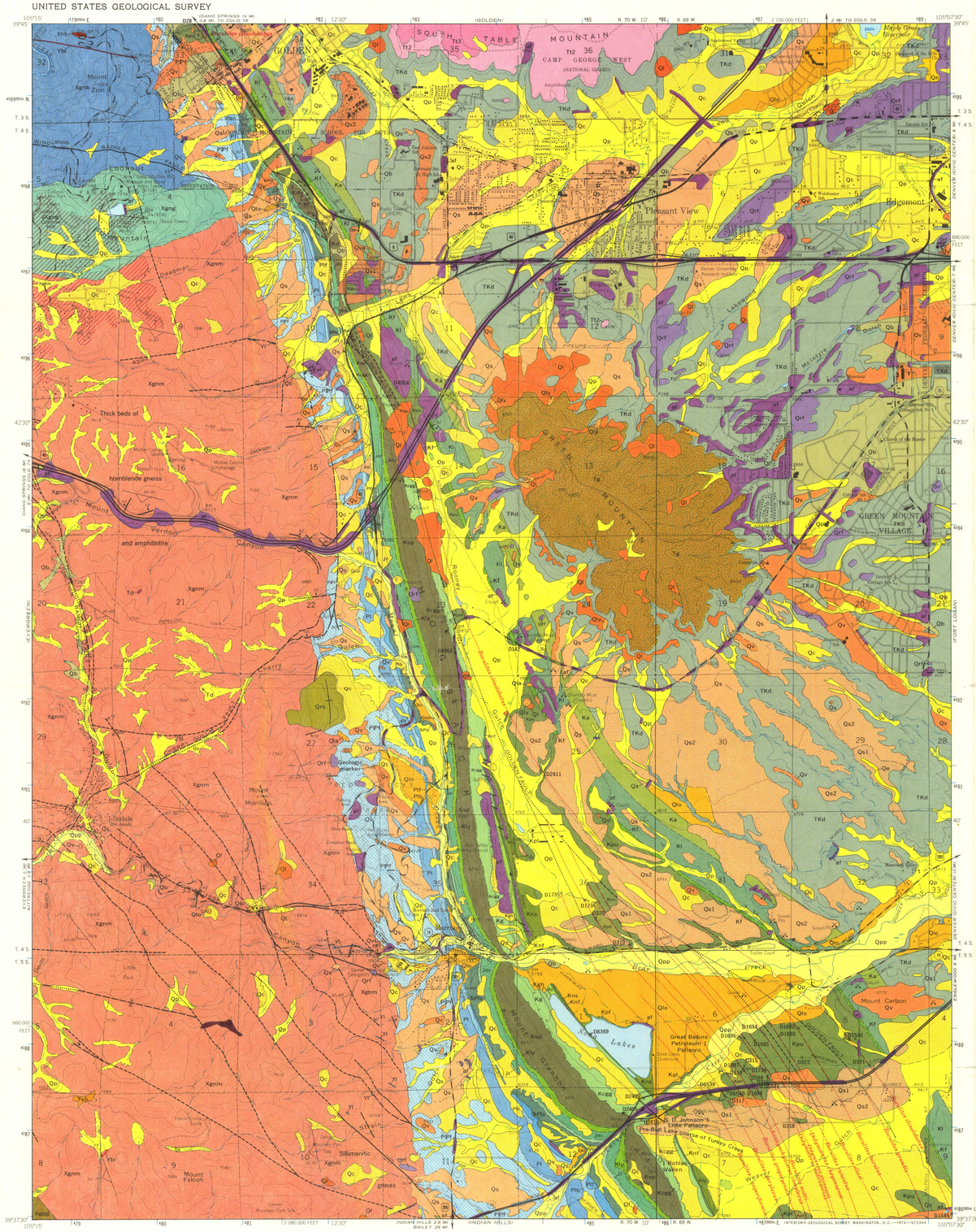


CORRELATION OF MAP UNITS

af			
Qfa	Qpp		
Qo	Qlv	Qt	Holocene
Qe			
Unconformity			
Qb			
Unconformity			
Qlo			
Unconformity			
Qs	Qs2	Qs1	Qls	Qc	Pleistocene
Unconformity			
Qv	Qv2	Qv1	Qlo		
Unconformity			
Qrf			
Qrs			
Unconformity			
Qn			
Unconformity and local major uplift			
Unconformity and local uplift			
Tsh	Td		Pleistocene to Eocene (?)
Unconformity and local uplift			
TKd	Tk		
	Tt3		
	Tt2		Paleocene
	Ka		
Unconformity and local major uplift			
Kl			
Kf			
Kpu			
Kph			
Kpl			Upper Cretaceous
Kns			
Knf			
Unconformity			
Kcgg	Kc		
Kgh	Kg		
Kd	Kso	Kly	Lower Cretaceous
Unconformity			
Jm			
Unconformity			
Jr			Upper Jurassic
Unconformity			
TrPls			
Ptf			
Ptb			
Pl			
Unconformity			
PPf			
Major unconformity and uplift			
Ybl			
Yl			
Xgsg			
Xgng	Xnb		Precambrian Y (?)
Xgnm			
Xgng			
Xgnb			Precambrian X[1]

QUATERNARY | TERTIARY | CRETACEOUS | JURASSIC | TRIASSIC (?) | PERMIAN | PENNSYLVANIAN | PRECAMBRIAN

DESCRIPTION OF MAP UNITS

Surficial deposits, where mapped, generally are 5 feet or more thick

af ARTIFICIAL FILL – Includes uncompacted rubbish, uncompacted dumped fill, and compacted select fill. Rubbish is unsuitable for most foundations and is a source of pollution to shallow water supplies. Dumped fill commonly contains large blocks of concrete or other debris and voids that make it unsuitable for most foundations. Compacted fill generally is placed under highways and in small earth dams at optimum moisture and maximum density

Qls ACTIVE LANDSLIDE (UPPER HOLOCENE) – Earthflows on northeast and southwest sides of Green Mountain and in northern part of Red Rocks Park. Slides were moving in 1971

Qpp POST-PINEY CREEK ALLUVIUM (UPPER HOLOCENE) – Dark-gray humic sandy to gravelly alluvium containing sticks and roots. Only along major streams where it forms flood plain and one or rarely two terraces less than ten feet above stream level. Lies within channels cut into Piney Creek Alluvium along arroyos and valleys, but overlies Piney Creek Alluvium where arroyos are not cut. Underlain by older gravelly alluvium along large valleys. Thickness about 5-15 feet. Most seasonal floods cover this unit

