UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Lithologic descriptions of selected Middle and Upper Jurassic rocks from Gallup to Laguna in northwest New Mexico

by

Steven M. Condon

Open-File Report 85-126

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1USGS, Denver, Colorado

1985
LITHOLOGIC DESCRIPTIONS OF SELECTED MIDDLE AND UPPER JURASSIC ROCKS FROM GALLUP TO LAGUNA IN NORTHWEST NEW MEXICO

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INTRODUCTION

The seven sections presented in this report were measured along well-exposed cliffs that mark the transitional boundary between the Zuni Mountains and the San Juan Basin in northwestern New Mexico (fig. 1). The exception to this is the Mesita section (no. 7), which occurs east of the Zunis near the southeastern boundary of the San Juan Basin. The study area is entirely within the Colorado Plateau physiographic province.

The Zuni Mountains are cored by Precambrian granitic and metamorphic rocks and have Pennsylvanian(?), Permian, and Triassic strata exposed on their flanks. The poorly indurated Triassic Chinle Formation in part forms a broad strike valley that separates the vegetated upland of the Zunis from the less vegetated canyon and mesa topography of the southern San Juan Basin. Jurassic and Cretaceous strata are exposed around the edges of the basin, and Tertiary sedimentary rocks are present farther north in the central basin. Tertiary and Quaternary volcanic rocks are exposed in the Mt. Taylor area east of Grants (fig. 1). General geology of the area and references to other literature are provided by Hackman and Olson (1977) and Wyant and Olson (1978).

The purpose of this report is to provide detailed descriptions and thicknesses of some selected Middle and Upper Jurassic rocks in this area. These data can then be used as the basis for surface and subsurface correlations of the Jurassic rocks described.

STRATIGRAPHY

The rocks measured in this study are divided here into two main units, the Middle Jurassic San Rafael Group and the Upper Jurassic Morrison Formation (fig. 2). The San Rafael Group consists of the Entrada Sandstone at the base, the Wanakah Formation, and the Cow Springs Sandstone. The Morrison Formation comprises, from oldest to youngest, the Recapture, Westwater Canyon, and Brushy Basin Members. A unit informally referred to in this report as the sandstone at Mesita (fig. 2) has previously been called the Bluff Sandstone and was included in the San Rafael Group (Rapaport and others, 1952, p. 14; Hilpert, 1963, p. 6), but may belong, in part, with the Morrison Formation. Regional relations of the rocks described are shown as figure 3.

San Rafael Group.--The Entrada Sandstone is the oldest Jurassic formation present in this area and consists of three members, the Iyanbito at the base, the medial silty, and the upper sandy. The Iyanbito and upper sandy members are composed of reddish-orange, very fine to fine-grained, well sorted, flatbedded and cross-stratified sandstone. The medial silty member contains a high percentage of reddish-brown, structureless siltstone, but also contains lenses of fine-grained sandstone. Aggregate thickness of the Entrada is 150-250 ft, of which only the upper few feet were measured in this study.
Figure 1. Index map showing locations of measured sections. Numbers refer to the following sections: 1. Navajo Church, 2. Midget Mesa, 3. Pinedale Monocline, 4. East Thoreau, 5. Andrews Ranch, 6. Haystack Mountain, 7. Mesita.
<table>
<thead>
<tr>
<th>SAN RAFAEL GROUP</th>
<th>GALLUP AREA</th>
<th>LAGUNA AREA</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Dakota Sandstone</td>
<td>Dakota Sandstone</td>
</tr>
<tr>
<td></td>
<td><strong>MORRISON</strong> FORMATION</td>
<td><strong>MORRISON</strong> FORMATION</td>
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<tr>
<td></td>
<td>Westwater Canyon Member (Jmw)</td>
<td>Brushy Basin Member (Jmb)</td>
</tr>
<tr>
<td></td>
<td>Recapture Member (Jmr)</td>
<td>Westwater Canyon Member (Jmw)</td>
</tr>
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<td></td>
<td><strong>WANAKAH</strong> FORMATION</td>
<td>Recapture Member (Jmr)</td>
</tr>
<tr>
<td></td>
<td>Cow Springs Sandstone (Jcs)</td>
<td>Sandstone at Mesita (Jme)</td>
</tr>
<tr>
<td></td>
<td>Beclabito Member (Jwb)</td>
<td>Beclabito Member (Jwb)</td>
</tr>
<tr>
<td></td>
<td>Todilto Limestone Member (Jwt)</td>
<td>Todilto Limestone Member (Jwt)</td>
</tr>
<tr>
<td></td>
<td><strong>ENTRADA</strong> Sandstone (Je)</td>
<td><strong>ENTRADA</strong> Sandstone (Je)</td>
</tr>
</tbody>
</table>

