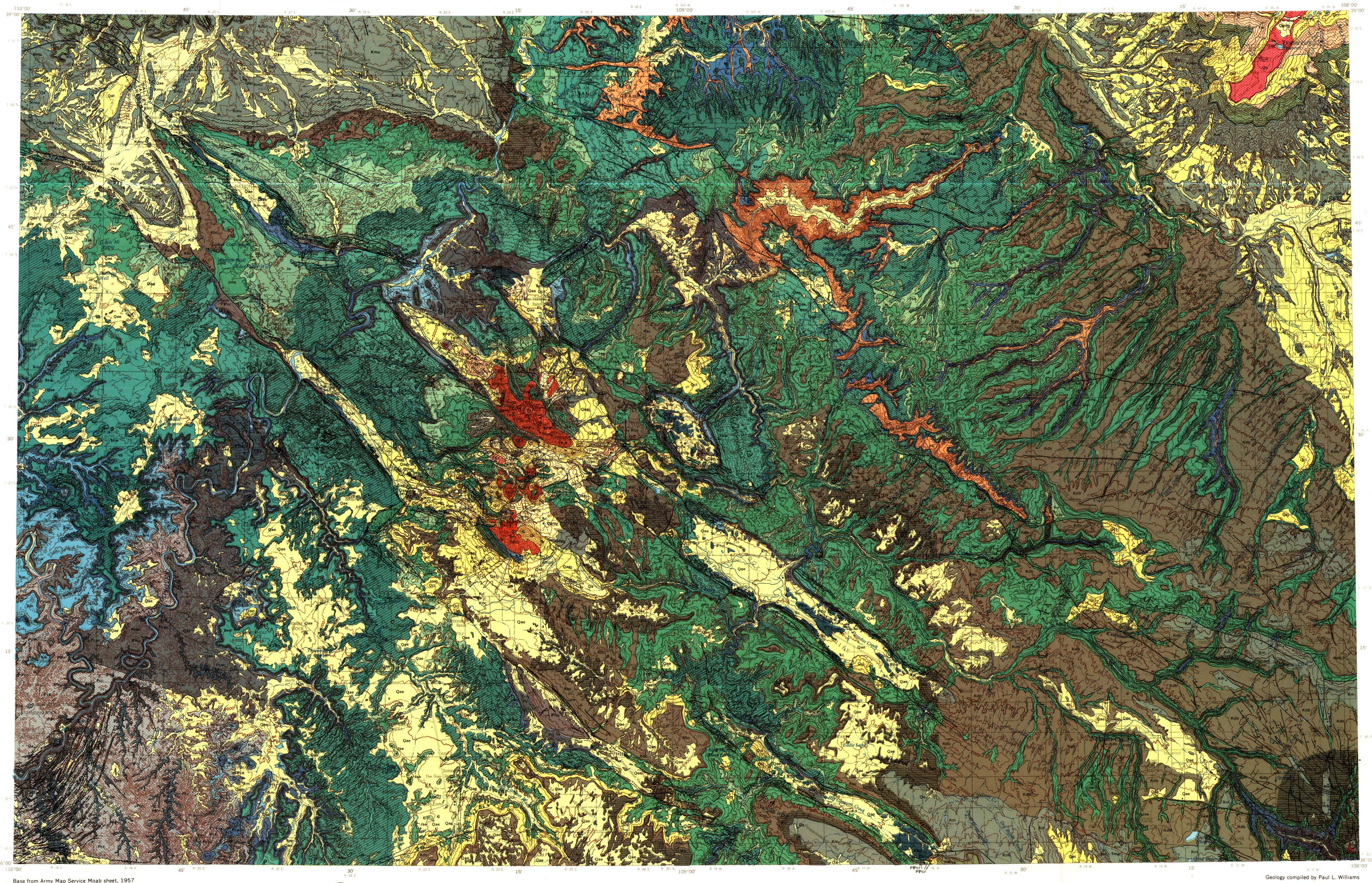


Base from Army Map Service Moab sheet, 1957

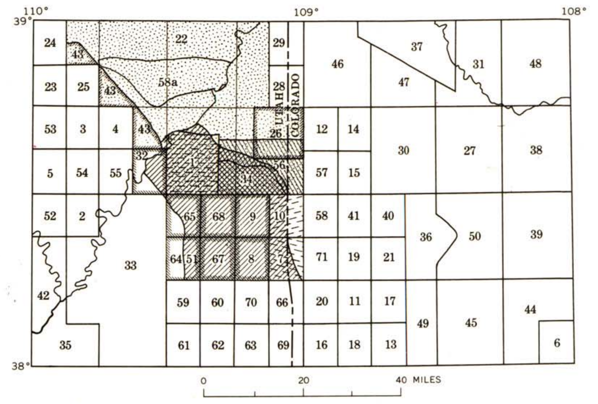
Geology compiled by Paul L. Williams

SCALE 1:250 000

5 0 5 10 15 20 MILES

5 0 5 10 15 20 KILOMETERS

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS
DATUM IS MEAN SEA LEVEL



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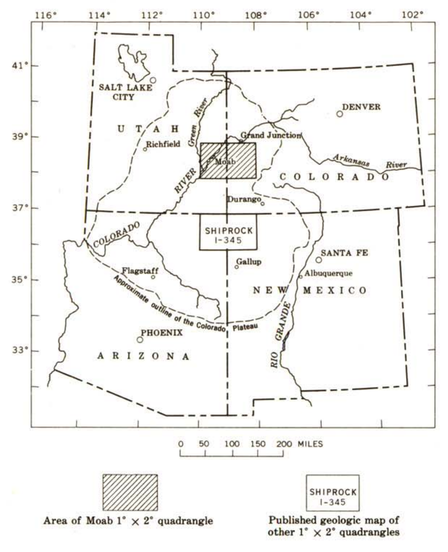

INDEX MAP SHOWING AREA OF MOAB QUADRANGLE

EXPLANATION

QUATERNARY

Pleistocene and (or) Recent

Qae Qa Qap — **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*

Qc Qct Qcl — **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*

Qat — **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

Qaf Qaf₃ Qaf₂ Qaf₁ — **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*

Qag Qag₃ Qag₂ Qag₁ — **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*

Qgm Qgm₃ Qgm₂ Qgm₁ — **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*

Qfc — **Conglomerate in Fisher Valley**
Partly consolidated; of uncertain age

Qb — **Basalt**
Extrusive scoriaceous and vesicular basalt capping Grand Mesa. Includes intercalated volcanic ash and breccia

UNCONFORMITY

TERTIARY

Pliocene

Tcc — **Conglomerate in Castle Valley and Geyser Creek**
Chiefly pebbles and cobbles of igneous rock derived from North Mountain

Miocene(?)

Tcd — **Clastic dike**
Consists of fragments of gneiss, schist, limestone, granitic rocks, and eruptive rocks of intermediate composition; in Placerville area

Tmq — **Monchiquite**
