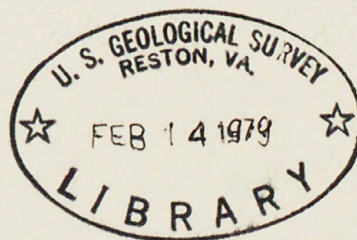


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Stratigraphic Sections of Jurassic San
Rafael Group and Adjacent Rocks in
Rio Blanco and Garfield Counties,
Colorado

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UNITED STATES (DEPARTMENT OF THE INTERIOR)
GEOLOGICAL SURVEY

[Reports - Open file series]

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Stratigraphic Sections of Jurassic San
Rafael Group and Adjacent Rocks in
Rio Blanco and Garfield Counties,
Colorado

By ^{James} J. C. Wright and ¹⁹²³⁻¹⁹⁶⁸ D. D. Dickey, ^{Wright} 1927-^{collected}

Open-File Report 79-245

1979

This report is preliminary and has not
been edited or reviewed for conformity
with U.S. Geological Survey standards.

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Stratigraphic Sections of Jurassic San Rafael Group and
Adjacent Rocks in Rio Blanco and Garfield Counties, Colorado

By J. C. Wright and D. D. Dickey

Introduction

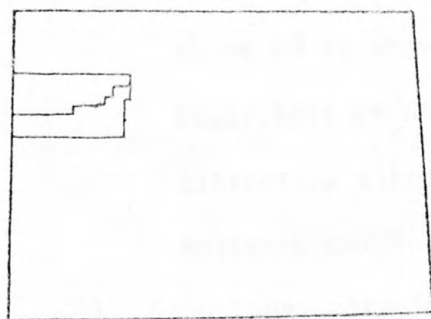
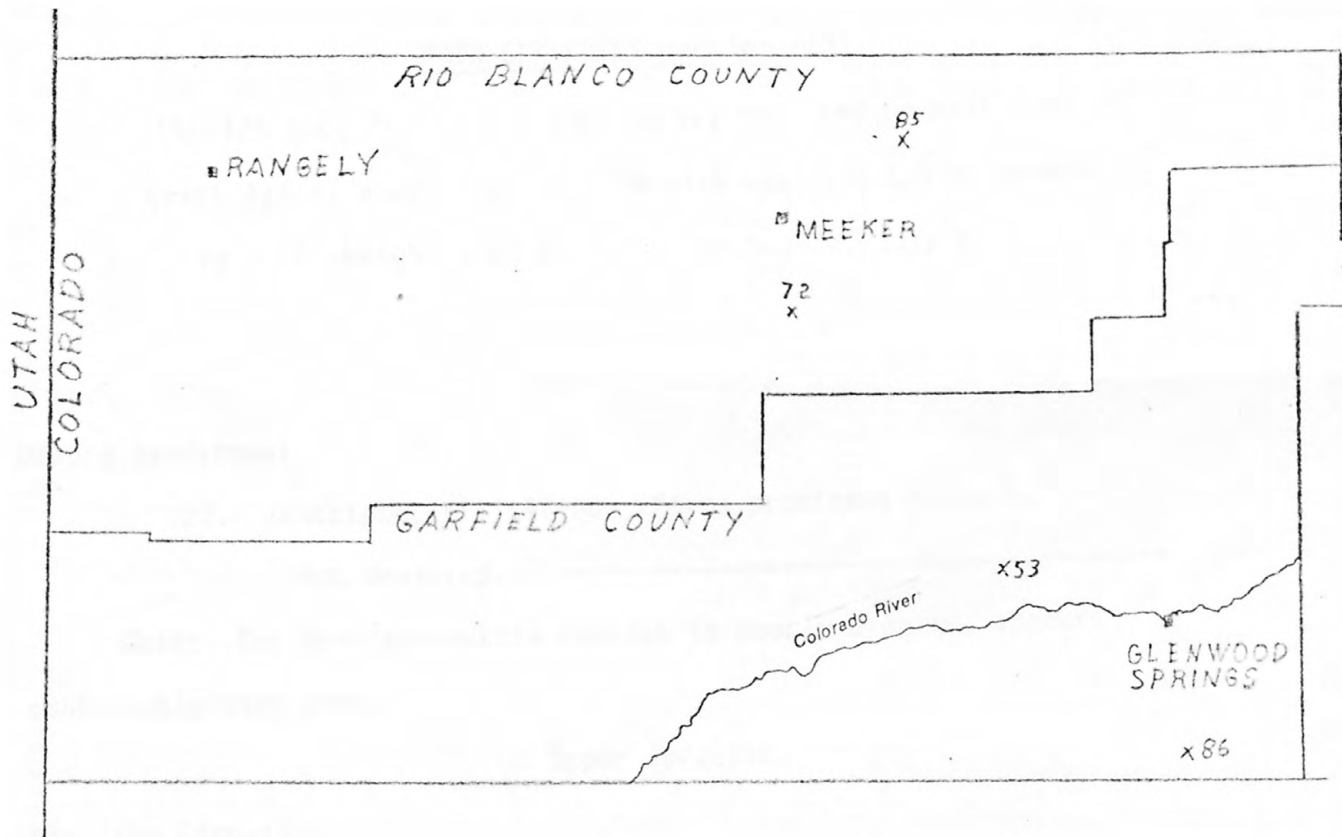
These sections were measured prior to 1960, before adoption of the metric system. Publication was delayed by other assignments of the authors and later by the untimely death of J. C. Wright. They are being released at this time because of the increased interest in the uranium potential of Jurassic rocks.