Figure 2. Chart showing nomenclature of this report.
Figure 3. Generalized cross section showing relations between rock units from Gallup to Mesita. Numbers for sections are the same as in figure 1. Vertical scale - 1" = 200'; no horizontal scale. Thicknesses of Recapture and sandstone at Mesita (formerly Bluff Sandstone) from Craig and others (1959, sec. no. 140).
The Wanakah Formation conformably overlies the Entrada Sandstone and has
two members in this area, the Todilto Limestone Member and the Beclabito
Member (Condon and Huffman, in press). The Todilto Limestone, which is at the
base, consists of light to medium gray, fine- to coarsely crystalline
limestone, white gypsum, and minor greenish-gray, calcareous siltstone. The
limestone and siltstone display well-developed symmetric and asymmetric ripple
marks, and the upper surface of the limestone has dome-shaped undulations and
mounds up to 5 feet in diameter in many places. These mounds have been
interpreted to be algal structures (Rawson, 1980, p. 307) or to have formed as
a result of plastic deformation by loading (Green, 1982). The Todilto
thickens from west to east; measured thicknesses range from 3 ft to 125 ft.
Green and Jackson (1976) have mapped the pinchout of the limestone a short
distance to the west of the westernmost section, Navajo Church (no. 1), and
note that the stratigraphic interval is marked by a stringer of granules and
pebbles of chert. This stringer appears to correlate with the chert pebbles
that occur at the base of the Todilto Limestone at the Navajo Church
section. At the eastern end of the outcrop belt (Mesita section, no. 7) the
Todilto includes 110 ft of crudely stratified to structureless gypsum.

The Beclabito Member conformably overlies the Todilto Limestone
throughout the study area. The Beclabito consists of reddish-orange to
reddish-brown, very fine to fine-grained, very well sorted sandstone and
reddish-brown siltstone. Sedimentary structures consist of ripple cross-
stratification, small-scale trough cross-beds, and flatbedding; many beds have
indistinct bedding or are structureless. Siltstone is present in minor
amounts in the Gallup area, and in general increases from west to east. In
the area between the Midget Mesa section (no. 2) and the East Thoreau section
(no. 4) there are numerous white, very fine grained sandstone beds in the
upper part of the Beclabito that are lithologically similar to sandstone of
the overlying Cow Springs Sandstone. These beds reflect the gradational
nature of the contact between the two units. The contact is actually quite
arbitrary in many places because the units have similar lithologies and
sedimentary structures. Color was used as a general guide for picking the
contact, with the Beclabito being shades of red and the Cow Springs being
lighter colors of white, green, and pink. The Beclabito also has
proportionately more flatbedded units and less crossbedded units than the Cow
Springs. Thicknesses of the Beclabito range from 58.5 ft to 196.5 ft;
aggregate thicknesses of the Wanakah Formation range from 61.5 to 262.5 ft.

