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EXPLANATION

QUATERNARY

Pleistocene and (or) Recent

Alluvium and eolian deposits

Qae, *alluvium and eolian deposits, undifferentiated; mostly wind-deposited silt and sand on mesa tops, benches, and in broad valleys, reworked in part by running water.*
Qa, *alluvial deposits, chiefly sand, gravel, and silt of Recent age in flood plains of streams.*
Qap, *pediment gravels; limited to deposits veneering pediment surfaces in the present cycle of erosion*

Colluvial deposits

Qc, *colluvial deposits, undifferentiated; includes talus, slope wash, block rubble, and rock glaciers.*
Qct, *talus; deposits of angular blocks at base of cliffs.*
Qcl, *landslide deposits; angular, unsorted debris, occurring chiefly below steep outcrops of Morrison Formation*

Terrace gravels

Includes gravels along larger streams and pediment gravels of earlier cycles of erosion, occurring principally near Grand Mesa and south of Book Cliffs

Pleistocene

Alluvial fan gravels in the La Sal Mountains

Locally derived, poorly sorted angular to subangular sand, silt, and gravel.
Qaf, *undifferentiated as to age.*
Qaf_3, *of Pinedale age.*
Qaf_2, *of Bull Lake age.*
Qaf_1, *of pre-Bull Lake age*

Alluvial gravels in the La Sal Mountains

Well-rounded and well-sorted deposits, mostly of glacial outwash origin.
Qag, *undifferentiated as to age.*
Qag_3, *of Pinedale age.*
Qag_2, *of Bull Lake age.*
Qag_1, *of pre-Bull Lake age*

Glacial till

Unsorted, unstratified deposits occurring in moraines on Grand Mesa and in the La Sal Mountains.
Qgm, *undifferentiated as to age.*
Qgm_3, *of Pinedale age.*
Qgm_2, *of Bull Lake age.*
Qgm_1, *of pre-Bull Lake age*

Conglomerate in Fisher Valley

Partly consolidated; of uncertain age

Basalt

Extrusive scoriaceous and vesicular basalt capping Grand Mesa. Includes intercalated volcanic ash and breccia

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TERTIARY

Pliocene

Conglomerate in Castle Valley and Geyser Creek

Chiefly pebbles and cobbles of igneous rock derived from North Mountain

Miocene(?)

Clastic dike

Consists of fragments of gneiss, schist, limestone, granitic rocks, and eruptive rocks of intermediate composition; in Placerville area

Monchiquite

Dikes, chiefly biotite and augite, and carbonates derived during alteration; in Placerville area

Diorite and andesite

Dikes and sills of diorite, diorite porphyry, and andesite, chiefly plagioclase, hornblende, and biotite; in Placerville area

Microgranogabbro

Basaltic dike, chiefly plagioclase and augite, and biotite partly altered to chlorite; between Gypsum Valley and Placerville

Eocene

Green River Formation

White friable sandstone and gray to gray-green lacustrine shale. Poorly exposed near top of Grand Mesa

Wasatch Formation

Variegated clay shale, in part sandy. Sparse beds of massive fluvial sandstone, numerous thin sandy lenses, and some fresh-water limestone. Locally conglomeratic at base. Maximum thickness is about 1,500 feet. Occurs only in Grand Mesa area

CRETACEOUS AND (OR) TERTIARY

LA SAL MOUNTAINS AREA

Vent breccia

Chiefly fragments of aegirine granite porphyry and altered diorite porphyry

Soda syenite porphyry

Small intrusive bodies, consisting of coarse phenocrysts of microperthite and augite in groundmass of aegirine-augite and anorthoclase

Syenite porphyry

Dikes consisting chiefly of perthite, sodic plagioclase, and aegirine-augite.
TKdi, *dike swarm.*
d, *individual dikes*

Monzonite porphyry

Closely spaced dikes. Chiefly plagioclase, potassium feldspar, hornblende, and pyroxene

Diorite porphyry

Chiefly phenocrysts of plagioclase and hornblende in groundmass of orthoclase, albite-oligoclase, and quartz.
TKds, *stocks.*
TKdl, *laccoliths*

CRETACEOUS

BOOK CLIFFS

Upper part of Mesaverde Group

Alternating light-colored nonmarine sandstone and shale containing some coal

GYPSUM VALLEY

Mesaverde Group

Yellowish-gray, thick-bedded marine and nonmarine sandstone beds separated by light-gray marine and nonmarine shale. Total exposed thickness about 1,200 feet

Mesaverde Group [1]

Castlegate Sandstone

Buff-weathering, coarse- to fine-grained, massive cliff-forming marine sandstone

Upper member of Blackhawk Formation

An upper cliff-forming sandstone and a lower shale; locally coal-bearing

Buck Tongue of the Mancos Shale

Similar in lithology to the Mancos Shale to the south; occurs in the Book Cliffs

GRAND MESA

Mesaverde Formation

Kmv, *similar in lithology to upper part of Mesaverde Group (Kmvu).*
Kmvr, *Rollins Sandstone Member; white, coarse-grained, massive sandstone*