The Curtis and Entrada are the only formations of the San Rafael Group that are present in these sections. The name Glen Canyon Sandstone (Lower Jurassic and Upper Triassic) has replaced use of Navajo or of Nugget Sandstone in northwest Colorado.

Figure 1 is a map showing the locations of the stratigraphic sections included in this report. The following terms were found convenient in helping to describe stratigraphic sections on the Colorado Plateau:

Entrada berries--Very well rounded, nearly spherical, frosted sand grains larger than grains of the matrix and composing a very small part of the total volume. They are common in the Entrada Sandstone, but are not exclusive to it

Slickrim--A slightly rounded or curved cliff of sandstone as opposed to a vertical cliff



COLORADO

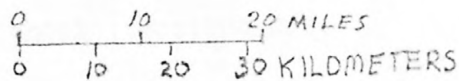


Figure 1. Map showing the locations of the stratigraphic sections in this report. (Section numbers are in system referred to by Wright, J. C., and Dickey, D. D., 1963, Block diagram of the San Rafael Group and underlying strata in Utah and part of Colorado: U.S. Geological Survey Oil and Gas Investigations Chart OC-63.)

COLORADO - GARFIELD COUNTY

MAIN ELK CREEK section (53)

[SE 1/4 sec. 15, T. 5 S., R. 91 W.; measured on east side of creek 1/4 mi above its junction with West Elk Creek; measured by J. C. Wright with W. B. Satterthwaite, July 2, 1957]

Feet

Lower Cretaceous

Dakota Sandstone:

22. Sandstone, silicified. Forms prominent hogback.

Not measured-----

Note: The Morrison-Dakota contact is poorly exposed, appears conformable over area.

Upper Jurassic

Morrison Formation:

21. Mostly covered, predominately siltstone and claystone; about 50 ft above base is a 1 ft thick limestone bed. Upper half of unit has much dark green and purple silicified siltstone and claystone, which may be of volcanic origin. Mostly in even beds----- 243.5
20. Sandstone, very fine grained, very well cemented with siliceous cement. Forms ledge----- 8.5
19. Covered, mostly gray and greenish-gray shale and siltstone; contains several thin gray limestone beds in lower half----- 38.0
18. Limestone, medium light-gray (N 6), micro-crystalline----- 2.0

MAIN ELK CREEK section--Continued

	Feet
Morrison Formation--Continued	
17. Covered, probably similar to unit 15-----	13.0
16. Limestone, very sandy, light-greenish-gray (5G 8/1), weathers light-gray (N 7), thick even massive bed. Forms slight ledge-----	<u>2.5</u>
Total of Morrison Formation-----	<u>307.5</u>

Note: Morrison-Curtis contact; poorly exposed, appears conformable.

Middle Jurassic

Curtis Formation:

15. Claystone, dusky red (10R 3/2), weathers grayish-red (10R 4/2); thin even laminations, weathers shaly on poorly exposed slope. Contains a few thin interbeds of limestone medium-gray (N 5) to light- greenish-gray (5G 8/1); the medium gray is slightly silty, the greenish gray is quite sandy-----	30.0
14. Sandstone, greenish-white (5G 9/1), weathers nearly same; very fine grained, well sorted; contains sparse orange, green, and black accessory grains; firmly cemented; thin even beds. Forms dip slope-----	3.0
13. Covered, similar to unit 12, but less sandy and thinner-bedded-----	7.5