Qp PINEY CREEK ALLUVIUM (UPPER HOLOCENE) – Dark-gray to reddish-brown humic clayey silt and sand containing layers of pebbles, generally in lower part. Underlain by older gravelly alluvium or bedrock. Grades upslope into colluvium. Contains upper Holocene weak brown soil in upper part. Thickness 5-20 feet. Terrace is 10-20 feet above modern streams. Generally not covered by seasonal floods

Qfy YOUNG LANDSLIDE (HOLOCENE) – Earthflows obviously younger than nearby landslides. All are on or near Green Mountain

Qt TALUS (UPPER HOLOCENE) – Block rubble of Precambrian rock types on steep unstable slopes along Bear Creek

Qll LANDSLIDE (UPPER HOLOCENE TO PLEISTOCENE) – Landslides in the Precambrian rocks; earthflows mostly on Green Mountain near top of Denver Formation and in Green Mountain Conglomerate but also below the middle shoshonite flow (of the Table Mountain Shoshonite) in Denver Formation on South Table Mountain and on north flank of pediment on Denver Formation east of Youngfield Avenue and north of Colfax Avenue. Most steep slopes in Denver Formation and Green Mountain Conglomerate are potentially unstable. Some slides are as old as Pleistocene

Qc COLLUVIUM (UPPER HOLOCENE TO PLEISTOCENE) – Dark-gray to reddish-brown bouldery to sandy silt and clay on slopes in mountains and plains where it was deposited by gravity and sheet wash. Grades downslope into Piney Creek Alluvium. Locally contains some alluvium. Generally thicker than 5 feet. Ranges in age from Holocene to pre-Bull Lake; most is Piney Creek or Louviers in age. Contains soil in upper part

Qe EOLIAN SAND (LOWER HOLOCENE AND UPPER PART OF PINEDALE GLACIATION) – Light-brown well-sorted medium sand in two small patches on high areas, one on U.S. Highway 6 2 miles south of Golden and the other one mile north of Bear Creek near the east edge of the quadrangle. Brown soil of early Holocene age (Altithermal) in upper part. Blown from bedrock during early Holocene arid climate

