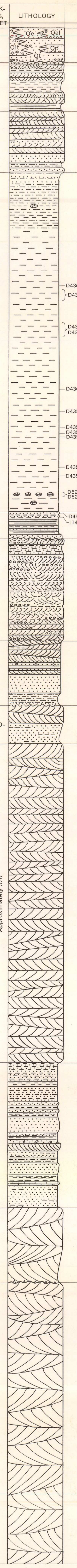
COLUMNAR SECTION

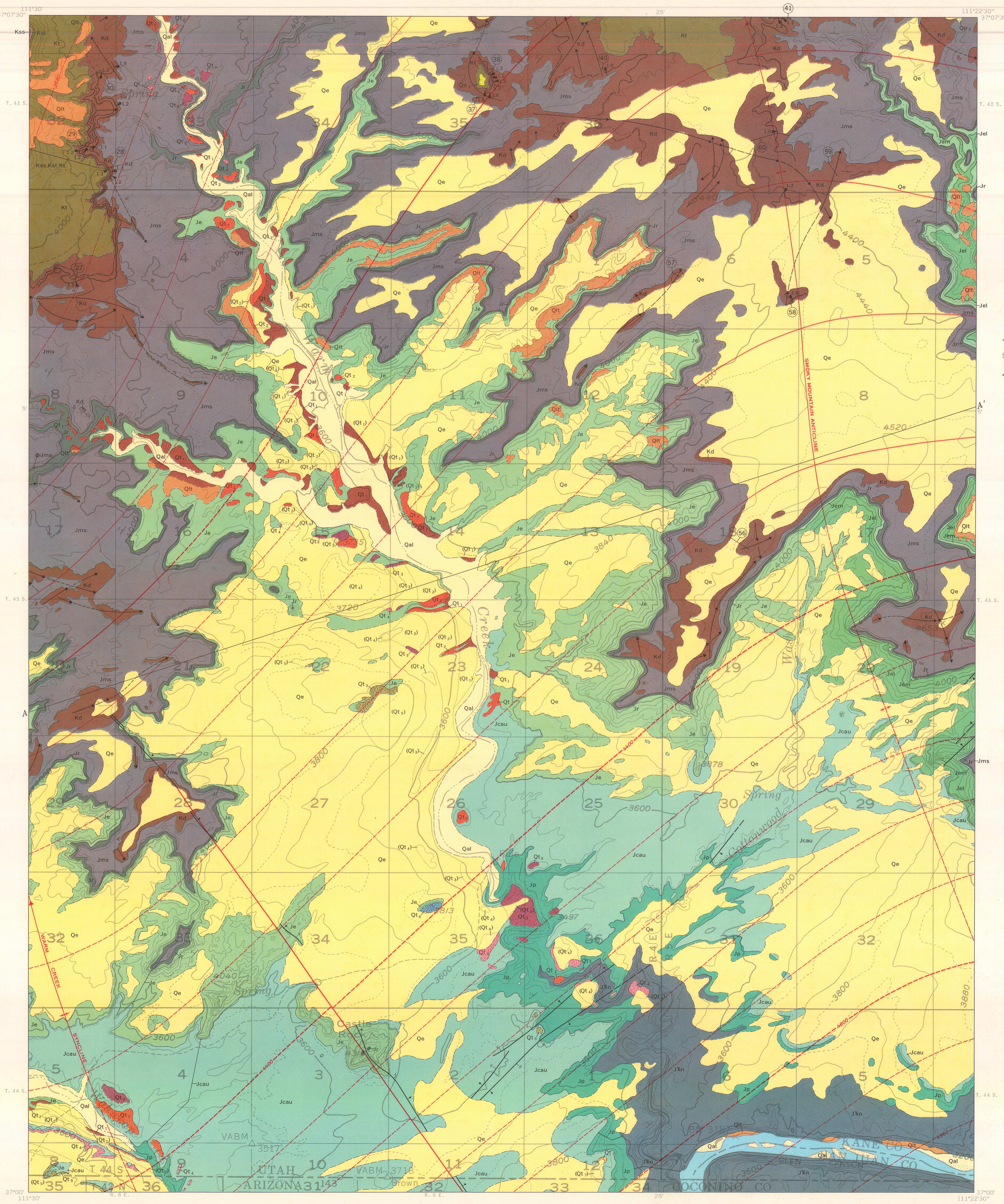


SYSTEM	SERIES	FORMATION AND MEMBER	THICKNESS, IN FEET	DESCRIPTION
QUATERNARY	Holocene ? Pleistocene	Surficial units (not to scale)		Surficial units. Alluvium (Qal): poorly sorted gravel, sand, and mud on present flood plains; locally includes talus and eolian deposits; 0–20 feet. Eolian deposits (Qe): windblown sand and silt; locally includes landslide, talus, and terrace deposits; 0–20 feet. Landslide and talus deposits (Qlt): landslide materials, toreva blocks, and unsorted boulders, gravel, sand, and mud in talus sheets at foot of cliffs; 0–30 feet. Terrace deposits (Qt): poorly sorted gravel and sand, commonly concealed by a thin veneer of eolian deposits; 0–20 feet. Subscript numbers on map indicate relative height above present flood plains and probable correlation between major drainage systems. Qt_1, lower deposits formed during Holocene erosion cycle; Qt_2–Qt_6, intermediate deposits probably formed during Wupatki erosion cycle of middle and late Pleistocene age; Qt_7, upper deposits probably formed during late Black Point erosion cycle of early Pleistocene age (Cooley and others, 1969, p. A35). Pediment deposits (Qp): poorly sorted gravel, sand, and mud on pediment surfaces; 0–20 feet. Subscript numbers on map indicate probably correlation with terrace deposits and relative height above present flood plains; Qp_2 is the lower.
		UNCONFORMITY		
CRETACEOUS	Upper	Straight Cliffs Formation: Smoky Hollow Member	87	Straight Cliffs Formation. Smoky Hollow Member. Calico bed (12 ft): Sandstone, white to very light gray, fine- to coarse-grained, poorly sorted, very thinly to thickly crossbedded; scattered granules and fine pebbles or conglomerate lenses common; clasts composed of white and pink feldspar, clear quartz, and gray to black chert. Lower contact sharp and channeled but interfingering in nearby areas; upper contact just outside map area is an unconformity; widespread braided-stream deposits. Barren zone (62 ft): Interbedded sandstone and mudstone. Sandstone, grayish-orange to yellowish-gray, very fine grained to medium-grained, poorly to moderately sorted, very thinly to thickly crossbedded; scattered granules and fine pebbles locally common; clasts composed of white and pink feldspar, clear quartz, and gray to black chert; commonly in beds 5–20 feet thick, locally ripple crossbedded at top. Mudstone, bentonitic, dusky-yellow to light-olive-gray, very thin bedded; includes siltstone and sandstone, coarse silt to very fine grained, moderately sorted, very thin bedded and ripple crossbedded. Lower contact gradational and interfingering; alluvial-plain deposits. Coal zone (13 ft): Mudstone, carbonaceous, medium-dark-gray to black, laminated to very thin bedded; carbonized plant fragments abundant; contains thin coal beds in nearby areas; lower contact sharp and conformable, interfingering in nearby areas; coastal swamp and lagoon deposits.