MAIN ELK CREEK section--Continued

Feet

Curtis Formation--Continued

12. Siltstone, very sandy, very pale red (10R 7/2), weathers same, very firmly cemented with calcite; very small scale cross-laminae and ripple marks. Forms a dip slope----- 3.5
11. Sandstone, white (N 9), weathers medium-light-gray (N 6), fine- to medium-grained, well-sorted, composed of rounded clear quartz grains with secondary overgrowths, and common orange, green (glauconite?), and black accessory grains; firmly cemented with calcite; mudstone chips on a few planes; thin sets of medium-scale cross-strata. Forms small ledge----- 2.0
10. Claystone, reddish-brown (10R 4/4); laminated; weathers flaky----- 1.5
9. Claystone, very silty, very dark greenish-gray (5GY 3/1), weathers greenish-gray (5GY 7/1); laminated. Weathers shaly on dip slope----- 1.5
8. Sandstone, like unit 6 in color and lithology, contains green accessory grains; thin sets of medium-scale cross-laminae. A scour channel 1 ft deep and 3 ft broad noted at the base. Forms ledge----- 13.5
7. Sandstone, like unit 6 but without green accessory grains; a few thin interbeds of reddish-brown siltstone. Poorly exposed on dip slope----- 12.0

MAIN ELK CREEK section--Continued

Feet

Curtis Formation--Continued

6. Sandstone greenish-white (5GY 9/1) weathers nearly same, fine-grained, well-sorted; composed of clear, subrounded quartz grains with amber, green (glauconite?), and black accessory grains; firmly cemented with calcite; massive ledge with very indistinct lamination, probably cross-stratified; upper 3 ft is thin- and even-bedded with ripple marks. Unit forms very prominent ledge----- 19.0
5. Incompletely exposed interbedded sandstone (50 percent) and siltstone (50 percent). Sandstone, greenish-white (5GY 9/1), weathers nearly same, very fine grained, moderately well sorted; composed of clear quartz with abundant orange, green (glauconite?), and black accessory grains; firmly cemented by calcite; thin even beds and thin sets of small-scale cross-strata. One sandstone bed near the top is pale-red (10R 6/2) and lacks green accessory grains. Siltstone, pale reddish-brown (10R 5/4). Whole unit forms a ledgy slope----- 21.0

MAIN ELK CREEK section--Continued

Feet

Curtis Formation--Continued

4. Incompletely exposed interbedded mudstone (70 percent), limestone (15 percent), and sandstone (15 percent). Mudstone, dusky red (10R 3/2), very silty and sandy; concealed so that bedding cannot be observed. Limestone, medium dark-gray (N 4), weathers same; most surfaces appear microcrystalline, but on some etched, weathered surfaces a coarse clastic texture shows. Sandstone, white (N 9), weathers same, fine-grained, well-sorted; composed of clear rounded quartz grains, with black and orange accessory silt grains, a few medium-grained gray-frosted "Entrada berries", and rare green glauconite(?) or chert(?); firmly cemented with calcite; thin flat beds. Unit forms
rubbly slope----- 11.0

Total of Curtis Formation----- 125.5

Note: Curtis-Entrada contact is concealed; appears concordant on west side of canyon.

MAIN ELK CREEK section--Continued

Feet

Entrada Sandstone:

3. Sandstone, yellowish-white (5Y 9/4), weathers same to pale greenish-yellow (10Y 8/2), very fine grained, some strata fine-grained, well-sorted; composed of rounded quartz grains with black and orange accessory silt grains and common rounded, gray, frosted, medium-grained "Entrada berries"; Entrada berries are particularly common in lower 0.5 ft; firmly cemented; thin to thick wedging planar sets of medium- to large-scale cross-strata. Forms prominent ledge, slightly more rounded than the Navajo ledge----- 52.0
- Total of Entrada Sandstone----- 52.0

Note: Entrada-Navajo contact is irregular over a broad area; it is described in the note on the Chinle-Navajo contact. The Entrada Sandstone appears to bury a preexisting hill of Navajo Sandstone.

MAIN ELK CREEK section--Continued

Feet

Jurassic and Triassic(?)

Navajo Sandstone:

2. Sandstone, moderate orange-pink (10R 7/4), weathers orange-pink (10R 6/4), very fine grained, silty, moderately well sorted; composed of clear subrounded quartz grains with black accessory silt-sized grains; firmly cemented; thick sets of very large-scale cross-laminae. Forms a prominent blocky jointed ledge----- 40.5
- Total of Navajo Sandstone----- 40.5

Note: Navajo-Chinle contact is not exposed. Shape of ledge suggests that the contact is even and conformable, like the Chinle-Entrada contact on the west side of the canyon. The Navajo Sandstone, in a distance of about 200 or 300 yd, decreases from about 100 ft thick near the top of the ridge to a thin-edge near the base of the canyon wall. Section is on the east side of the canyon about 150 ft updip from the pinch-out of the Navajo Sandstone. As the thickness of the Navajo Sandstone decreases the thickness of the Entrada Sandstone increases so that the upper surface of the Entrada is essentially concordant with the uppermost beds of the Chinle Formation.