Mancos Shale [1]

Mancos Shale

Dark-gray to black, soft, fissile marine shale with thin sandstone beds at various horizons. The upper beds intertongue with, and grade vertically into, the lower part of the Mesaverde Group (Kc, Kb). Maximum thickness about 4,000 feet.
Km, *Mancos Shale, undifferentiated.*
Kmu, *upper shale member.*
Kmfe, *Ferron Sandstone Member. Fine-grained, thin-bedded sandstone and sandy shale; thin and persistent; occurs near base of Mancos Shale.*
Kml, *lower shale member*

Dakota Sandstone

Yellowish-brown and gray friable to quartzitic fluvial sandstone and conglomeratic sandstone with interbedded gray to black carbonaceous nonmarine shale. Plant impressions are common; a coarse basal conglomerate is locally present. Ranges in thickness from a few feet to about 200 feet

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Burro Canyon Formation

White, gray, and light-brown fluvial sandstone and conglomerate interbedded with green and purplish lacustrine siltstone, shale, and mudstone, and thin beds of impure limestone. Thickness ranges from 0 to 200 feet. Forms discontinuous lenses in the Placerville area, and is not differentiated from the Dakota Sandstone (Kd) there

Mancos Shale, Dakota Sandstone, and Burro Canyon Formation

Dakota Sandstone and Burro Canyon Formation

Upper Cretaceous

Lower Cretaceous

JURASSIC

Upper Jurassic

San Rafael Group [2]

Summerville Formation and Entrada Sandstone

Summerville Formation and Moab Sandstone Member of Entrada Sandstone

Summerville Formation

Red, gray, green, and brown sandy shale and mudstone of terrestrial origin; masses of red and white chert occur in places near top. Thickness ranges from 60 to 150 feet and varies irregularly from place to place

Entrada Sandstone

Jem, *Moab Sandstone Member; light-colored, medium-grained, massive, and crossbedded sandstone at top of formation in western two-thirds of area.*
Je, *Entrada Sandstone; orange, buff, and white, fine- to medium-grained, massive and crossbedded eolian sandstone. Basal few feet of Entrada, consisting of red siltstone and fine-grained sandstone, has been termed Carmel Formation by some workers. In southeasternmost part of area the Entrada contains tabular vanadium-uranium deposits. Total thickness, including Moab Tongue, ranges from 550 to 60 feet, decreasing from west to east*

Glen Canyon Group

Includes Navajo Sandstone, Kayenta Formation, and Wingate Sandstone

Navajo Sandstone

White, grayish-yellow, gray, and pale orange-pink, fine-grained, crossbedded eolian sandstone; prominent vertical joints in most outcrops; absent in most of eastern half of area; attains thickness of 400 feet in western half

Kayenta Formation

Irregularly interbedded fluvial red, buff, gray, and lavender shale, siltstone, and fine- to coarse-grained sandstone. Thin beds of limestone and of shale-pellet conglomerate locally present. Thickness ranges from 0 in east to maximum of 240 feet in west

Wingate Sandstone

Reddish-brown, buff, and grayish-orange, fine-grained, massive, thick-bedded, and prominently crossbedded eolian sandstone. In most exposures forms vertical cliffs and exhibits dark-brown desert varnish on weathered surfaces. Thickness ranges from 0 at east edge to about 350 feet throughout most of western half

Upper Triassic

Chinle and Moenkopi Formations

Chinle Formation

Trc, *Chinle Formation, undifferentiated. Terrestrial sedimentary rocks, including red, reddish-brown, and orange-red siltstone interbedded with lenses of red sandstone and shale, limestone-pebble and shale-pellet conglomerate, with lenses of grit and quartz-pebble conglomerate near base. Thickness ranges from 0 to 600 feet, increasing from north to south.*
Trcu, *upper part of Chinle Formation in parts of area between Green and Colorado Rivers.*
Trcb, *Moss Back Member. Gray, brown, and pale gray-green, calcareous, fluvial sandstone and grit, with red, purplish, and gray-green mudstone; carbonaceous plant fragments locally abundant; occurs in parts of area between Green and Colorado Rivers. Contains uranium deposits in western quarter of map; in Lisbon Valley its stratigraphic equivalent contains large uranium deposits*

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Moenkopi Formation

Chocolate-brown, ripple-bedded shale; brick-red sandy mudstone; reddish-brown and chocolate-brown sandstone; purple and reddish-brown arkosic conglomerate; and local gypsum beds. Thickness ranges from 0 to more than 1,000 feet

Lower and Middle(?) Triassic

PERMIAN

Pennsylvanian and Permian

Rocks of Triassic, Permian, and Pennsylvanian ages, undifferentiated, in La Sal Mountains. May contain some or all of the Chinle, Moenkopi, Cutler, Rico, and Hermosa Formations