		Straight Cliffs Formation: Tibbet Canyon Member	108	Tibbet Canyon Member: Sandstone, yellowish-gray to grayish-orange; middle and upper parts, fine- to medium-grained, moderately sorted, thin- to thick-bedded, thinly to thickly crossbedded; interbedded with minor siltstone and mudstone; grades downward to lower part, very fine grained, poorly to moderately sorted, laminated to very thin bedded and thinly crossbedded. Scattered pebbles of clear quartz and white to black chert locally common; red or white quartzite pebbles rare; fossils scarce. Lower contact gradational and interfingering; nearshore marine and beach deposits.
		Tropic Shale	610	Tropic Shale: Shale, bentonitic, medium-dark-gray, laminated to very thin bedded; calcareous about 24–450 feet above base. Upper 50–100 feet, dusky-yellow to light-olive-gray mainly very thin bedded mudstone and siltstone. Thin white bentonite beds common in lower 50 feet, uncommon above. Limestone concretions (ft above base): about 550 feet, cone-in-cone structure, rare; 28–38 feet, fossiliferous, common; 16 feet, septarian, scarce. Lower contact fairly sharp; formation generally concealed by talus; offshore marine deposits. (Section measured with H. A. Waldrop.)
	Lower(?)	Dakota Formation	48	Dakota Formation (48–75+ ft). Upper member (13 ft, ranges from 1 to 13 ft): Sandstone, mudstone, and shale. Sandstone, grayish-orange to moderate-brown, very fine grained to fine-grained, very thin bedded to thin-bedded and uncommonly very thinly crossbedded; basal bed contains abundant oyster shells and scarce granules and fine pebbles of black chert and light-gray quartzite. Mudstone, dusky-yellow, and medium-dark-gray shale, laminated to very thin bedded, fossiliferous; includes thin coquinoid marlstone lenses near west edge of map area. Lower contact sharp and conformable; member generally concealed; brackish-water to marine deposits. (Section measured with H. A. Waldrop.) Middle member (27 ft, ranges from 26 to 68+ ft): Interbedded channel sandstones, mudstone, and coal. Channel sandstones, light-gray, grayish-orange, and yellowish-gray, very fine grained to fine-grained, moderately sorted, very thinly to thinly crossbedded, commonly ripple crossbedded at top; contain scarce clear quartz and white to black chert granules and fine pebbles (fluvial channel deposits). Bentonitic mudstone, dusky-yellow to light-olive-gray, very thin bedded; small siderite concretions fairly common; includes siltstone and sandstone, coarse silt to very fine grained, moderately sorted, very thin bedded to thin-bedded and ripple crossbedded; more common in southern part of outcrop area. Carbonaceous mudstone, pale-brown to black, laminated to very thin bedded; carbonized plant fragments abundant; more common in northern part of map area. Coal, black, laminated to very thin bedded; in four thin beds that thin or pinch out southward. A thin very pale orange bentonite marker bed is generally present in lower half of member. Lower contact interfingering and gradational; alluvial-plain and swamp deposits. Lower member (8 ft, ranges from 1 