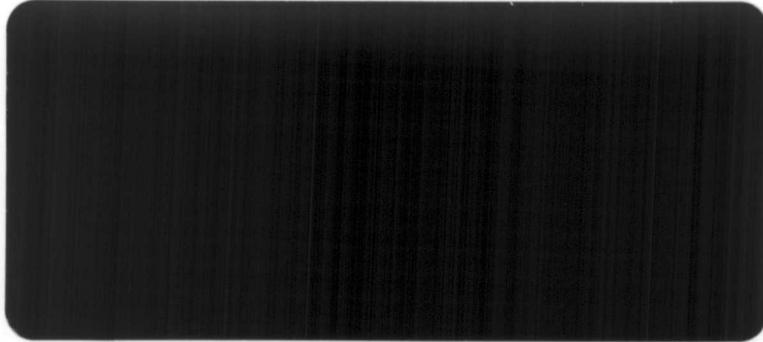


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UNITED STATES DEPARTMENT OF THE INTERIOR
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Stratigraphic Sections of Jurassic San Rafael
Group and Adjacent Rocks in Rio Arriba and
Santa Fe Counties, New Mexico

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

Open-File Report 79-247

1979

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Stratigraphic Sections of Jurassic San Rafael Group
and Adjacent Rocks in Rio Arriba and Santa Fe Counties,
New Mexico

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 Summerville, Todilto, and Entrada are the only formations of the San Rafael Group that are present in these sections. Figure 1 is a map showing the locations of the stratigraphic sections included in this report.

The following terms we 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

Hoodoos.--Weathering forms style characteristics of sandstone and siltstone beds with disrupted internal bedding. The hoodoo forms stand in columns and have an appearance of rounded boulders stacked on top of each other. Boulder tops and bottoms of adjacent columns are at the same elevation because they are controlled by softer thin beds or bedding planes.