MAIN ELK CREEK section--Continued

Feet

Upper Triassic

Chinle Formation:

1. Covered on east side of creek but exposures on west side indicate siltstone and claystone weathering moderate-red (5R 4/6), interbedded with subordinate thick beds of yellowish-orange (10YR 7/6) sandstone. Not measured-----

RIO BLANCO COUNTY - COLORADO

FLAG CREEK section (72)

[SW 1/4 sec. 36, T. 1 S., R. 94 W., 1.5 mi up east fork
of Flag Creek on north side, 7 mi south of Meeker;
measured by D. D. Dickey and J. C. Wright with
W. B. Satterthwaite, July 3, 1957]

Note: Strata above unit 26 are poorly exposed and faulted.

Feet

Upper Jurassic

Morrison Formation:

26.	Covered; probably claystone, grayish-red-----	>5.0
25.	Sandstone, like unit 23-----	2.0
24.	Covered; probably claystone, grayish-red-----	4.0
23.	Sandstone, very light gray (<u>N</u> 8), weathers same; very fine grained, silty, moderately well sorted; very firmly cemented with calcite. Forms massive ledge-----	3.0
22.	Claystone, dark-greenish-gray (<u>5GY</u> 4/1), weathers greenish-gray (<u>5GY</u> 6/1), thinly laminated, weathers shaly on concealed slope. Used 58° dip-----	8.5
21.	Sandstone, yellowish-gray (<u>5Y</u> 8/1), weathers pale-orange (<u>10YR</u> 7/2), very fine grained, well- sorted; composed of clear quartz with feldspar(?) and black accessory grains; well cemented. Small- to medium-scale cross-laminae noted. Carbonaceous stringers in fractures at site of small prospect. Forms blocky ledge. Used 51° dip-----	7.0

FLAG CREEK section--Continued

Feet

Morrison Formation--Continued

20. Sandstone, conglomeratic, in stringers and thin beds; dark-yellowish-gray (5Y 7/1), weathering same to light-olive-gray (5Y 6/1), medium-grained, well- to moderately well sorted except for pebbles; composed of rounded quartz grains, white chert, black and red accessory grains of medium grain size; well-cemented. Pebbles as much as 0.5 in. in diameter of dark gray limestone, light gray limy claystone and dark gray chert. One limestone pebble resembles the charophyte bearing limestone which occurs at the base of the Morrison Formation several miles south of here. Forms mostly covered ledge----- 4.5

Total of incomplete Morrison Formation----- 34.0

Note: The Morrison-Curtis contact was placed at the base of unit 20 because the limestone pebble conglomeratic sandstone may represent erosion and redeposition of the limestone which has been arbitrarily selected as the basal bed of the Morrison Formation.

FLAG CREEK section--Continued

Feet

Middle Jurassic

Curtis Formation

19. Sandstone, light-greenish gray (5GY 8/1), weathers to greenish-gray (5GY 7/1); fine grained, well-sorted; composed of rounded quartz, black, orange, and green accessory grains; well cemented with much calcite. Forms massive ledge----- 1.0
18. Claystone, olive-gray (5Y 4/1), weathers greenish-gray (5GY 7/1), thinly laminated; weathers flaky on poorly exposed slope. Used 50° as dip----- 8.0
17. Claystone, grayish-red (10R 4/2), slightly silty, thinly laminated; weathers shaly on poorly exposed slope. Used 50° as dip----- 8.0
16. Sandstone, like unit 14 in color and lithology; weathers to partially covered flaggy ledge. Used 49° as dip----- 9.0
15. Claystone, dusky red (10R 3/2), weathering same, evenly laminated, weathers shaly; has subordinate thin interbeds of sandstone like unit 12. Poorly exposed on slope----- 7.5

FLAG CREEK section--Continued

Feet

Curtis Formation--Continued

14. Sandstone, light-greenish-gray (5GY 8/1), to yellowish-gray (5Y 8/1), weathering same, very fine to fine-grained, well- to moderately well sorted; composed of subrounded quartz with white chert, and orange, black, and green accessory grains; moderately well cemented; indistinct small-scale cross-laminae. Forms massive ledge----- 4.0
13. Covered; probably mostly sandstone like unit 14----- 3.0
12. Sandstone, white (N 9), weathering very light-gray (N 8), very fine grained, moderately well sorted, composed of subrounded clear quartz grains with red, black, and orange accessory grains, a big percent of the accessory grains are well-rounded, medium-grained and many are medium-grained gray frosted "Entrada berries"; moderately well cemented. Forms ledge----- 6.0
11. Covered; in the middle of the unit is about 0.5 ft of sandstone, white (N 9), weathering very light gray (N 8), medium-grained, well-sorted; composed of subrounded clear quartz grains with abundant orange, red, black, and pale green glauconite accessory grains; firmly cemented; a thin flat bed. Used 48° dip----- 7.0