to 16 ft): Interbedded sandstone and conglomerate. Sandstone, yellowish-gray to light-brown, fine- to coarse-grained, poorly to moderately sorted, irregularly thin bedded and thinly to thickly crossbedded; black grains of carbonaceous material and scattered granules and fine pebbles common. Conglomerate, yellowish-gray; clasts mainly granule to medium pebble size; composed mainly of white to black chert and scarce light-gray quartzite, thickly crossbedded; includes scarce thin silty carbonaceous mudstone lenses. Lower contact is sharp and channeled with as much as 20 feet of relief and is a slightly angular unconformity that bevels underlying beds southwestward; braided-stream and residual deposits.
		UNCONFORMITY		
JURASSIC	Upper	Morrison Formation: Salt Wash Member	182	Morrison Formation. Salt Wash Member (120–280 ft): Sandstone, very light gray, yellowish-gray, brownish-gray, and grayish-yellow-green, very fine grained to medium-grained, poorly to moderately sorted, thinly to thickly crossbedded; scattered pebbles and pebble conglomerate lenses common, pebbles mainly red, orange, brown, green, gray, or black chert; commonly in beds 3–40 feet thick. Includes some grayish-yellow-green and moderate-reddish-brown irregularly very thin bedded to thin-bedded mudstone. Lower contact is sharp and channeled and locally has as much as 20 feet of relief, regional studies indicate it is an unconformity; alluvial-plain deposits.
		UNCONFORMITY		
		Sandstone at Romana Mesa	115	Sandstone at Romana Mesa (80–150 ft): Sandstone, grayish-yellow-green to yellowish-gray, very fine grained to fine-grained, moderately sorted, thin- to thick-bedded and thickly to very thickly crossbedded; scattered granules common, small granule conglomerate lenses rare, granules same composition as in Morrison Formation; flat-bedded siltstone common in lower part. "Summerville band," basal 2 feet: Siltstone and silty mudstone, moderate-reddish-brown, irregularly very thin bedded; lower contact sharp and parallel to bedding, regional studies indicate it is an unconformity. Formation deposited in nearshore marine, beach, and possibly eolian environments. Width of outcrop band on map may be slightly exaggerated in cliffs to show continuity.
		UNCONFORMITY		
		Entrada Sandstone: Middle member (Members distinguished in eastern part of map area)	640 (Middle member 70–)	Entrada Sandstone (610–680 ft). Middle member: Interbedded sandstone, siltstone, and mudstone. Sandstone and siltstone, white, moderate-reddish-orange, and moderate-reddish-brown, coarse silt to very fine grained, moderately sorted, thin- to thick-bedded and thinly to thickly crossbedded. Mudstone, moderate-reddish-brown, laminated to very thin bedded; includes scarce very thin beds of grayish-purple bentonite. Generally forms red and white banded steep slopes or cliffs; lower contact conformable and somewhat gradational; probably shallow marine, tidal flat, beach, and eolian deposits. Width of outcrop band on map may be slightly exaggerated in cliffs to show continuity.