COLORADO
NEW MEXICO

CHAMA

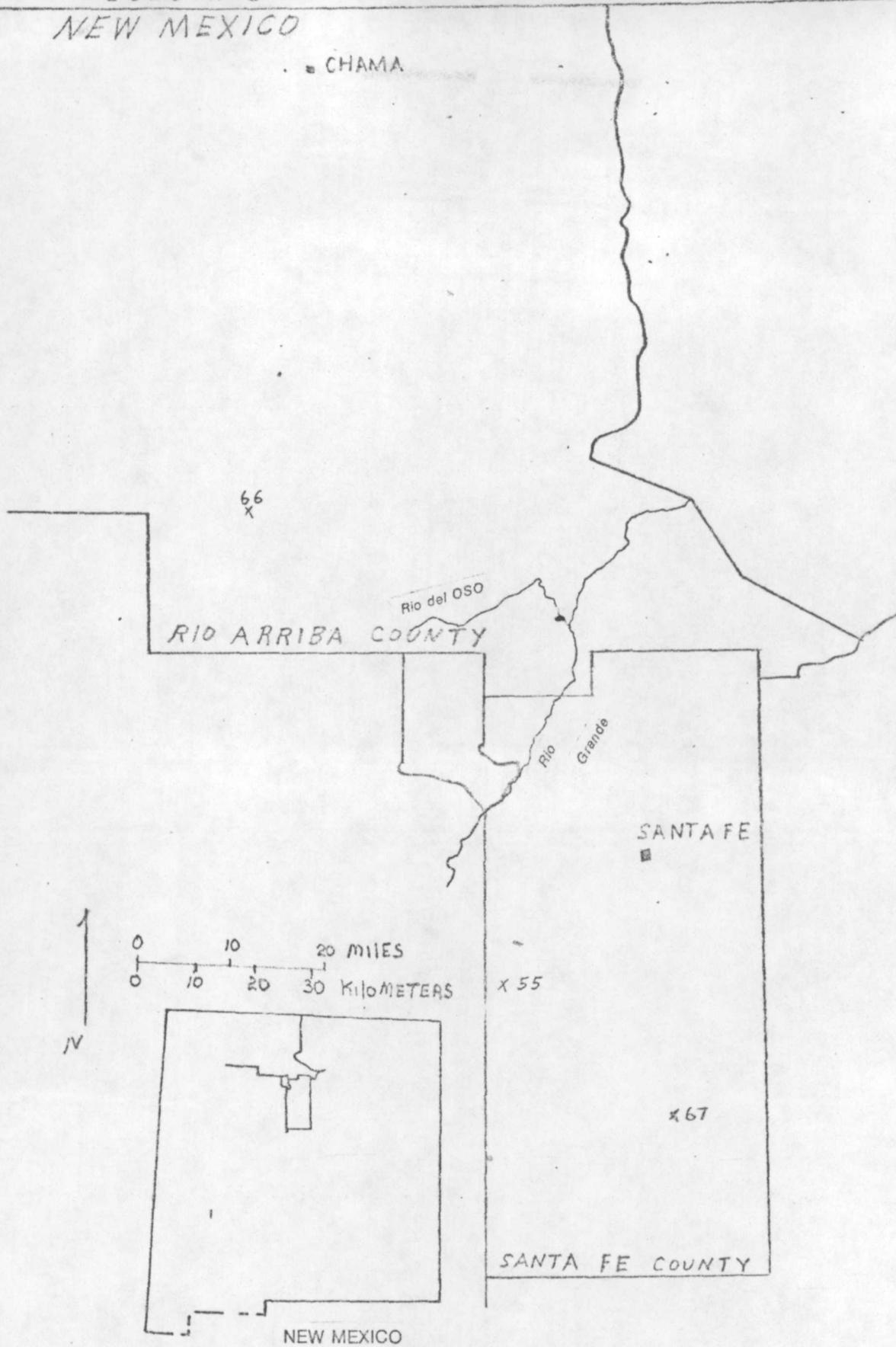


Figure 1. Map showing locations of stratigraphic sections in this report. (Section numbers are in system referred to by Wright, J. C., and Dickey, D. D., 1963, Block diagram of the San Rafael Group and underlying strata in Utah and part of Colorado: U.S. Geological Survey Oil and Gas Investigations Chart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

SANTA FE COUNTY - NEW MEXICO

GALISTEO CREEK section (55)

[Measured 1 1/2 mi southeast of Highway 85 and 1 mi northeast of A T and SF tracks; W 1/2 sec. 29, T. 15 N., R. 7 E.; measured by D. D. Dickey with W.B. Satterthwaite, August 7, 1957]

Feet

Upper Jurassic

Morrison Formation (incomplete):

Recapture Shale Member (incomplete):

- | | | |
|-----|--|------|
| 17. | Sandstone and claystone like unit 16. Not measured----- | --- |
| 16. | Sandstone, like unit 14 (70 percent), claystone like
unit 11 (30 percent) in beds 5-30 ft thick----- | 75.0 |
| 15. | Claystone, like unit 11 (60 percent), and sandstone
like unit 14 but some very fine grained (40 percent)
in beds averaging 5 ft thick; crossbedding locally
more prominent in some sandstone layers. Unit forms
ledgy slope----- | 42.0 |
| 14. | Sandstone, grayish-pink (5R 8/2), weathers same,
fine grained, moderately well sorted; composed of
subrounded quartz grains, abundant pink, black and
rare green subrounded accessory grains, and abundant
subangular white accessory grains; moderately
well cemented; medium scale low angle cross laminae.
Forms ledge----- | 8.0 |
| 13. | Claystone, like unit 11, but some greenish color----- | 5.0 |

GALISTEO CREEK section--Continued

Feet

Morrison Formation (incomplete)--Continued:

Recapture Shale Member (incomplete)--Continued:

12. Sandstone, very silty, grayish-orange (10YR 7/4), weathers very pale-red (10R 7/2), very fine grained; contains black, pink, green, and white accessory grains, some very small black-stained spots; bedding indistinct, probably flat to slightly irregular. Forms ledge----- 5.5
11. Claystone, very silty, dusky-red (10R 3/2), poorly exposed----- 9.0
10. Mostly covered; mostly siltstone like unit 7, a few very thin beds of limestone, medium light-gray (N 6), weathers light-gray (N 7), lithographic; no chert seen with the limestone bed at top of unit----- 12.75
9. Limestone, like unit 6 but with more chert, some of which is gray----- 1.0
8. Sandstone, pale-orange (10YR 7/2), weathers same, very fine grained, silty; contains some red and orange accessory grains; flat to very low angle cross laminae. Forms ledge----- 4.0

GALISTEO CREEK section--Continued

Feet

Morrison Formation (incomplete)--Continued:

Recapture Shale Member (incomplete)--Continued:

- | | |
|---|-------|
| 7. Siltstone, like that in unit 5 but sandy. A few
very thin beds of limestone like unit 6----- | 11.0 |
| 6. Limestone, light-gray (N 7), contains blebs, patches,
and stringers of red chert or jasper----- | 0.25 |
| Total of incomplete Recapture Shale Member----- | 173.5 |
| Total of incomplete Morrison Formation----- | 173.5 |

Note: The Morrison-Summerville contact is poorly exposed; placed at lowest limestone noted.

Middle Jurassic

Summerville Formation:

- | | |
|--|------|
| 5. Poorly exposed; siltstone, very clayey, dusky-yellow
(5Y 6/4) with dark yellowish-orange (10YR 6/6)
stain, and grayish-red (10R 4/2), weathering same
colors. Forms slope----- | 14.0 |
| Total of Summerville Formation----- | 14.0 |

Note: The Summerville-Todilto contact is not exposed.

GALISTEO CREEK section--Continued

Feet

Todilto Formation:

4. Gypsum, white (N 9 and N 10), massive; thickness only approximate, probably less because the upper contact is not exposed. Unit poorly exposed on low hill----- 68.0
3. Limestone, olive-gray (5Y 4/1), weathering same to light-gray (N 7), sandy and silty at bottom, much organic material in lower part of limestone, becomes less carbonaceous upward. Laminated in lower part, thick bedded in upper part; lower part weathers platy, upper part forms fractured ledge. Upper part weathers as if composed of limestone fragments, mostly angular and irregular in shape averaging about 1 mm in size. Thickness of limestone may vary----- 19.0
- Total of Todilto Formation----- 87.0

Note: The Todilto-Entrada contact is slightly irregular. Sandy limestone of the Todilto is laid down over irregularities of Entrada Sandstone; relief of about 1 ft.

GALISTEO CREEK section--Continued

Feet

Entrada Sandstone:

Upper sandy member:

2. Sandstone and siltstone. Siltstone, coarse, sandy, grayish-orange (10YR 7/4), weathers same to very pale-orange (10YR 8/2). Grain size of unit becomes coarser upward and at top is sandstone, fine grained, light grayish-orange (10YR 8/4), weathering same; composed of rounded to subrounded quartz grains, with much calcite and yellow cement. Flat structureless beds average 5 ft thick at bottom of unit separated by reddish very slightly finer grained material. Top of unit is composed of thick sets of medium-scale low-angle cross-laminae and thick possibly flat structureless beds; much bedding is indistinct. Unit forms cliff----- 94.0
- Total Upper sandy member----- 94.0

Note: Upper sandy member--medial silty member contact appears gradational and even over small exposure.

GALISTEO CREEK section--Continued

Feet

Entrada Sandstone--Continued:

Medial silty member:

1. Siltstone, reddish-brown (10R 4/4), weathering same;

appears to be in thick structureless beds----- >40.0

Total of incomplete medial silty member----- >40.0

Total of incomplete Entrada Sandstone----->134.0

Note: Bottom of section at fault, probably near base of Entrada Sandstone.