Qb BROADWAY ALLUVIUM (PLEISTOCENE – PINEDALE GLACIATION) – Yellowish-orange to light-brown sandy to clayey alluvium along small intermittent streams or cobbly alluvium along major streams. Contains fossil mollusks. Thickness probably about 25 feet. Brown soil of early Holocene age (Altithermal) in upper part. Terrace is 25-40 feet above modern streams

Qlo LOUVIERS ALLUVIUM (PLEISTOCENE – BULL LAKE GLACIATION) – Reddish-brown pebbly to bouldery alluvium along permanent streams and sandy to clayey alluvium along intermittent streams. Coarse alluvium is stained by manganese and iron. Thickness probably more than 25 feet. Terrace is about 65 feet above modern streams. Strong Brown soil of post-Bull Lake pre-Pinedale age in upper part. Alluvium contains fossil mollusks. Six-foot boulders in torrential flood deposit between Bear Creek and Turkey Creek resulted from flash flood during capture of Turkey Creek by small tributary of Bear Creek. Turkey Creek in pre-Louviers time flowed southeast from gap in Dakota hogback

Qs SLOCUM ALLUVIUM (PLEISTOCENE – SANGAMON INTERGLACIATION) OR ILLINOIAN GLACIATION – Moderate-reddish-brown pebbly silt and clay interlayered with gravel. Gravel contains larger and more abundant boulders near mountains than to east. Stones are altered by weathering and are coated by calcium carbonate. Thickness probably averages about 15 feet. Contains fossil mollusks. Upper part of most deposits is overbank silt on which a very strong Brown soil of pre-Bull Lake (Sangamon?) age is developed. The B (clay-enriched) horizon of this soil commonly has a high swell potential

Qs2 Lower of two terraces or pediments lies about 100 feet above modern stream

Qs1 Upper terrace or pediment lies about 120 feet above modern stream

Qv VERDOS ALLUVIUM (PLEISTOCENE – YARMOUTH INTERGLACIATION) OR KANSAN GLACIATION – Yellowish-brown pebbly silt and clay interlayered with gravel. Gravel contains larger and more abundant boulders near mountains than to east. Stones are altered by weathering and are coated by calcium carbonate. Thin beds of sand are crudely interlayered with thick beds of gravel. Upper part of most deposits is overbank silt on which is a very strong Brown soil of pre-Bull Lake (Yarmouth?) age. B horizon commonly has high swell potential. Cca (white calcium carbonate-enriched horizon) underlies B horizon and has abrupt upper boundary but has stringers that fade out downward at about 4 or more feet. Thickness of alluvium averages 15 feet

Qv2 Lower of two terraces or pediments lies about 200 feet above modern stream

Qv1 Upper terrace or pediment lies about 250 feet above stream. Alluvium in upper terrace contains ash layer (Qva) in lower part

Qva Pearlette-like volcanic ash layer type 0 of Izett and others (1970) – a white water-laid ash that chemically and mineralogically resembles the ash of the Cudahy pit, Meade County, Kansas

Qrf ROCKY FLATS ALLUVIUM (PLEISTOCENE – AFTONIAN INTERGLACIATION) OR NEBRASKAN GLACIATION – Reddish-brown pebbly silt and clay interlayered with gravel. Gravel in Rocky Flats Alluvium from Green Mountain is finer than from mountains. Stones deeply weathered, and, in upper part of deposit, coated by calcium carbonate. Very strong brown soil of pre-Bull Lake (Aftonian?) age developed in upper part. Pediment lies about 350 feet above modern streams. Inferred Rocky Flats erosion disconformity covered in Mount Vernon Canyon and in wind-gap through Dakota hogback west of Green Mountain. Thickness of alluvium 0-15 feet

Qrs ROCKSLIDE (PLEISTOCENE – NEBRASKAN GLACIATION) – Large volume of Fountain Formation that slid down dip slope along east side of Mount Morrison. Slide possibly was caused when stream flowing parallel to mountain front between Nusabaum and Rocky Flats time undercut Fountain Formation

Qn NUSSBAUM(?) ALLUVIUM (PLEISTOCENE) – Yellowish-brown bouldery alluvium in northeast corner of quadrangle. Thickness probably about 10 feet. Strong soil of pre-Bull Lake age lies in the upper part of alluvium. Pediment is about 450 feet above modern streams

Tsh SAPROLITIC WEATHERED ZONE (PLEISTOCENE to EOCENE?) – Approximate extent of deeply weathered zone more than 8 feet thick over much of nearly level upland on Lookout Mountain. Upland surface probably cut in Eocene(?) time and then weathered for part 38 million years. Remnants of surface are preserved on Precambrian rocks between Mount Morrison and Ralston Creek north of area

Tsh SHONKINITE (TERTIARY) – Dark-brown to black medium-grained rock in a small igneous plug northwest of Mount Falcon. Chief minerals are sanidine, clinopyroxene, and biotite. Weathers to rounded boulders

Td DIABASE (TERTIARY) – Dark-gray dense rock in narrow igneous dikes. Principal minerals are labradorite, pyroxene, and magnetite.