		Entrada Sandstone: Lower member	Approximately 570	Lower member: Sandstone, moderate-reddish-orange, very fine grained, moderately well sorted, thinly to thickly crossbedded; contains minor laminated to thin-bedded siltstone and sandstone; lower contact sharp and conformable; probably eolian, flat beds probably nearshore marine and beach. The two members of the Entrada correlate with the lower two of three members that can be recognized about 40 miles northwest of the map area near Escalante, Utah. The upper part of the middle member locally contains several sets of large-scale cross-stratification and may correlate with the large-scale cross-stratified upper member of the Entrada near Escalante. These members do not correlate with the lower sandy, medial silty, and upper sandy members of the Entrada of northeastern Arizona (Harshbarger and others, 1957). Middle and lower members: undivided in central and western part of map area where a reasonably clear separation cannot be made because entire formation is white to very light gray and forms cliffs; color change is laterally gradational but clearly of postdepositional origin, commonly cuts across bedding although locally may parallel some of the flat bedding. (Thickness measured with alidade by H. A. Waldrop.) Section with members differentiated was measured 3,000 feet east of map area in the SE¼NE¼ sec. 21, T. 43 S., R. 5 E., Kane County, Utah.
		Carmel Formation: Upper member	262	Carmel Formation. Upper member (180–340 ft): Interbedded sandstone, mudstone, and siltstone. Sandstone, moderate-reddish-orange to moderate-reddish-brown (several beds are white), very fine grained, poorly to moderately sorted, very thin bedded to thin-bedded and thinly to thickly crossbedded. Mudstone and siltstone, moderate-reddish-orange to pale-reddish-brown, laminated to very thin bedded and ripple cross-laminated. Includes a laminated moderate-orange-pink argillaceous limestone bed in lower part; scarce very thin beds of grayish-purple bentonite; scattered granules and fine pebbles or very thin granule conglomerate lenses in middle of member; clasts include abundant pale-red and white rhyolite porphyry, common white, gray, black, red, and orange chert, and scarce green and dark-red quartzite. Lower contact sharp and conformable; probably shallow marine, tidal flat, and lagoon deposits. A lower member known as the Judd Hollow Tongue is present about 8 miles west of the map area.
	Middle	Sandstone at Page	134	Sandstone at Page (120–200 ft): Sandstone, reddish-orange to reddish-brown, fine-grained, moderately to well-sorted, very thickly crossbedded; angular small chert pebbles at base; lower contact sharp, regional studies indicate an unconformity; eolian deposits.
		UNCONFORMITY		
TRIASSIC(?) AND JURASSIC		Navajo Sandstone	500+	Navajo Sandstone: Sandstone, moderate-reddish-orange to grayish-pink and very light gray, fine-grained, moderately to well-sorted, very thickly crossbedded; about 1,600 feet thick but only upper 500 feet exposed in map area; eolian deposits.