RIO ARRIBA COUNTY - NEW MEXICO

MESA ALTA section (66)

[Secs. 14 and 23, T. 23N., R. 2 E., Chinle Formation through lower part of Morrison Formation measured in the NE1/4, sec. 23, upper Morrison Formation measured in SE 1/4, sec. 14; about 1/4 mi east of forest service road onto Mesa Alta; measured by D. D. Dickey and J. C. Wright with K. J. Monson and W. B. Satterthwaite, August 5, 1957]

Note: The Dakota-Morrison contact is entirely covered.

Feet

Morrison Formation:

Brushy Basin Shale Member:

27. Nearly all covered on line of section. In lower 100 ft is much mudstone, grain size from clay to very fine sand. Some of this is silicified, moderate reddish brown (10R 4/6) and gives red color to cliff; softer grayish yellow-green (5GY 6/2) mudstone is also common. Upper 100 ft probably sandstone, pale-orange (10YR 7/2) with darker orange speckles, very fine to fine-grained, clayey, some feldspar, few black-stained blocks; probably crossbedded. Possibly equivalent to economic units of the Jackpile or Poison Canyon type sandstones. Forms alluvium covered, wooded slope----- 342.0
Total Brushy Basin Shale Member----- 342.0

Note: The Brushy Basin-Westwater Canyon contact appears even, possibly gradational.

MESA ALTA section--Continued

Feet

Morrison Formation--Continued:

Westwater Canyon Sandstone Member:

26. Sandstone, yellowish-gray (5Y 7/2), weathers same, fine- to medium-grained with abundant very fine and coarse grains, moderately well sorted, composed of rounded to subangular clear quartz, black, orange, pink, red, and green rounded accessory grains, and subangular feldspar and yellow chert grains, in some parts of the sandstone the grains have a thin coat of clay and very fine silt; moderately well cemented; bedding indistinct, probably mostly crossbedded. Forms cliff immediately below a red band at top of cliff----- 75.0
- Total of Westwater Canyon Sandstone Member----- 75.0

Note: The Westwater Canyon-Recapture contact appears even in some areas, is probably channeled in other areas.

Recapture Shale Member:

25. Sandstone, very limy, lithology like sandstone in unit 24----- 1.0

MESA ALTA section--Continued

Feet

Morrison Formation--Continued:

Recapture Shale Member--Continued:

24. Sandstone (85 percent) and siltstone, very clayey (15 percent). Sandstone, grayish orange-pink (10R 8/2), weathers very pale red (10R 7/2), fine-grained, moderately well sorted; composed of rounded to subrounded quartz grains, abundant rounded amber, orange, black, red, and common green accessory grains; common white angular chert grains, and some green and red clay chips; moderately well cemented; bedding like the sandstone in unit 23. Siltstone, very clayey, dusky-red (10R 3/2), weathers same; forms partings between sandstone beds. Minor green clayey sandstone occurs along bedding planes, much like siltstone. A thin bed of limestone-pebble conglomerate 29 ft above base contains rounded pebbles of dark-gray limestone. Forms weathered cliff----- 189.0

MESA ALTA section--Continued

Feet

Morrison Formation--Continued

Recapture Shale Member--Continued:

23. Sandstone, pinkish-white (5R 9/2) and grayish orange-pink (5YR 8/2), weathers grayish orange-pink (5YR 7/2), fine-grained, moderately well sorted, composed of rounded to subrounded quartz grains with abundant black, orange, red, and common green rounded accessory grains, and common angular white chert accessory grains; moderately well cemented; thin to thick sets of mostly medium scale low angle cross laminae; some horizontal truncation planes, clay partings occur above truncation planes at bottom of sets. Forms weathered cliff or steep slope. Unit not of a constant thickness due to broad truncation by overlying unit----- 89.0
- Total Recapture Shale Member----- 279.0
- Total of Morrison Formation----- 696.0

Note: The Morrison-Summerville contact is placed on a horizontal truncation plane that separates dominantly crossbedded sandstone above from more even bedded sandstone and siltstone below.