Dikes, chiefly biotite and augite, and carbonates derived during alteration; in Placerville area

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

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

Eocene

Tgr — **Green River Formation**
White friable sandstone and gray to gray-green lacustrine shale. Poorly exposed near top of Grand Mesa

Tw — **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

TKvb — **Vent breccia**
Chiefly fragments of aegirine granite porphyry and altered diorite porphyry

TKs — **Soda syenite porphyry**
Small intrusive bodies, consisting of coarse phenocrysts of microperthite and augite in groundmass of aegirine-augite and anorthoclase

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

TKmp — **Monzonite porphyry**
Closely spaced dikes. Chiefly plagioclase, potassium feldspar, hornblende, and pyroxene

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

CRETACEOUS

Upper Cretaceous

BOOK CLIFFS

Mesaverde Group[1]

Kmvu — **Upper part of Mesaverde Group**
Alternating light-colored nonmarine sandstone and shale containing some coal

Kc — **Castlegate Sandstone**
Buff-weathering, coarse- to fine-grained, massive cliff-forming marine sandstone

Kb — **Upper member of Blackhawk Formation**
An upper cliff-forming sandstone and a lower shale; locally coal-bearing

Kmb — **Buck Tongue of the Mancos Shale**
Similar in lithology to the Mancos Shale to the south; occurs in the Book Cliffs

GYPSUM VALLEY

Kmvg — **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

GRAND MESA

Kmv Kmvr — **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]