Fossil collections in Tropic Shale (lithology column): D4362, D4364, D4363, D4361, D4360, D4358, D4359, D4357, D4356, D4354*, D4355, D5260*, D5253; Dakota Formation: D4350*, 114*

FEET 0 50 100

*Projected



Base from U.S. Geological Survey 1:62,500, 1953

APPROXIMATE MEAN DECLINATION, 1973 — TRUE NORTH, MAGNETIC NORTH, 15°

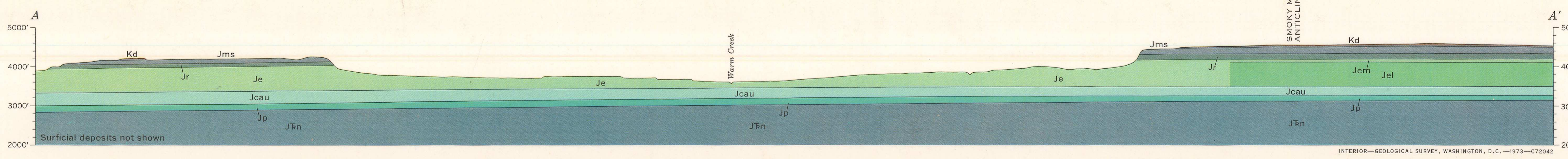
SCALE 1:24 000

1 ½ 0 1 MILE

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 80 FEET
DASHED LINES REPRESENT HALF INTERVAL CONTOURS
DATUM IS MEAN SEA LEVEL

Geology mapped in 1964–65 and 1969
Assisted by C. J. Flynn and B. E. Law



INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1973—C72042

GEOLOGIC MAP OF THE SOUTHWEST QUARTER OF THE GUNSIGHT BUTTE QUADRANGLE, KANE AND SAN JUAN COUNTIES, UTAH, AND COCONINO COUNTY, ARIZONA

By
Fred Peterson
1973

EXPLANATION

QUATERNARY

Holocene

Qal — Alluvium

Qe — Eolian deposits

Qt_1 — Lower terrace deposits

Pleistocene

Qt_2, Qt_3, Qt_4, Qt_5, Qt_6 — Intermediate terrace deposits

Qt_7 — Upper terrace deposits

Qp_2, Qp_3 — Pediment deposits

Qlt — Landslide and talus deposits

UNCONFORMITY

CRETACEOUS

Upper Cretaceous

Kss, Kst — Straight Cliffs Formation
Kss, *Smoky Hollow Member*
Kst, *Tibbet Canyon Member*

Kt — Tropic Shale

Lower(?) and Upper Cretaceous

Kd — Dakota Formation

UNCONFORMITY

JURASSIC

Upper Jurassic

Jms — Salt Wash Member of Morrison Formation

UNCONFORMITY

Jr — Sandstone at Romana Mesa

UNCONFORMITY

Je, Jem, Jel — Entrada Sandstone
Jem, *middle member*
Jel, *lower member*

Middle Jurassic

Jcau — Upper member of Carmel Formation

Jp — Sandstone at Page

UNCONFORMITY

TRIASSIC(?) AND JURASSIC

J̄Ћn — Navajo Sandstone

1.3 (56) — Coal bed
Dashed where approximately located. Thickness of coal, in feet, measured at triangle. Number in circle refers to measured coal section of Dakota Formation. Not mapped where less than 1.0 foot thick