MESA ALTA section--Continued

Feet

Middle Jurassic

Summerville Formation:

22. Siltstone (40 percent), sandstone (40 percent), and claystone (20 percent). Siltstone, dark grayish-red (5R 3/2). Sandstone, grayish-pink (5R 8/2) very fine grained, common orange and black accessory grains. Claystone, dusky-red (10R 3/2). Unit appears even bedded in beds a fraction of one 1- to 10-ft-thick, but is locally lenticular; internal cross-laminae may occur within sandstone beds. Unit forms a banded steep slope----- 144.0

MESA ALTA section--Continued

Feet

Summerville Formation--Continued:

21. Poorly exposed; mostly mudstone, dusky yellow-green
(5GY 5/2), and siltstone, sandy, dark grayish-
orange (10YR 6/4), streaked with red----- 30.0
Total of Summerville Formation----- 174.0

Note: The Summerville-Todilto contact is unexposed. This section and most others measured in the Chama Basin (including Craig's Ghost Ranch section) do not report the thick gypsum bed that is generally present at the top of the Todilto Formation. This is because the sections are located at the only feasible places to climb the cliff; that is, at points where the gypsum is absent. At some places it appears to be absent due to nondeposition; its position is occupied by a locally thick lense of sandstone representing an ancient sandbar or dune associated with the lagoon in which the gypsum formed. At other points flat-bedded Summerville sandstone and siltstones occupy the usual position of the gypsum; these appear to have been deposited after an original gypsum deposit had been eroded away. This section is measured at such a point. On either side of the gap through which the road onto Mesa Alta passes, the gypsum along the Mesa Alta cliffs appears to be generally 50-75 ft thick (and the Summerville Formation is compensatingly thinner).

MESA ALTA section--Continued

Feet

Todilto Formation:

- | | |
|--|------|
| 20. Limestone, medium-gray (N 5), weathers same, finely crystalline, massive, poorly exposed, but float is abundant----- | 2.0 |
| 19. Sandstone, yellowish-gray (5Y 7/4), weathers same, about 50 percent gypsum cement and interlamination, possibly some calcite; indistinct thick massive beds. A few hundred yards to the east pure gypsum occupies this stratigraphic position. Weathers back on a broad bench----- | 17.0 |
| 18. Limestone, very light gray (N8) aphanitic, probably contains gypsum impurities; flat very thin beds and laminae. Forms papery, shaly ledge capping Entrada cliff----- | 6.0 |
| Total Todilto Formation----- | 25.0 |

Note: The Todilto-Entrada contact is well exposed, flat and conformable.

MESA ALTA section--Continued

Feet

Entrada Sandstone:

17. Sandstone, dark-yellow (5Y 7/8), weathers moderate yellow (5Y 7/6), very fine to fine-grained, moderately well sorted; composed of subrounded quartz grains with rare accessory black silt grains; moderately well cemented; very indistinct bedding which appears to be mostly very thick wedge-planar sets of very large-scale cross-strata. No bedding visible in upper 10 ft. Forms vertically jointed cliff----- 48.0
16. Sandstone, grayish-yellow (5Y 8/4), weathers yellowish-white (5Y 9/1), fine-grained, fair-sorted, composed of subrounded quartz grains with black silt-size accessory grains; grains are conspicuously clear and there is very little cement; thin flat beds, except for the lower 3 ft which comprises wedge-planar(?) sets of small- medium-scale cross-strata. Forms uppermost part of slickrim cliff----- 46.5
15. Sandstone, like unit 9. Forms the uppermost reddish unit and is slightly paler than the underlying beds----- 11.0

MESA ALTA section--Continued

Feet

Entrada Sandstone--Continued:

14. Sandstone, pale reddish-brown (10R 5/4), weathers reddish-orange (10R 5/6), fine-grained, moderately well sorted; composed of subrounded clear quartz with rare accessory green grains and black silt grains; firmly cemented; lower 25 ft comprises thick wedge-planar sets of large-scale cross-laminae separated from the upper 15 ft of similar but medium-scale cross-strata by 2 ft of irregular flat beds. Forms major part of slickrim cliff----- 40.0
13. Sandstone, like unit 9. Forms lowest part of slickrim cliff----- 19.0
12. Sandstone, like unit 10 with about 1 1/2 ft of flat reworked beds at top. Top is marked by a very prominent, persistent recess filled with silty, dusky red-purple (5RP 3/2) clay. Unit forms top of vertically jointed cliff----- 8.0

MESA ALTA section--Continued

Feet

Entrada Sandstone--Continued:

11. Sandstone, like unit 10, but dominantly fine-grained; contains some rounded, medium-grained, frosted "Entrada berries", also rare accessory white chert and dark green minerals. A horizontal truncation plane at top----- 20.0
10. Sandstone, like unit 9 in color and lithology; wedge-planar sets about 1-4 ft thick of medium- and large-scale cross-laminae, no horizontal truncation planes either within unit or at top contact; upper contact is entirely gradational. Forms part of continuous vertically jointed cliff----- 16.5
9. Sandstone pale reddish-brown (10R 5/4), weathers reddish-orange (10R 5/6), very fine grained, silty, fair- to poor-sorted; contains black accessory silt grains; moderately well cemented; irregular thin flat beds. Forms lowest part of vertically jointed cliff----- 4.0
- Total Entrada Sandstone----- 213.0

Note: The beds at the Entrada-Chinle contact are parallel to each other but the base of Entrada Sandstone fills erosional irregularities 2-3 in. deep in the Chinle surface.

MESA ALTA section--Continued

Feet

Upper Triassic

Chinle Formation (incomplete):

8. Claystone, like unit 6 with subordinate interbedded conglomerate like unit 7. No zones of disrupted bedding noted above conglomerate beds in this unit----- 12.5
7. Conglomerate, reddish-brown (10R 4/4), mottled greenish-gray (5G 6/1); very abundant matrix of silty and sandy clay carries coarser grains, granules, and pebbles as much as 2 in. in diameter. Individual flat beds about 1 ft thick are massive, separated from each other by beds few inches thick of similar but much finer material with disrupted bedding. Texture and structure of unit is identical to that of many tillites(?); probably subaqueous mudflows. Forms part of slope----- 8.0
6. Claystone, dark reddish-brown (10R 3/4), mottled greenish-gray (5G 6/1); even thin beds and laminae. Forms steep slope (units 6, 7, 8, show very large-scale (approximately 100 ft) low-angle cross-stratification)----- 8.0

MESA ALTA section--Continued

Feet

Chinle Formation (incomplete)--Continued:

5. Sandstone, pale-green (5G 7/2) fine-grained, conglomeratic, poorly sorted, clayey; carries abundant pebbles many of which are large rounded clay pellets 1 in. in diameter of the underlying claystones; a cast of fossil plant stem about 1 cm in diameter was also noted; small scale low angle cross strata, little or no scouring on bottom. Forms very minor ledge----- 1.0
4. Claystone, when wet is grayish-red (10R 4/2) to pale reddish-brown (10R 5/4), when dry is light grayish-red (5R 5/2) to light grayish-red (10R 5/2), streaked along fractures very pale green (10G 8/2); limy, structureless, carries clay pellets and chips, fine hackly fracture. Filling channels on irregular surface on base is claystone, silty, limy, pale yellow-green (5GY 8/2), ripple marked, which forms a small ledge where present. Whole unit forms steep clayey slope----- 13.0

Note: Units 4 to 8 could possibly be the Rock Point Member of the Wingate Formation.