The Cow Springs Sandstone conformably overlies the Wanakah in the Gallup
area and grades into the upper part of the Beclabito Member east of Thoreau.
The Cow Springs consists of reddish-orange, pinkish-gray, greenish-gray, and
white, very fine to fine-grained, well sorted sandstone. Sedimentary
structures consist of small- to large-scale trough crossbeds, wavy parallel
laminations, and wavy nonparallel laminations (flatbedded units);
structureless intervals are present in some places. Laterally extensive
horizontal bedding planes that bound depositional units are common in the Cow
Springs. Measured thicknesses of the Cow Springs generally decrease from west
to east, from 161.5 ft at Navajo Church (no. 1) to 88.5 ft at East Thoreau
(no. 4). This is an inverse relationship with respect to the Wanakah
Formation, whose thickness generally increases from west to east. The Cow
Springs is not recognized east of the Thoreau area.
In the Grants and Laguna areas (sections no. 7, 8, and 9), the sandstone at Mesita occupies a stratigraphic position similar to that of the Cow Springs Sandstone in the Gallup area; however, the lithologies of the two units are different. The contrast is mainly in grain size, sorting, and accessory mineral assemblage. While the Cow Springs is very fine to fine grained and very well sorted, the sandstone at Mesita is fine to medium grained and well to moderately sorted. These are subtle differences, but seem to characterize the two units in most areas. Another feature of the sandstone at Mesita is the presence of coarse grains of white chert that are concentrated on crossbed foresets and in horizontal layers; these grains were not noted in any of the sections measured of Cow Springs Sandstone. Sedimentary structures of the two units are similar, consisting of small- to large-scale trough crossbedding, wavy parallel laminations, and wavy nonparallel laminations (flatbedding). Both units show an increase in large-scale crossbedding upwards in the section; a thickness of about 40 feet for one crossbed set in the sandstone at Mesita was recorded by Craig and others (1959, sec. no. 140). Complete thicknesses of the sandstone at Mesita were measured at only two places (East Thoreau, no. 4, and Haystack Mountain, no. 6, and range from 5.5 ft to 126.5 ft. Craig and others (1959, sec. no. 140) measured 317 ft of the unit just east of the Mesita section.

The sandstone at Mesita has previously been called the Bluff Sandstone (Rapaport and others, 1952; Freeman and Hilpert, 1956; Craig and others, 1959) in the Grants and Laguna areas. Maxwell (1976, 1982) has applied the name Bluff Sandstone to the lower part of the unit and the name Zuni Sandstone to the upper part in the area south and west of Laguna. Maxwell divides the unit into two parts on the basis of differences in sedimentary structures and inferred environments of deposition.

I believe that Maxwell's division of the unit is valid, but that the lower part has affinities with the underlying San Rafael Group and the upper part should possibly be included in the Morrison Formation. The reasons for this interpretation are thus: (1) The contact between the sandstone at Mesita and the underlying Beclabito Member of the Wanakah Formation, while sharp and erosional at one section (Andrews Ranch, no. 5), is more commonly conformable. Deposition of the lower part of the sandstone at Mesita seems to be a continuation of the same processes that deposited the underlying Beclabito Member of the Wanakah. In the one section where the sandstone at Mesita overlies the Cow Springs Sandstone (East Thoreau, no. 4) the contact also appears conformable. (2) The contact between the upper part of the sandstone at Mesita and the Recapture Member of the Morrison Formation is conformable, and the two units interfinger in the Laguna area (Freeman and Hilpert, 1956, p. 313). This implies that deposition of the two units occurred at least in part simultaneously. Further work needs to be done on the sandstone at Mesita, particularly concerning the contact between the upper and lower parts of the unit.

Morrison Formation.--The Recapture Member is the basal member of the Morrison Formation in the southern San Juan Basin. Pipiringos and O'Sullivan (1978, p. A25) stated that there is an unconformity at the base of the Morrison Formation or equivalent units throughout most of the Western Interior, and have shown one in the vicinity of Navajo Church (Pipiringos and O'Sullivan, 1978, pl. 1, section C-C'). In the area of this study, the contact between the Recapture and the Cow Springs Sandstone appears to be
planar; no channeling was noted. In many places the contact appeared to be
gradational and was difficult to pick with certainty. As noted previously,
Freeman and Hilpert (1956, p. 313) described interfingering between the
Recapture and the sandstone at Mesita (formerly Bluff Sandstone).