FLAG CREEK section--Continued

Feet

Curtis Formation--Continued

10. Sandstone, light-greenish-gray (5G 8/1), weathering very light gray (N 8), fine-grained, well-sorted; composed of subrounded clear quartz grains with orange, black, and sparse glauconite accessory grains; firmly cemented; thin to thick wedging planar sets of medium-scale cross strata. Forms ledge. Used 47° as dip----- 27.5
9. Covered. Float indicates some sandstone near base like unit 4. Claystone, dark-grayish-red (5R 3/2) slightly silty, interbedded with claystone, dark-gray (N 3), limy, slightly silty. Claystone is laminated and shaly weathering. Used 47° as dip----- 7.5
8. Sandstone, light-greenish-yellow (10Y 7/2), weathers same; like unit 6 in lithology and bedding; green color seems to be caused by very slight film on grains----- 2.5
7. Covered, probably similar to unit 5. Used 47° as dip----- 7.0

FLAG CREEK section--Continued

Feet

Curtis Formation--Continued

- | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 6. Sandstone, white (<u>N 9</u>), weathers same, very fine grained, well-sorted; composed of clear rounded quartz grains with orange and black accessory grains; firmly cemented with calcite; thin flat beds. Poorly exposed on scarp slope----- | 2.5 |
| 5. Covered; probably sandstone similar to unit 6, but thinner bedded and less resistant. Used 46° as dip----- | <u>15.5</u> |
| Total of Curtis Formation----- | <u>116.0</u> |

Note: The Curtis-Entrada contact is concealed and could be as much as 16 ft higher.

Entrada Sandstone:

- | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 4. Sandstone, poorly exposed, very pale orange (<u>10YR 8/2</u>), weathering same to pale yellowish-brown (<u>10YR 6/2</u>), fine to very fine grained, well- to moderately well sorted; composed of rounded to subrounded quartz grains and minor black accessory grains; poorly cemented; thick sets of large- to medium-scale cross-strata; crops out on dip slope and ledges in draw. Uncertain thickness due to changing dip and concealed Entrada-Navajo contact----- | <u>202.0</u> |
| Total of Entrada Sandstone----- | <u>202.0</u> |

Note: The Entrada-Navajo contact is concealed on a dip slope; possibly as much as 30 ft higher.

FLAG CREEK section--Continued

Feet

Jurassic and Triassic(?)

Navajo Sandstone:

3. Sandstone, moderate orange-pink (10R 7/4) to very pale orange (10YR 8/2), weathering same, some minor pale reddish-brown (10R 5/4); very fine grained, moderately well to well sorted; composed of subrounded to rounded quartz and some black and orange accessory grains; well cemented. large-scale cross-stratification; jointed, flaggy weathering. Forms a hogback. The dip steepens from 32° at bottom to 40° at the top of the unit. Top 30 ft concealed on dip slope; thickness uncertain due to steepening dip and concealed contact-----

98.0

Total of Navajo Sandstone----- 98.0

Note: The Navajo-Chinle contact appears even and conformable; forms recess in cliff.

Upper Triassic

Chinle Formation (incomplete):

2. Siltstone, sandy, dark-reddish-brown (10R 3/6), weathering same, top 1 ft bleached pale orange (10YR 7/2)-----

5.0

FLAG CREEK section--Continued

Feet

Chinle Formation (incomplete)--Continued

1. Mostly covered; siltstone and very fine grained sandstone; weathering dark reddish-brown

(10R 3/6), even bedded. Forms slope----- >50.0

Total of incomplete Chinle Formation----- >55.0

Feet

16. Covered. The interval about 100-250 ft above base is mostly exposed in a roadcut. Siltstone and silty sandstone, very dark grayish-gray (10R 3/7). Section measured by E. M. Weaver (unpublished, 1931). Indicated that this covered interval is approximately 250.0

18. Covered. Near top is float of limestone, medium gray (10R 5), silty sandstone, about 1-1/2 ft thick, approximately----- 57.0

17. Sandstone, very light gray (10R 6) weathered, fine grained, well-sorted; composed of close grains with sparse grayish-green siliceous shaly grains, and very sparse white feldspar accessory grains; has small spots of dead-olive thin to thick fine bed----- 14.0

RILAND - MIDNIGHT MINES section (85)

[Near middle of north edge of sec. 28, T. 2 N., R. 92 W.,
on west limb of Coal Creek anticline about 13 mi
northeast of Meeker; measured by J. C. Wright,
September 9, 1958]

Note: The basal Cretaceous sandstone is not exposed close to the line
of the section. It is believed, however, that essentially all of the Morrison
Formation is represented in the measured section.