Tg GREEN MOUNTAIN CONGLOMERATE [1](PALEOCENE) – Upper 200 feet is mainly conglomerate, but contains some sandstone and claystone; next 250 feet is thin-bedded claystone, siltstone, sandstone, and conglomerate; next 150 feet is conglomerate and sandstone; in lowermost 50 feet is yellowish-brown cobble-and-boulder conglomerate. Grain size of conglomerate increases upward. Andesite pebbles make up small part of lower conglomerate and decrease upward. Other stones are gneiss, pegmatite, quartzite, and sandstone. Contains pollen and plant fossils of Paleocene age in lower 450 feet. Thickness 650 feet. East-trending erosion channel inferred in mountains west of thick pile of coarse Green Mountain Conglomerate

Tt3 TABLE MOUNTAIN SHOSHONITE [2](PALEOCENE) – Dark-gray porphyritic flow rock crops out at two flows interlayered with andesitic sedimentary rock above middle of Denver Formation on South Table Mountain. Lowest of three flows crops out north of area (Van Horn, 1972, unit Tv1). Shoshonite is potassium-rich basalt and contains augite, plagioclase, olivine, and magnetite set in a fine-grained groundmass. Cavities contain zeolite minerals. Total thickness of both flows is about 150 feet

Tt3 Upper flow

Tt2 Middle flow

TKd DENVER FORMATION (PALEOCENE AND UPPER CRETACEOUS) – Yellowish-brown to grayish-olive fluvial claystone, siltstone, friable sandstone, and conglomerate, and interlayered olive-gray mudflows ranging from clay containing a few small volcanic pebbles to clay containing a preponderance of boulder-sized angular volcanic blocks or rounded boulders. Sandstone and finer grained fluvial rocks are tuffaceous and commonly weather to montmorillonitic clay having low to high swell potential. Fluvial conglomerate is composed of about 95 percent andesitic volcanic rocks and 5 percent granitic igneous and metamorphic rocks. Although quite altered, conglomerate has high penetration resistance. Clayey matrix in mudflows also weathers to montmorillonite having high swell potential. Blocks of potassium-rich shoshonite in mudflows are only slightly weathered. Heulandite and chabazite partly fill cavities in the pebbles and sandstone. Some fine-grained layers are unstable on slopes as gentle as 8°; many earthflows were mapped on slopes steeper than 15°. Denver Formation contains fossil leaves, dinosaur and mammal bones, and silicified wood. Thickness 950 feet

Ka ARAPAHOE FORMATION (UPPER CRETACEOUS) – Coarse- and fine-grained sandstone, siltstone, claystone, and thin pebble beds in upper part; white, yellowish-gray, and yellowish-orange coarse-grained sandstone and poorly sorted pebble-and-cobble conglomerate in lower part. Stones from sedimentary rocks make up about 60 percent and igneous and metamorphic rocks about 40 percent of basal conglomerate, but proportions reverse upward. Sandstone composed of quartz, feldspar, and mica. Conglomerate contains shale blocks 4 by 2 feet, sandstone blocks 1 by 1 foot, chert, and petrified wood. Cut-and-fill structure in conglomerate. Contains concretions and layered concentrations of ironstone and dinosaur bones. Thickness 400 feet

Kl LARAMIE FORMATION (UPPER CRETACEOUS) – Upper part is light-gray micaceous siltstone stained yellowish orange, light-, olive-, and pinkish-gray silty claystone, grayish-brown lignitic claystone, minor white and yellowish-orange friable ridge-forming sandstone, and near top thin layers of conglomerate composed of pebbles of sedimentary rocks. Sand grains are quartz and chert. Yellowish-orange sandy ironstone concretions. Lower part is almost entirely yellowish-gray iron-stained and white "salt-and-pepper" friable sandstone composed of quartz, biotite mica, and kaolinized feldspar. Sandstone 110 feet thick at base is considered Fox Hills Sandstone by one authority. Gray sandstone contains gray shale chips. Contains thin ironstone layers and shale layers near base. Subbituminous coal beds as thick as 8 feet lie in lower 200 feet above basal sandstone. Abandoned coal mines are areas of potential subsidence, as in the valley south of Alameda Parkway. Gray or white claystone in beds more than 10 feet thick is used for manufacture of brick and tile. Contains fossil leaves, wood, and other plant remains. Thickness 550 feet