(Qt_1) — Contact
Dashed where approximately located; dotted where contacts of terrace deposits are concealed by eolian deposits. Letter symbols shown in parentheses where terrace deposits are concealed

Fault
Dashed where approximately located. Bar and ball on downthrown side. Displacement, in feet, shown at leader

Anticline
Showing crestline and direction of plunge. Dashed where approximately located

Syncline
Showing troughline and direction of plunge. Dashed where approximately located

Strike and dip of beds

Axis of fluvial channel sandstone in Dakota Formation
Showing principal dip direction of crossbedding; axis of older channel broken where crossed by younger channel. Dashed where approximately located or concealed; short dashes indicate correlation between outcrops

4400 — Structure contours
Drawn on base of Morrison Formation. Dashed where approximately located; short dashed where above surface of ground. Contour interval 80 feet

Fault trace projected to base of Morrison Formation

Jcau — Location of measured section shown in columnar section

GEOLOGY

INTRODUCTION

Glen Canyon National Recreation Area includes a large part of the mapped area along the Colorado River, Wahweap Creek, and Warm Creek. The Recreation Area, administered by the National Park Service, was established primarily to include Lake Powell, the reservoir currently forming behind Glen Canyon Dam which is about 4 miles south of the Arizona-Utah State line near Page, Ariz. The area is dissected into colorful buttes, canyons, and mesas that are carved in rocks of Triassic(?), Jurassic, and Cretaceous age.

Lake Powell, currently filling Glen Canyon, rose from approximately 3,450 to 3,600 feet above sea level while the area was being mapped, although ultimately it will reach a maximum altitude of about 3,710 feet. The geology of the submerged lands was interpreted from aerial photographs flown in 1951 aided by a brief reconnaissance in 1963. The quadrangle was mapped primarily as part of the U.S. Geological Survey program of evaluating and classifying mineral lands in the public domain.

COAL

A small amount of coal of bituminous or subbituminous rank occurs in the middle member of the Dakota Formation. The coal occurs principally in four beds, all of which thin or pinch out locally. The thickest bed measured 2.0 feet (measured section 37, coal sections) which is considered too thin to be of commercial value by present standards. Possibly some of the coal could be mined by augering methods, but at present this is not practical because thicker and more continuous coal beds occur several miles north of the map area in the John Henry Member of the Straight Cliffs Formation.

A sample of coal from the Dakota Formation was taken 1.0 mile west of the map area from coal bed 4 in an abandoned mine in the NE ¼ NW ¼ sec. 7, T. 43 S., R. 4 E., Kane County, Utah. The sample on an as-received basis gave the following values: 5.3 percent moisture, 45.1 percent volatile matter, 44.1 percent fixed carbon, 5.5 percent ash, 1.6 percent sulfur, and 10,670 British thermal units (Waldrop and Peterson, 1966). The Btu value of this sample is probably low because the sample was taken from a face that had not been worked for 50 or more years.

The Smoky Hollow Member of the Straight Cliffs Formation contains a 1.5-foot-thick coal bed just west of the map area where the section shown in the columnar section was measured. This bed apparently does not extend into the map area.

A summary of data pertaining to the coal deposits of the entire Kaiparowits coal field is given by Doelling (1970).

GROUND WATER

Several small springs or seeps occur in sandstones of the Morrison Formation in the northern part of Warm Creek canyon or near the head of some of the tributary canyons. Some of these have been developed for cattle that are grazed in the area, but it is doubtful that adequate quantities of water for more extensive use could be obtained from these places. The Entrada and Navajo Sandstones consist largely of clean and porous sandstone, are excellent aquifers, and are recharged from Lake Powell. Large quantities of water could be obtained from these formations where they are below the level of the lake.

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Cooley, M. E., Harshbarger, J. W., Akers, J. P., and Hardt, W. F., 1969, Regional hydrogeology of the Navajo and Hopi Indian Reservations, Arizona, New Mexico, and Utah: U.S. Geol. Survey Prof. Paper 521-A, p. A1–A61.