Feet

Upper Jurassic

Morrison Formation:

19. Covered. The interval about 100-250 ft above base is
partly exposed in a roadcut. Claystone and siliceous
shale, very dark-greenish-gray (5G 3/1). Sections
measured by B. N. Webber (written commun., 1943), indi-
cate that this covered interval is approximately----- 250.0
18. Covered. Near top is float of limestone, medium-
gray (N 5), siliceous, dense, about 1-1/2' ft thick.
Approximately----- 67.0
17. Sandstone, very light-gray (N 8) weathers same, fine-
grained, well-sorted; composed of clear quartz
with sparse grayish-green glauconite accessory
grains, and very sparse white feldspar accessory
grains; has small spots of dead-oil; thin to
thick flat beds----- 12.0

RILAND - MIDNIGHT MINES section--Continued

Feet

Morrison Formation--Continued

16. Sandstone, yellowish-gray (5Y 8/1); weathers yellowish-orange (10YR 7/6), medium-grained, fair-sorted; composed of clear quartz grains and subordinate weathered white feldspar; few if any, accessory grains; thin to thick to massive beds. Locally the upper 1.0-2.0 ft are impregnated with a black uranium mineral and stained with yellow carnotite. There appears to have been bedding slip along upper surface which may have localized ore. This is the "Main ore-zone" of the district----- 12.0
15. Covered. Soil along edge of bulldozer cut indicates mostly mudstone and claystone with minor interbedded sandstone. Mudstone and claystone, grayish-red (5R 4/2) and greenish-gray (5GY 6/1). Sandstone, white (N 9), very fine grained, well-sorted; composed of clear quartz grains with very few accessory grains----- 81.5
14. Claystone (80 percent) and sandstone (20 percent) similar to unit 11----- 6.0

RILAND - MIDNIGHT MINES section--Continued

Feet

Morrison Formation--Continued

13. Sandstone, yellowish-gray (5Y 7/2) weathers yellowish-orange (10YR 7/6), medium-grained, poorly sorted; composed of subrounded grains of clear quartz, gray quartz, and white feldspar with abundant accessory pale-green glauconite; thick wedging planar sets of medium-scale cross-beds----- 7.0
12. Mudstone, grayish-red (5R 4/2) weathers same; silty, poorly sorted----- 0.5
11. Sandstone (60 percent); thinly interbedded with claystone (40 percent). Sandstone, pale yellowish-gray (5Y 8/2) weathers same, very fine grained, silty; contains accessory weathered feldspar, weathered pale green glauconite, and black opaque iron oxide grains; firmly cemented, limy; thin flat beds with oscillation ripple-marks. Claystone, light-olive-gray (5Y 5/2) weathers light-greenish-yellow (10Y 7/2); thinly laminated. Sandstone dominant in lower part; claystone dominant in upper part. Exposed in bulldozer cut----- 11.5

RILAND - MIDNIGHT MINES section--Continued

Feet

Morrison Formation--Continued

10. Sandstone, grayish-orange (10YR 7/4) to very pale orange (10YR 8/2), weathers grayish-orange, fine- to medium grained, moderately well sorted; composed of subrounded clear quartz grains with abundant accessory white feldspar (and kaolin clots), and common pale-green glauconite and opaque iron oxide grains; contains numerous olive-green claystone chips; thin festoon sets of small-scale cross-beds, and a few thick wedging planar sets of medium-scale cross-beds. A few of the sets have thinly interlaminated fine sand and carbonaceous material along their lower surfaces; these zones are a few inches thick and may contain uranium mineralization. Exposed in a bulldozer cut----- 23.0
- Total of Morrison Formation. Approximately----- 470.5

Middle Jurassic

Curtis Formation:

9. Claystone, light-olive-gray (5Y 5/2), weathers same; silty; some layers limy; thinly laminated----- 3.0
8. Covered, probably contains much claystone similar to units 7 and 9----- 13.0

RILAND - MIDNIGHT MINES section--Continued

Feet

Curtis Formation--Continued

7. Claystone, dark gray (N 3), weathers to clayey soil, greenish-gray (5GY 6/1), thinly laminated, Poorly exposed----- 3.0
6. Limestone, medium-light-gray (N 6), weathers light-olive-gray (5Y 6/1); crystalline with crystals about 0.5-2.0 mm across; may contain sparse oolites; contains about 3-4 percent fresh, pearly dark green round glauconite grains; slightly sandy; lowermost 2 in. is thin-bedded, very fine grained limy sandstone reworked from sandstone below. Lower 6 in. of limestone is abundantly fossiliferous; here brachiopods are abundant and belemnites sparse; about 1,500 ft south the proportions are reversed. Upper foot is quite sandy. Unit forms a ledge----- 2.5
- Total of Curtis Formation----- 21.5