Kf FOX HILLS SANDSTONE (UPPER CRETACEOUS) – Upper 105 feet is olive-gray to dark-yellowish-brown silty shale and interbedded wavy-banded friable micaceous sandstone. Shale contains flattened gray limestone concretions 12 inches in diameter. Lower 75 feet is yellowish-orange massive to thin-bedded, locally cross-bedded, friable fine-grained ridge-forming sandstone and interbedded dark-olive-gray shale and claystone. Contains large reddish-brown hard calcareous iron-stained sandstone concretions about 65 feet above base. Shale beds are abundant near base. Contains large flow casts about 20 feet above base. Contains fossil pelecypods in lower part of upper shale and at top of lower sandstone. Thickness 180 feet. Entire mapped formation is considered Pierre Shale by one authority

PIERRE SHALE (UPPER CRETACEOUS) – Thin bentonite (clay) layers common in formation. Shale and bentonite beds have potential of swelling when wetted and shrinking when dried. Concretions contain marine fossils. Thickness 6,200 feet

Kpu Upper transition member – Olive-gray shale, fine-grained brown sandstone layers containing hard 4-foot brown sandstone concretions, and interbedded yellowish-brown to olive-gray silty sandstone and sandy shale containing limestone and ironstone concretions. Underlying olive-gray claystone contains ironstone and limestone concretions. Large limestone masses called Tepee Butte limestone, an informal name, lie between zone of *Baculites elaini* and zone of *Baculites scotti*. Thin sandstone bed in zone of *Didymoceras cheyennense*. At base is yellowish-brown sandy siltstone equivalent to upper part of type Hygiene Sandstone Member

Kph Hygiene Sandstone Member – Yellowish-gray or olive-brown sandstone

Kpl Lower part – Olive-gray clayey shale containing ironstone and limestone concretions

Kns NIOBRARA FORMATION (UPPER CRETACEOUS)
Smoky Hill Shale Member – Pale- to yellowish-brown soft thin-bedded calcareous shale and interbedded thin layers of limestone. Three ridge-forming beds: yellowish-orange chalk at top, yellowish-gray chalky limestone in middle, and gray soft platy limestone in lower third. Contains many bentonite beds. Contains marine fossils. Thickness 410 feet

Knf Fort Hays Limestone Member – Yellowish-gray dense hard limestone in beds 1-7 feet thick. Thin shale beds make up only about 5 percent of the member. Contains marine fossils. Thickness 35 feet

Kcgg CARLILE SHALE, GREENHORN LIMESTONE, AND GRANEROS SHALE – Fossils in many parts. Total thickness 530 feet

Kc CARLILE SHALE (UPPER CRETACEOUS) – In descending order, Juana Lopez Member, grayish-brown hard calcarenite (sandy limestone composed of shell fragments); Blue Hill Shale Member, gray silty sandstone; Fairport Chalky Shale Member, yellowish-gray soft calcareous shale

Kgh GREENHORN LIMESTONE (UPPER CRETACEOUS) – In descending order, Bridge Creek Limestone Member, gray dense limestone beds and hard gray calcareous shale; Hartland Shale Member, gray shaly calcarenite; Lincoln Limestone Member, grayish-brown thin beds of hard calcarenite and shaly calcarenite containing marker bentonite at base

Kg GRANEROS SHALE (UPPER AND LOWER CRETACEOUS) – Dark-gray hard clayey shale; at base dark-gray hard platy siltstone equivalent to Mowry Shale

Kd DAKOTA GROUP (LOWER CRETACEOUS) – Thickness 300 feet

Ksp SOUTH PLATTE FORMATION (LOWER CRETACEOUS) – Contains three sandstone members separated by two shale members. Sandstone yellowish gray, well sorted, cross stratified, porous; composed of well-rounded to subrounded fine to medium quartz sand. Shale dark gray, silty, hard, parallel bedded; interbedded with thin gray sandstone layers; contains gray or white refractory clay or porcellanite layers. Asphalt occurs in a seep and with pyrite in uranium prospects near Turkey Creek. Dinosaur footprints along Alameda Parkway. Thickness about 220 feet