In many areas the Recapture can be divided into two parts, lower and
upper. The lower part consists of white, yellowish-gray, and purplish-gray,
fine- to medium-grained, moderately well to well-sorted sandstone, and minor
interbedded reddish-brown siltstone and mudstone. Sedimentary structures are
medium- to very large scale, high angle trough and tabular-planar crossbeds
and flatbeds; structureless intervals are common. This unit varies in
thickness from about 100 ft to about 240 ft and weathers to vertical cliffs in
many places. The upper part, which is lithologically more heterogeneous,
consists of white to light brown, fine- to coarse-grained, well to poorly
sorted sandstone, and reddish-brown mudstone and siltstone. The sandstone
beds commonly are lenticular, have irregular scoured bases, and fine
upwards. Sedimentary structures consist of small- to medium-scale trough
crossbeds and ripple cross-stratification. The mudstones and siltstones are
commonly structureless, but ripple cross-stratification is present; horizontal
bands of calcareous concretions are present in some fine-grained interbeds,
usually just below an overlying sandstone. The thickness of this unit varies
from about 85 ft to about 200 ft. The combined thickness of the lower and
upper parts of the Recapture ranges from about 225 ft to about 340 ft.

The Westwater Canyon Member conformably overlies the Recapture Member.
The Westwater Canyon consists of reddish-orange to grayish-purple, fine- to
course-grained, moderately well to poorly sorted sandstone and minor
interbedded reddish-brown mudstone. Sedimentary structures vary from trough
and tabular-planar crossbeds to horizontal laminations. In some areas lenses
of pebbles are present. These commonly occur at the base of crossbed sets.
Only the lowest few feet of Westwater Canyon were measured in this study.

The upper member of the Morrison in this area, the Brushy Basin, was not
measured or described as part of this study.

METHODS

Nearly all of each section was measured with a 5 ft Jacob's staff and
Abney level. A cloth or metal tape was used when cliffs precluded use of the
Jacob's staff. Structural dip in this area is low, ranging from 1° to 4°, and
vegetation posed no problem. Lithologic data were recorded on the section-
measuring forms that are reproduced in Appendix II. Each section has a header
card that shows what kind of information each column contains. The other
cards for each section are continuation sheets that do not have the columns
labeled. The forms are designed to be attached together to form a continuous
strip chart of lithologic data. (See Appendix I for a complete explanation of
the forms.) Finally, thanks go to Bob Pool for able assistance in the field.
REFERENCES CITED


APPENDIX I
Explanation of section forms

The section forms in this report are divided into vertical columns that contain different types of information. Each column will be discussed briefly below.

Thickness/sample no. In this report this column is used to indicate thicknesses of the units in feet.

Unit no. This column could be used to number each depositional unit. The units are not numbered in this report.

Fm/mbr. Formation and member names are shown in this column. Abbreviations for formations and members are shown on figure 2.

Radioact./CPS. CPS refers to counts-per-second of a hand-held scintillometer. This column was not used in this report.

Visual porosity estimate. This column is a continuous line graph representing an estimate of the porosity of the unit measured. Estimates were obtained by placing a few drops of water or dilute HCl on the rock.

Core. This indicates the number of the core run for subsurface studies. It was not used in the present report.

Rock type. The rock type column contains a weathering profile of the outcrop, a lithologic symbol for rock type, sketches of sedimentary structures within the units, and circled numbers that designate the position of samples taken. Small strike and dip symbols next to some intervals indicate the presence of calcareous zones.
Lithology
- Sandstone
- Conglomeratic sandstone
- Siltstone
- Mudstone
- Claystone
- Limestone
- Gypsum
- Limestone clasts or nodules

Sedimentary structures
- Trough or wedge-planar crossbeds
- Tabular-planar crossbeds
- Ripples (current or oscillation)
- Adhesion ripples (flatbedding)
- Contorted bedding

Miscellaneous
- Burrows
  - Vertical
  - Horizontal

Footnotes/Color. Both these columns are used to indicate color of the units. Colors were estimated by a comparison with the GSA Rock-color chart (Goddard and others, 1948). Where possible, colors were estimated from fresh, dry outcrops.
Dominant grain size. The dominant grain size of rock units was estimated by comparing them to standard grain size charts. Class divisions correspond to the phi scale. Dots to the left or right of the solid line indicate variations from the norm.