Kmu Kmfe Kml Km — **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*

Kd — **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

UNCONFORMITY

Lower Cretaceous

Kbc — **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

Kmdb — **Mancos Shale, Dakota Sandstone, and Burro Canyon Formation**

Kdb — **Dakota Sandstone and Burro Canyon Formation**

JURASSIC

Upper Jurassic

Jm Jmb Jms — **Morrison Formation**
Variegated fluvial and lacustrine shale, mudstone, and sandstone; local thin limestone beds. Total thickness ranges from 450 to 950 feet.
Jm, *Morrison Formation, undifferentiated.*
Jmb, *Brushy Basin Shale Member. Chiefly gray, pale-green, red, and light-purple bentonitic mudstone, fluvial sandstone and conglomerate lenses, some of which contain uranium and vanadium deposits. Thickness ranges from 250 to 500 feet.*
Jms, *Salt Wash Sandstone Member. White, gray, rusty-red, and buff fluvial sandstone interbedded with red, gray, and green fluvial mudstone, with thin limestone beds near base. Uppermost continuous sandstone beds contain major uranium-vanadium deposits through much of the area. Thickness ranges from 190 feet in the north to a maximum of 490 feet in the south*

San Rafael Group[2]

Js — **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

Jem Je — **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*

Jsem — **Summerville Formation and Moab Sandstone Member of Entrada Sandstone**

Jse — **Summerville Formation and Entrada Sandstone**

Jwe — **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

JŦsen — **Summerville Formation, Entrada Sandstone, and Navajo Sandstone**

JURASSIC AND TRIASSIC

Glen Canyon Group

JŦn — **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

JŦgc — **Glen Canyon Group**
Includes Navajo Sandstone, Kayenta Formation, and Wingate Sandstone

TRIASSIC

Upper Triassic

Ŧk — **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

Ŧw — **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

Ŧkw — **Kayenta Formation and Wingate Sandstone**

Ŧc Ŧcu Ŧcb — **Chinle Formation**
Ŧc, *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.*
Ŧcu, *upper part of Chinle Formation in parts of area between Green and Colorado Rivers.*
Ŧcb, *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*

Ŧwc — **Wingate Sandstone and Chinle Formation**

Ŧd — **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

Ŧcm — **Chinle and Moenkopi Formations**

UNCONFORMITY

Lower and Middle(?) Triassic

Ŧm — **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

ŦP₽u — **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

PERMIAN

Pc Pca Pcw Pco Pcc Pcwo Pcao Pcac — **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*

PERMIAN AND PENNSYLVANIAN

P₽r — **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

P₽cr — **Cutler and Rico Formations**

PENNSYLVANIAN

Middle Pennsylvanian

₽h ₽hu ₽hp — **Hermosa Formation**
₽h, *Hermosa Formation, undifferentiated.*
₽hu, *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.*
₽hp, *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*

UNCONFORMITY

PRECAMBRIAN

p€ — **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

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Contact

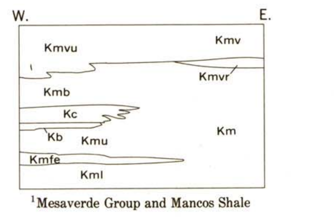
Fault
Dashed where approximately located; dotted where concealed. Bar and ball on downthrown side

Strike and dip of beds

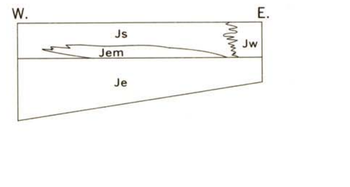
Horizontal beds

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

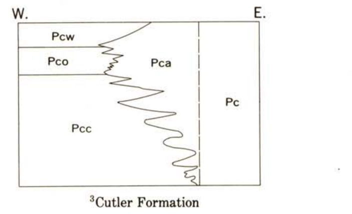
Collapse structures
Small vertical pipelike bodies of breccia, bounded by circular faults, occurring on northeast side of Spanish Valley; contain blocks of rock from all formations from Navajo Sandstone through Dakota Sandstone. Age of collapse unknown; possibly Tertiary



[1]Mesaverde Group and Mancos Shale



[2]San Rafael Group



[3]Cutler Formation

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1969—G62250

GEOLOGY, STRUCTURE, AND URANIUM DEPOSITS OF THE MOAB QUADRANGLE, COLORADO AND UTAH

Compiled by
Paul L. Williams

1964

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