Cutler Formation [3]

Pc, *Cutler Formation, undifferentiated. Mostly red to purple, fluvial arkose and arkosic conglomerate. Total thickness ranges from 0 to about 3,000 feet; locally attains thickness of 8,000 feet at west edge of Uncompahgre uplift.*
Pca, *unnamed arkose and arkosic conglomerate in western part of map. Reddish-brown, red, and purple, medium- to coarse-grained, crossbedded, fluvial arkose and arkosic conglomerate. Contains small copper-uranium deposits in Lisbon Valley area and in area between Green and Colorado Rivers. Interfingers complexly with other members.*
Pcw, *White Rim Sandstone Member. White, gray, and buff, medium- to coarse-grained, crossbedded, eolian, quartzose sandstone.*
Pco, *Organ Rock Tongue. Reddish-brown siltstone and thin-bedded, fine-grained sandstone.*
Pcc, *Cedar Mesa Sandstone Member. Yellowish-gray, reddish-orange, and reddish-brown, fine-grained, thickly crossbedded, eolian sandstone.*
Pcwo, *White Rim Sandstone Member and Organ Rock Tongue, undivided.*
Pcao, *transition zone where arkosic beds interfinger with Organ Rock Tongue.*
Pcac, *transition zone where arkosic beds interfinger with Cedar Mesa Sandstone Member*

Rico Formation

Reddish-brown and greenish-gray, fine- to medium-grained, crossbedded fluvial sandstone; gray thin- to thick-bedded, cherty, fossiliferous marine limestone; red micaceous siltstone. Distinguished from overlying Cutler Formation chiefly by presence of limestone beds. Exposed thickness ranges from 0 on Uncompahgre uplift to about 650 feet near west border

Hermosa Formation

Ph, *Hermosa Formation, undifferentiated.*
Phu, *upper member. Blue and gray, thin- to thick-bedded fossiliferous marine limestone; gray fine-grained, micaceous, crossbedded sandstone and siltstone; red sandy shale and sandstone; gray arkose and conglomerate. Ranges in thickness from 0 to 1,800 feet.*
Php, *Paradox Member. Salt, gypsum, anhydrite, black shale, gray sandstone and limestone. Thickness ranges from 0 in Uncompahgre uplift to more than 11,000 feet under salt anticlines*

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PRECAMBRIAN

Precambrian rocks

Rock types not differentiated on map. Includes gneiss, schist, granite, and pegmatite, occurring in two main groups. Younger group, a granitic intrusive complex, consists chiefly of granite with coarse microcline phenocrysts, minor amounts of gneissic granite, pegmatite dikes, and a few lamprophyre dikes; crops out extensively in Ryan Creek area and at east and west ends of Unaweep Canyon. Granitic complex has intrusive relations with older sequence of quartz-biotite and quartz-feldspar schists and gneisses, with minor amounts of slate and injection gneiss

JURASSIC

Summerville Formation, Entrada Sandstone, and Navajo Sandstone

Wanakah Formation and Entrada Sandstone

Wanakah Formation is the lateral equivalent of Summerville Formation in the southeasternmost part of area; it is greenish-gray limy siltstone and sandstone at top, underlain by light-colored, friable, fine-grained sandstone of the Bilk Creek Sandstone Member; at base of Wanakah is the Pony Express Limestone Member, a dark-gray to black bituminous limestone. Total thickness about 80 feet

Kayenta Formation and Wingate Sandstone

Wingate Sandstone and Chinle Formation

Dolores Formation

Approximate lateral equivalent to parts of Wingate Sandstone and Chinle Formation in southeasternmost part of area. Consists of fluvial red siltstone sandstone, and shale, with a few limestone-pebble conglomerate lenses; a quartz-pebble conglomerate or grit occurs at base; locally contains a thin Wingate Sandstone equivalent at the top. Total thickness about 575 feet

Cutler and Rico Formations

Contact

Fault

Dashed where approximately located; dotted where concealed. Bar and ball on downthrown side

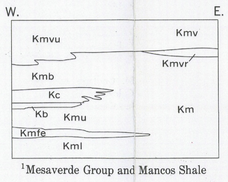
Strike and dip of beds

Horizontal beds

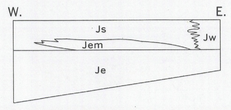
Limit of deposition of a formation or member, in this case the Kayenta Formation

Collapse structures

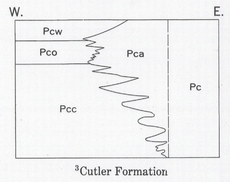
Small vertical pipelike bodies of breccia, bounded by circular faults, occurring on northeast side of Spanish Valley; contain blocks of rock from all formations from Navajo Sandstone through Dakota Sandstone. Age of collapse unknown; possibly Tertiary



[1]Mesaverde Group and Mancos Shale



[2]San Rafael Group



[3]Cutler Formation

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THE MOAB QUADRANGLE, COLORADO AND UTAH

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