MESA ALTA section--Continued

Feet

Chinle Formation (incomplete)--Continued:

3. Claystone, like unit 1, similarly structureless with abundant clay chips and pellets; pebbles present but rare, upper surface has irregularities of 4 or more feet. Contact between 3 and 4 is the most prominent color change from reddish-browns to purplish-reds----- 19.5
2. Claystone, light-brown (5YR 6/4), slightly silty, indistinct very fine laminations. One tubule filled with same claystone about 1/4 in. in diameter and more than 1 in. long seen (worm-burrow?). Forms minor ledge----- 3.0

MESA ALTA section--Continued

Feet

Chinle Formation (incomplete)--Continued:

1. Claystone, when wet dark reddish-brown (10R 3/6), when dry reddish-orange (10R 5/6), weathers within this range, minor limy beds about every 10-15 ft, one irregularly bleached very pale-green (10G 8/2), some bleached color occurs along a few vertical joints. Clay is quite pure, structureless with a fine hackly fracture; in the lower part of the unit coarse grains, granules, and small pebbles of quartz and chert are abundantly disseminated through the clay. Indistinct pellets of clay (almost identical to the matrix clay) are also disseminated in the same beds;

slope----- 45.5

Total of incomplete Chinle Formation----->110.5

SANTA FE COUNTY- NEW MEXICO

BLAKELY'S SAN CRISTOBAL RANCH section (67)

[Measured in the southwest part of the San Cristobal Grant between the two branches of the Arroyo de la Jara; measured by J. C. Wright and D. D. Dickey with W.B. Satterthwaite and K. J. Monson, August 6, 1957]

Feet

Upper Jurassic

Morrison Formation (incomplete):

18. Sandstone, like unit 16, except the accessory grains are abundant orange, common black and abundant white chert. Limestone and sandstone pebbles in bottom of unit. Fluvial origin----- 15.0

Note: Remainder of cliff above this unit composed of units similar to units 17 and 18. Thick sandstone ledges probably channel into softer units. About 5 sandstone units to top of hill.

17. Claystone and sandstone, interbedded. Claystone, dusky-red (10R 3/2). Sandstone, same color and lithology as unit 16. In beds 1/4-3 ft thick----- 9.5

BLAKELY'S SAN CRISTOBAL RANCH section--Continued

Feet

Morrison Formation (incomplete)--Continued:

- | | | |
|-----|---|------|
| 16. | Sandstone, very pale-orange (10YR 8/2), weathers same to grayish-orange (10YR 7/4), very fine grained, moderately well sorted; composed of subrounded to subangular clear quartz and orange, green, and black accessory grains; moderately well cemented; thin to thick sets of medium- to large-scale low-angle cross strata. Gray limestone pebble conglomerate near top. Unit forms ledge----- | 8.0 |
| 15. | Claystone, very silty, dusky-red (10R 3/2), poorly exposed; some green claystone, very minor sandstone and a few beds of limestone like unit 12, one of which is at top of unit. Forms covered slope----- | 18.5 |
| 14. | Limestone, like unit 12----- | 0.25 |
| 13. | Claystone, light greenish-gray (5GY 8/1), light grayish-red (10R 5/2)----- | 1.0 |
| 12. | Limestone, very light gray (N 8), with speckles and masses of red chert or jasper----- | 0.25 |
| | Total of incomplete Morrison Formation----- | 52.5 |

Note: The Morrison-Summerville contact is poorly exposed, but not highly irregular within small area seen.

BLAKELY'S SAN CRISTOBAL RANCH section--Continued

Feet

Middle Jurassic

Summerville Formation:

- 11. Siltstone, dusky-red (10R 3/2) and grayish-red (10R 4/2), weathers same, sandy and clayey. Forms covered slope----- 11.5
- 10. Poorly exposed. Sandstone, very light gray (N 8), weathers same to pale-orange (10YR 7/2), very fine grained, fair-sorted; composed of subrounded quartz grains with minor orange, black, amber, and red accessory grains; moderately well cemented with calcite. Forms sandstone littered slope----- 3.0
- Total Summerville Formation----- 14.5

Note: The Summerville-Todilto contact is very poorly exposed and apparently even.