Kly LYTLE FORMATION (LOWER CRETACEOUS) – Yellowish-gray or yellowish-brown medium- to fine-grained ironstained sandstone and conglomerate. Conglomerate generally near base composed of quartz, quartzite, chert, and some petrified wood. Silicified tree trunks in upper part of the formation. Thickness about 80 feet

Jm MORRISON FORMATION (UPPER JURASSIC) – Red siltstone and thin brown sandstone beds in upper part; green siltstone and claystone, some varicolored maroon and green beds, and interbedded sandstone and limestone layers in middle; several brown lenticular sandstone beds containing clay balls and red jasper in lower part. Dense gray limestone beds in middle part contain charophytes (algae). Dinosaur bones occur in middle green siltstone beds and in lower sandstone. Thickness 300 feet

Jr RALSTON CREEK FORMATION (UPPER JURASSIC) – Purplish-gray sandstone and siltstone, underlain by grayish-yellow silty sandstone containing crystalline clayey limestone having red jasper and calcite crystals; thin layers of vermilion and white sandstone like above base of formation. South of Turkey Creek, formation contains thick bed of gypsum. Thickness 90 feet

LYKINS FORMATION (TRIASSIC? AND PERMIAN) – Thickness 450 feet

TrPls Strain Shale Member of LeRoy (1946) – Maroon stratified micaceous fine-grained silty sandstone and siltstone containing some green siltstone layers. Thickness about 300 feet

Ptf Forelle Limestone Member – Pink wavy-laminated sandy marine limestone 130 feet above base of formation; contains algal stromatolites. Thickness about 17 feet

Ptb Bergen Shale, Falcon Limestone and Harriman Shale Members of LeRoy (1946) – Maroon and green siltstone containing laminated red-weathering gray crystalline sandy limestone (Falcon) 75 feet above base and yellow crystalline limestone 2 feet above base. Thickness about 133 feet

Pl LYONS SANDSTONE (PERMIAN) – Yellowish-gray conglomerate composed of Precambrian detritus as large as 2 inches, which grades downward into yellowish-gray and yellowish-orange ironstained fine-grained cross-stratified sandstone that also contains conglomerate a few feet above base. Thickness about 190 feet

PPf FOUNTAIN FORMATION (PERMIAN AND PENNSYLVANIAN) – Maroon arkosic thick-bedded coarse-grained sandstone and conglomerate containing thin layers of dark-maroon micaceous silty fine-grained sandstone that are more abundant in lower part. Characterized by festooned and torrential crossbedding. Composed primarily of Precambrian detritus, but contains rare fragments of lower Paleozoic rocks in lower part. Conglomerate near base contains boulders as large as 10 inches in diameter. Thickness 1,650 feet

Ybl BIOTITE LATITE (PRECAMBRIAN Y?[3]) – Reddish-gray porphyritic dike rock with aphanitic groundmass; along Lariat Loop road and northwest of Mount Falcon. Chief minerals are microperthite, oligoclase, biotite, quartz, and muscovite. Possible correlative of dikes related to Pikes Peak Granite (R. B. Taylor, oral commun., 1972)

Yl LAMPROPHYRE (PRECAMBRIAN Y?) – Dark-gray porphyritic dike rocks composed of potassic and sodic feldspar and either biotite or hornblende. Possible correlative of dikes emplaced near age of Silver Plume Quartz Monzonite or Pikes Peak Granite (R. B. Taylor, oral commun., 1972)

Xgsg GNEISSIC QUARTZ MONZONITE AND GRANODIORITE (PRECAMBRIAN X[3]) – Medium- to coarse-grained foliated biotite quartz monzonite and granodiorite, locally prophyritic and containing laths of potassic feldspar as much as 4 mm in length. Equivalent to the Boulder Creek Granodiorite

Xgb QUARTZ DIORITE (PRECAMBRIAN X) – Black and white massive medium to coarsely crystalline bodies composed chiefly of hornblende, plagioclase, biotite, and minor quartz

Xhb HORNBLENDITE (PRECAMBRIAN X) – Greenish-black medium to coarsely crystalline bodies composed chiefly of hornblende, quartz, and accessory minerals