RILAND - MIDNIGHT MINES section--Continued

Feet

Entrada Sandstone:

5. Sandstone, dark-grayish-orange (10YR 6/4), weathers very pale orange (10YR 8/2), fine- to medium-grained, well-sorted; composed of rounded clear quartz grains with common pink accessory grains and white feldspar; contains a few spots of dead-oil, thick wedging planar sets of large-scale cross-strata. Cross-stratified to top of unit which is truncated by flat-bedded limestone of Curtis Formation. Forms steep slope----- 21.0
4. Covered completely in a saddle. Probably similar to unit 5, with which it forms a continuous slope----- 52.0
- Total of Entrada Sandstone----- 73.0

Note: Separation of this entire cross-bedded sandstone into Navajo(?) and Entrada is based on its considerable thickness and the knowledge that both formations are present at many localities in the area. The division has been placed arbitrarily at the most pronounced topographic break.

Jurassic and Triassic(?)

Navajo(?) Sandstone:

3. Sandstone, light brown (5YR 6/4) to very pale orange (10YR 8/2), weathers same, fine-grained, well to moderately well sorted; composed of rounded and subrounded clear quartz grains with common accessory pink grains and white feldspar grains; a single huge set of low-angle cross-laminae about 200 ft long on exposed outcrop; the top 10 ft are indistinct flat-beds truncating the cross-strata below----- 72.0
2. Mostly covered. Sandstone, grayish-orange (10YR 7/4), weathers yellowish-gray (5Y 7/2), very fine to fine-grained, well-sorted; composed of quartz with sparse accessory white feldspar and pink grains; firmly cemented; thick wedging planar sets of large-scale thin cross-beds. Units 1 and 2 form a small cuesta on the steep dip slope; there is a saddle at the contact between units 2 and 3----- 97.0

RILAND - MIDNIGHT MINES section--Continued

Feet

Navajo(?) Sandstone--Continued

1. Poorly exposed. Sandstone, yellowish-white (5Y 9/1); weathers yellowish-gray (5Y 7/2), very fine grained, well-sorted, composed mostly of quartz with abundant accessory pink grains and white feldspar grains; contains small black dead-oil spots; firmly cemented; cross-bedded----- 55.0
- Probable total of Navajo(?) Sandstone----- 224.0

Note: This is local base of exposures. Heavy soil with thick brush-cover conceals any lower strata. The slope-form suggests that the lower strata are less resistant--very probably the Triassic redbeds. This interpretation is confirmed by the mapping done under B. N. Webber (written commun., 1943).

MARION CREEK section (86)

[NW 1/4 sec. 1, T. 8 S., R. 89 W., measured on northwest
side of road about 4 mi west of Carbondale; measured by
J. C. Wright, September 15, 1958]

	Feet
Lower Cretaceous	
Dakota Sandstone (incomplete):	
24. Sandstone-----	>30.0
Upper Jurassic	
Morrison Formation:	
23. Covered. Lower 45 ft dominantly greenish claystone-----	265.0
22. Sandstone like unit 16-----	4.0
21. Covered-----	8.0
20. Sandstone, fine-grained, otherwise like unit 16. Forms prominent ledge-----	10.5
19. Covered-----	7.5
18. Sandstone like unit 16. Base fills channels cut a foot deep in unit 17. Forms ledge-----	3.0
17. Covered. Probably claystone and mudstone greenish- gray and reddish-gray. Greenish-gray strata contain a swelling bentonitic clay-----	20.0
16. Sandstone, greenish-gray (5G 6/1), weathers very light gray (N 8); very firmly cemented with abundant calcite which obscures the lithology; very fine grained. Forms inconspicuous ledge-----	1.5

MARION CREEK section--Continued

Feet

Morrison Formation--Continued

15. Covered. Probably mostly claystone and mudstone, reddish-gray. Some greenish-gray color in upper 10 ft-----	42.0
14. Limestone like unit 12-----	1.5
13. Concealed. Mostly claystone, grayish-red (5R 4/2) and light-greenish-gray (5GY 8/1)-----	4.0
12. Limestone (70 percent) with interbeds of silty claystone (30 Percent). Limestone, medium-dark-gray (N 4) weathers medium light-gray (N 6), micro-crystalline, in flat beds about 0.5-2.0 ft thick. Much of limestone weathers to reveal a clastic, poorly sorted fragmental texture; thin, wormy fragments about a centimeter long that resemble charophyte stems are common. Forms ledges. Claystone, grayish-red (5R 4/2), very poorly exposed in recesses-----	13.5
Total of Morrison Formation. Approximately-----	<u>380.5</u>