Todilto Limestone:

- 9. Limestone, medium dark-gray (N4), weathers same, fetid odor; thin irregular laminae just visible but weathers to irregular slabs 1-3 in. thick----- 3.0
- 8. Sandstone, light olive-gray (5Y 6/1), weathers yellowish-gray (5Y 8/1), fine- to medium-grained; irregular flat beds, spongy texture and abundant gypsum cement----- 2.0

BLAKELY'S SAN CRISTOBAL RANCH section--Continued

Feet

Todilto Limestone--Continued:

- | | |
|--|-----|
| 7. Limestone, medium dark-gray (N 4), weathers same, aphanitic, very clayey, very fetid odor, very thin even laminae, weathers to paper shale on ledge----- | 2.0 |
| 6. Sandstone, dark-yellow (5Y 6/6), weathers pale olive (10Y 6/2), very fine grained, well-sorted, moderately well cemented with gypsum and calcite; very thin even laminae. Forms recess----- | 1.0 |
| . Total Todilto Limestone----- | 8.0 |

Note: The Todilto-Entrada contact appears even and conformable, possibly gradational. The top of the Entrada Sandstone is flat-bedded immediately beneath the Todilto Limestone.

BLAKELY'S SAN CRISTOBAL RANCH section--Continued

Feet

Entrada Sandstone:

5. Sandstone, very light gray (N 8) at base to pale yellowish-gray (5Y 8/2) at top, weathers very pale-orange (10YR 8/2), very fine grained, silty, moderately well sorted; contains abundant medium grained, well rounded frosted "Entrada berries" and rare black silt grains; moderately well cemented; most "berries" are gray quartz, but some are pale pink and pale yellow quartz and white chert. Bedding through most of unit is indistinct thin flat beds and indistinct thin sets of small and medium scale low angle cross strata. All beds are somewhat disturbed. The middle third has somewhat more distinct thin to thick wedge-planar sets of medium-scale cross strata. The sand in this part is dominantly fine grained. Unit forms prominent cliff and bench----- 97.5

Total Entrada Sandstone----- 97.5

Note: The Entrada-Chinle contact is well exposed; flat with irregularities less than 1 in.; appears locally conformable.

BLAKELY'S SAN CRISTOBAL RANCH section--Continued

Feet

Upper Triassic

Chinle Formation (incomplete):

4. Siltstone, pale reddish-brown (10R 5/4), weathers same, slightly clayey, very limy, very fine grained(?) silty, fair- to well-sorted; massive, structureless. One side of arroyo weathers to rounded hoodoos, probably because of incipient lime concretions and also because of numerous intersecting fractures. The other side of the arroyo weathers to blocky ledges on a slope revealing flat beds about 2-4 ft thick. The hoodoos suggest that this unit might be medial Entrada but the blocky ledges appear more widespread and suggest that it is Chinle. Other reasons for rejecting this unit as Entrada are: no sharp contact at base; sharp contact at top; abrupt lithologic change at top; and siltstone too fine and too well-sorted to be typical medial Entrada----- 30.0
3. Claystone, moderate-red (5R 4/4), with light greenish-gray (5G 8/1) mottling, weathers same, slightly silty; indistinct flat bedding. Forms slope. About in center of unit is a 1 ft thick bed of siltstone like unit 2----- 17.5

BLAKELY'S SAN CRISTOBAL RANCH section--Continued

Feet

Chinle Formation (incomplete)--Continued:

2. Siltstone, very clayey, limy, reddish-orange (10R 5/6), weathering same; irregular thin flat beds, probably ripple marked. Forms small ledge----- 14.0
 1. Claystone, reddish-brown (10R 4/4), to moderate reddish-brown (10R 4/6), with bleached streaks of light greenish-gray (5G 8/1). Some beds are structureless claystone, but most are formed of granules and small pebble-sized clay pellets; the clay in pellets and matrix is nearly identical. There are also a few small fragments of more resistant siltstones and sandstones. Unit forms slope----- 10.5
- Total of incomplete Chinle Formation----- 72.0