Xgnm MIGMATITIC QUARTZO-FELDSPATHIC GNEISS (PRECAMBRIAN X) – Grayish-orange to gray fine- to coarse-grained gneiss that locally may be nearly nonfoliated owing to intensive migmatization and intrusion of granitic material. Contains gray cordierite-bearing biotite-quartz gneiss near mouth of Bear Creek and to west and southwest. Contains reddish-orange to white sillimanitic-muscovite-quartz-plagioclase gneiss (fluorine metasomatized to rutile- and topaz-bearing gneiss) from Strain Gulch southward to border of quadrangle. Contains dark-gray hornblende gneiss in wide east-trending layers from about 1 mile north to 1 mile south of Mount Vernon Canyon. Migmatitic gneiss also contains many small dikes and irregular bodies of granite pegmatite

Xgng GARNETIFEROUS BIOTITE-QUARTZ-PLAGIOCLASE GNEISS (PRECAMBRIAN X) – Gray fine- to medium-grained gneiss composed chiefly of quartz, plagioclase, biotite, and minor garnet

Xgnb BIOTITE-QUARTZ-PLAGIOCLASE GNEISS (PRECAMBRIAN X) – Gray medium-grained gneiss consisting of quartz, plagioclase, and biotite

Contact – Dashed where approximately located; dotted where concealed; concealed bedrock contacts shown only in critical areas

Fault, showing dip – Dashed where approximately located; short dashed where inferred; dotted where concealed; queried where doubtful.U, upthrown side; D, downthrown side. Arrows show direction of relative movement. Many beds are thinned by faults that are not shown

Brecciated fault zone

Syncline

Ammonite zone – Dashed where approximately located; dotted where concealed. Zone line is drawn through principal collections of ammonites in faunal assemblage zones. The collections through which a zone line is drawn are not always at the same horizon; therefore the line may rise or fall within that ammonite zone

Strike and dip of beds – Inclined

Overturned

Vertical

Average strike and range of dip of many foliation attitudes – Placed on map to give well-drillers, contractors, and planners an indication of the attitude of layering in the metamorphic rocks in the mountains; original attitudes are shown in U. S. Geological Survey Bulletin 1251-E (Gable, 1968)

Prospect pit

Adit

Shaft

Quarry or open-pit mine

Gravel pit

Fossil mollusk locality

D2409 USGS Mesozoic invertebrate fossil locality

Rohlas-Wallen Dry hole

[1] An interim scheme for subdivision of Precambrian time recently adopted by the U.S. Geological Survey:
Precambrian Z - base of Cambrian to 800 m.y.
Precambrian Y - 800 m.y. to 1,600 m.y.
Precambrian X - 1,600 m.y. to 2,500 m.y.
Precambrian W - older than 2,500 m.y.

[2] The Green Mountain Conglomerate was named ("Green Mountain Conglomerate series") in an unpublished report by Marr (1929) for Green Mountain, 3 miles northeast of Morrison in the Morrison quadrangle. The first published use of the name and description of the rock were by LeRoy (1946). The formation consists of conglomerate, sandstone, siltstone, and claystone, as described in more detail above. It was deposited as coarse, basin-fill material from a through-going stream emerging from the rising Front Range to the west. The formation is restricted to Green Mountain, where it is 650 feet thick. It disconformably overlies the Denver Formation; the upper contact is an erosional one. On the basis of fossil leaves and pollen of Paleocene age, the Green Mountain possibly correlates with the uppermost part of the Dawson Formation in the Denver basin.