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Harshbarger, J. W., Repenning, C. A., and Irwin, J. H., 1957, Stratigraphy of the uppermost Triassic and the Jurassic rocks of the Navajo country [Colorado Plateau]: U.S. Geol. Survey Prof. Paper 291, 74 p.

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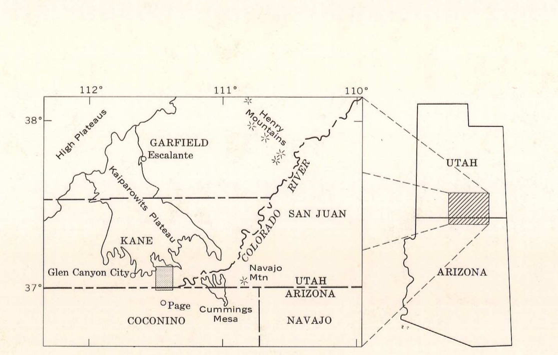
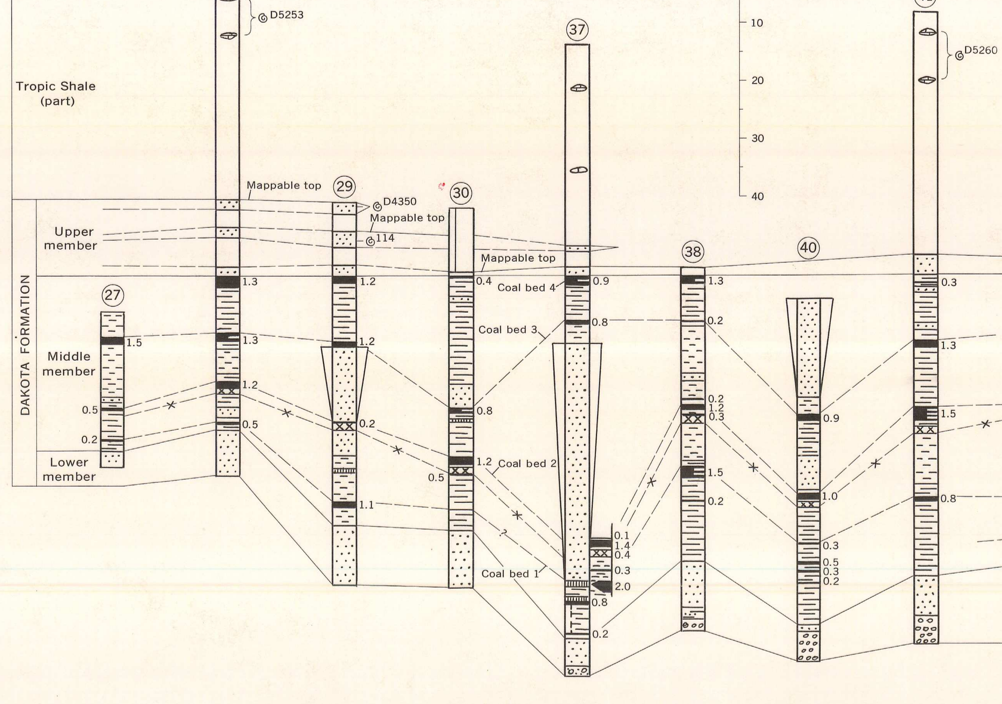
FOSSIL COLLECTIONS

[Location shown on coal and columnar sections. D5253 and D5260 identified by Fred Peterson; remainder identified by W. A. Cobban. Faunal zones are those of Cobban and Reeside (1952)]