Middle Jurassic

Curtis Formation:

11. Concealed. Probably mostly siltstone, very limy, greenish-white (5GY 9/1). Some silty claystone, limy, light-greenish-gray (5GY 8/1) and grayish-red (5R 4/2)-----	15.0
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MARION CREEK section--Continued

Feet

Curtis Formation--Continued

10. Sandstone, like unit 8 in color, lithology and bedding, but slightly finer grained and silty. Very firmly cemented with calcite. Forms prominent, blocky-jointed ledge near top of good outcrops----- 16.0
9. Sandstone like unit 8 in color, lithology, bedding, and outcrop form. Very slightly finer grained. Bedding slightly more distinct, planar and shallow festoon crossbeds in tabular sets about 1-3 ft thick. Contains two greenish siltstone interbeds like those in unit 8----- 27.5

MARION CREEK section--Continued

Feet

Curtis Formation--Continued

8. Sandstone, greenish-white (5G 9/1) weathers very light gray (N 8), very fine to fine grained; white and amber-stained quartz, and opaque iron as common accessory grains; firmly cemented with calcite; very indistinct bedding, probably cross-strata in tabular cosets* about 3-10 ft thick. Near middle and at top are flat beds about a foot thick of siltstone with greenish clay cement. Whole unit well exposed on partly soil-covered steep slope. From a distance units 8 and 9 appear as soft greenish flat beds----- 29.0
7. Concealed on slope. Probably similar to unit 6----- 5.5
6. Siltstone, clayey, grayish-red (10R 4/2) and greenish-gray (5GY 6/1), limy; poorly exposed on slope----- 5.0

*Nomenclature of McKee, E. D., and Weir, G. W., 1953, Terminology for stratification and cross-stratification in sedimentary rock: Geological Society of America Bulletin, v. 64, no. 4, p. 381-389.

MARION CREEK section--Continued

Feet

Curtis Formation--Continued

5. Limestone (80 percent) with thin interbeds of mudstone (20 percent). Limestone, medium dark gray (N 4) weathers medium gray (N 5), very fine grained; contains ostracods in some beds; even beds about 1-6 in. thick. Forms ledges. Mudstone like unit 4----- 6.5
4. Mudstone, clayey, grayish-red (5R 4/2), contains much quartz in both silt- and sand-sized grains, poorly sorted; laminated; mostly concealed. Has very thin interbeds of siltstone with green clay-cement in lower foot----- 2.5
3. Sandstone, white (N 9) to greenish-white (5GY 9/1) weathers light-gray (N 7), very fine to medium grained, fair-sorted; contains abundant accessory feldspar, both red and white, also quartz grains stained amber and red; greenish clay forms a film on grains along some bedding planes; thin flat-bedded. Top 2 in. contains abundant green clay cement----- 1.5
- Total of Curtis Formation----- 108.5

MARION CREEK section--Continued

Feet

Entrada Sandstone--Continued

2. Sandstone, yellowish-white (5Y 9/1) to grayish-orange pink (5YR 7/2) weathers very light gray (N 8), very very fine grained, moderately well sorted; many laminae (except in lower 30 ft) contain abundant well-rounded (but irregularly ovoid in shape) gray-frosted, medium clear quartz grains (or Entrada berries): also contains silt-sized accessory grains of opaque iron oxides and white weathered feldspar; also contains very rare accessory grains of a pale green mineral (or rock-chip) that is not as dark and fresh in appearance as the glauconite in higher units; sandstone filling shallow channels on basal contact is same but contains coarse-grained well-rounded, spherical, gray-frosted quartz grains, and angular coarse grains and granules of reddish and white feldspar as well as small clay chips of the underlying sediment. The upper 30 ft are slightly coarser grained than the lower part of the unit, and contains abundant accessory feldspar, both red and white; wedging planar sets about 10-20 ft thick of large-scale cross-laminae. Forms incompletely exposed rounded

"slickrim-like" outcrop on steep slope----- 112.5

Total of Entrada Sandstone----- 112.5

MARION CREEK section--Continued

Feet

Upper Triassic

Chinle Formation (incomplete):

1. Claystone, silty, grayish-red (10R 4/2) weathers same; laminated, in part even (shaly) and in part irregular. Poorly exposed on steep soil-covered

slope----- >10.0

Total of incomplete Chinle Formation----- >10.0

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