[3] The Table Mountain Shoshonite was named and described as the Table Mountain basalt by Cross (1896) for North and South Table Mountains near Golden, Colo. Although assigned 76 years ago, his name was never formally adopted for use in the U.S. Geological Survey. Two flows were described by Cross; a third and lower, less-extensive flow was later discovered and was mapped by Van Horn (1957, 1972). Six analyses of the rock – two reported by Cross (1896, p. 306, 308) and four recent analyses – show it to be a potassium-rich basalt (shoshonite) that chiefly contains augite, plagioclase, olivine, and magnetite set in a fine-grained groundmass. Although the rock was called mafic latite by W. T. Pecora (Van Horn, 1957), its silica content, according to these analyses, averages 51.73 percent, ranging only from 49.69 to 53.8 percent; its potash content ranges from 3.83 to 4.8 percent, and clearly lies in the range of Shoshonite compositions. Thicknesses of the three flows are: lower, 60 feet; middle, 90 feet and upper, 60-90 feet (Van Horn, 1957). The source of the flows was suspected by Cross to have been the Ralston dike about 4 miles north of Golden; this dike still is favored as the source. In 1964 (Evernden and others), a cobble from soft ductile pumice in the Denver Formation 225 feet below the middle flow in the SW¼NW¼ sec. 31, T. 3 S., R. 69 W., was dated by the K-Ar technique at 64.5 m. y. (million years); a sample of the middle flow about 10 feet above its base at the same locality was dated by the K-Ar method at 58.7 m.y. In 1970, John D. Obradovich, Glen A. Izett, and I examined this locality and collected material from a volcaniclastic ducktic pumice bed from Denver Formation about 35 feet above the level of the lower sample dated by Evernden and others. This new sample was recently dated by Obradovich using the K-Ar method at 64.3 m.y. An age of the Ralston dike was recently announced by Edwin E. Lawon, University of Colorado (oral commun., 1972), by the K-Ar method at 63 ± 2.5 m.y., or early Paleocene in age. This leads us to believe that the age of the middle flow is more likely to be 63-64 m.y., rather than 59 m.y.

REFERENCES CITED

Cross, Whitman, 1896, Igneous formations, Chap. 5 *in* Emmons, S. F., Cross, C. W., and Eldridge, G. H., Geology of the Denver Basin in Colorado: U.S. Geol. Survey Mon. 27, p. 279-315.

Evernden, J. F., Savage, D. E., Curtis, G. H., and James, G. T., 1964, Potassium-argon dates and the Cenozoic mammalian chronology of North America: Am. Jour. Sci., v. 262, p. 145-198.

Gable, D. J., 1968, Geology of the crystalline rocks in the western part of the Morrison quadrangle, Jefferson County, Colorado: U.S. Geol. Survey Bull. 1251-E, p. E1-E45.

Izett, G. A., Wilcox, R. E., Obradovich, J. D., and Reynolds, R. L., 1971, Evidence for two Pearlette-like ash beds in Nebraska and adjoining areas: Geol. Soc. America Abs. with Programs, v. 3, no. 4, p. 265-266.

LeRoy, L. W., 1946, Stratigraphy of the Golden-Morrison area, Jefferson County, Colorado: Colorado School Mines Quart., v. 41, no. 2, 115 p.

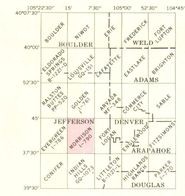
Marr, J. D., 1929, Stratigraphy of the post-Laramie sediments of the Green Mountain area, Jefferson County, Colorado: Colorado School Mines, Golden, Colorado, unpub. undergraduate report.

Pearl, R. H., 1968, Quaternary geology of the Morrison quadrangle, Colorado: Mtn. Geologist, v. 5, no. 4, p. 197-206.

Smith, J. H., 1964, Geology of the sedimentary rocks of the Morrison quadrangle, Colorado: U.S. Geol. Survey Misc. Geol. Inv. Map I-428.

Van Horn, Richard, 1957, Bedrock geology of the Golden quadrangle, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ-103.

_____ 1972, Surficial and bedrock geologic map of the Golden quadrangle, Jefferson County, Colorado: U.S. Geol. Survey Misc. Geol. Inv. Map I-761-A.



INDEX SHOWING LOCATION OF MORRISON QUADRANGLE

Base from U.S. Geological Survey, 1965
Photorevised in 1971
10,000-foot grid based on Colorado coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks, zone 13, shown in blue

APPROXIMATE MEAN DECLINATION, 1972

SCALE 1:24 000
1 0 1 MILE
1 5 0 1 KILOMETER
CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

COLORADO
QUADRANGLE LOCATION

Geology mapped during 1966-72. Geology of the western part of the quadrangle has in part been revised from Gable (1968). Geology of sedimentary rocks in part adapted from Smith (1964). Geology of surficial deposits in part adapted from Pearl (1968). Contact between sedimentary and crystalline rocks in part mapped in 1966 by C. T. Wrucke. Assistance on photogrammetric plotting by C. L. Pillmore and R. R. Beins. Assistance in the field by Juanita M. Scott

GEOLOGIC MAP OF THE MORRISON QUADRANGLE, JEFFERSON COUNTY, COLORADO

By
Glenn R. Scott

1972

FOLIO OF THE
MORRISON QUADRANGLE, COLORADO
MAP I-790-A

For sale by U.S. Geological Survey, price 75 cents