USGS Mesozoic locality	Field No.	Collector and year	Formation and member	Fossils	Faunal zone
-------	114	H. A. Waldrop and Fred Peterson, 1963.	Dakota Formation, upper member.	*Ostrea* sp.	Probably Zone of *Dunveganoceras pondi* Haas.
D4350	-----	-----do-----	-----do-----	*Ostrea* sp. *Brachidontes multilinigera* (Meek) *Cardium* sp.	Do.
D5253	-----	Fred Peterson, 1964.	Tropic Shale	*Serpula intrica* White *Solemya*? *obscura* Stanton *Gryphaea newberryi* Stanton *Exogyra* sp. *Camptonectes platessa* White *Lima utahensis* Stanton *Psilomya meeki* (White) *P. concentrica* (Stanton) *Veniella mortoni* Hall and Meek *Lucina subundata* Hall and Meek *Corbula kanabensis* Stanton *Euspira* sp. *Turritella whitei* Stanton *Cerithium*? sp. *Sciponoceras gracile* (Shumard)	Zone of *Sciponoceras gracile* (Shumard).
D5260	-----	-----do-----	-----do-----	*Serpula intrica* White *Gryphaea newberryi* Stanton *Exogyra* sp. *Lucina subundata* Hall and Meek *Corbula kanabensis* Stanton *Euspira* sp. *Turritella whitei* Stanton *Cerithium*? sp. *Drepanochilus ruida* (White) *Arrhoges prolabiata* (White) *Sciponoceras gracile* (Shumard)	Do.
D4354	-----	H. A. Waldrop and Fred Peterson, 1963.	-----do-----	*Inoceramus* sp. *Drepanochilus ruida* (White) *Baculites*? sp. *Kanabiceras*? sp. *Watinoceras*? sp.	Zone of *Inoceramus labiatus* (Schlotheim).
D4355	-----	-----do-----	-----do-----	*Inoceramus labiatus* (Schlotheim) *Ostrea* sp. *Mammites* sp.	Do.
D4356	-----	-----do-----	-----do-----	*Inoceramus labiatus* (Schlotheim) *Ostrea* sp. *Watinoceras*? sp.	Do.
D4357	-----	-----do-----	-----do-----	*Inoceramus labiatus* (Schlotheim)	Do.
D4358	-----	-----do-----	-----do-----	*Inoceramus labiatus* (Schlotheim) *Anomia* sp. *Drepanochilus ruida* (White)	Do.
D4359	-----	-----do-----	-----do-----	*Inoceramus labiatus* (Schlotheim) *Metoicoceras* sp.	Do.
D4360	-----	-----do-----	-----do-----	*Inoceramus labiatus* (Schlotheim) *Baculites* sp.	Do.
D4361	-----	-----do-----	-----do-----	*Inoceramus* sp. *Ostrea* sp. *Baculites* sp. *Collignoniceras woollgari* (Mantell)	Zone of *Collignoniceras woollgari* (Mantell).
D4362	-----	-----do-----	-----do-----	*Ostrea* sp. *Collignoniceras woollgari* (Mantell)	Do.
D4363	-----	-----do-----	-----do-----	*Ostrea* sp. *Collignoniceras woollgari* (Mantell)	Do.
D4364	-----	-----do-----	-----do-----	*Ostrea* sp. *Collignoniceras woollgari* (Mantell)	Do.



INDEX MAP SHOWING LOCATION OF MAP AREA AND PERTINENT GEOLOGIC FEATURES IN SURROUNDING AREA



COAL SECTIONS IN THE DAKOTA FORMATION

EXPLANATION

Conglomerate

Sandstone

Fluvial channel sandstone

Mudstone, gray to yellowish-green

Carbonaceous mudstone

Marine to brackish-water shale
Locally includes mudstone

1.3 — Coal bed with thin parting
Thickness, in feet

Impure coal or very carbonaceous mudstone

Bentonite marker bed

Fossiliferous limestone concretions

Septarian limestone concretions
Fossils rare

Partly covered

Covered

D5260 — Fossil collection

CORRELATION SYMBOLS

Formation or member boundary

Other correlation within formation

Utah (Gunsight Butte quad). Geol. 1:24,000. 1973.
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