Bedding. Bedding refers to set thickness of sedimentary units. Abbreviations are as follows: VTK - very thick; TK - thick; M, MED, or AV - medium; TN - thin; VTN - very thin; LAM - laminated; MASS - massive. Combinations of terms indicate a range of bedding thicknesses.

Sedimentary structures. This column indicates the type of sedimentary structure that is shown graphically in the rock type column. Abbreviations of sedimentary structures are as follows: CLL - curved, parallel laminations, (trough or wedge-planar crossbeds); in some cases the scale of the crossbeds is indicated; TAB. PLANAR - tabular-planar crossbeds; DWM - discontinuous, wavy, nonparallel laminations, (current or oscillation ripples); WLM - wavy, nonparallel laminations, (adhesion ripples); ELL - even, parallel laminations, (horizontal laminations); STRLESS - structureless.

Biology/organics. This column indicates the presence of organic material, burrowing, and bioturbation.

Sorting/roundness. Commonly used abbreviations for sorting are as follows: VWS - very well sorted; WS - well sorted; MWS - moderately well sorted; M or MOD - moderately sorted; FS - fair sorting; PS - poorly sorted. Abbreviations for roundness include: A - angular; SA - subangular; SR - subrounded; R - rounded. Many abbreviations are combinations of the above letters.

Cement. This column was used to indicate the presence of calcite cement. Abbreviations used include: VC - very calcareous; MC - moderately calcareous; SC - slightly calcareous; NC - non-calcareous.

Percent feldspar. Estimated percent feldspar, usually potassium feldspar, in the unit.

Accessory minerals or fragments. Colors of unidentified accessory minerals are in this column. Abbreviations for colors are: BLK - black; R or RD - red; OR - orange; GRN - green; GY - gray; WT - white.

Notes. This is essentially a "comments" section. It contains miscellaneous information not covered on the rest of the form.

Inferred environment of deposition. Possible environments of deposition are noted in this section. These interpretations are preliminary, and two or more possibilities are often listed.

Transport direction. Where possible, estimates of the direction of sediment transport were made. Most of these estimates were taken from axes of trough crossbeds.
APPENDIX II

Measured sections
Figure 4. Location of Navajo Church section.
### Stratigraphic Section Description (Strat. Interval: J.e... to J.m...)

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Unit No.</th>
<th>FM/MBR.</th>
<th>Radioact.</th>
<th>Cores</th>
<th>Visual Estimate</th>
<th>Core Type</th>
<th>Footnotes</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>S540</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Rock Type:**

- Thin C116
- TN shaly

**Footnotes:**

- Stained nearly black with organic matter coating the grains
- NC 26
- High clay content
- Floating pebbles

**Notes:**

- Alteration, Attitude, Clasts, Mineralization, Misc. Info.

**Location:**

- State: New Mexico
- County: McKinley
- Quadrangle: (750)Church Rock
- GEOL. Credit: A. B.
Well sorted sand except for common pebbles of black chert. Potential?

Large colonies of bivalves form pedestals up to 6" high and 12" in diameter. Siliceous cementation.

Nca-5

Still appears to be one very large set

Dune NS/SE

Nca-4

Silica-cemented concretions w/ burrows preserved.
Figure 5. Location of Midget Mesa section.
This unit correlates with the large tabular planar bedding unit at the top of the Navajo Church section. This appears to be the easternmost limit of the dune. Unit not present on mesa to the northeast.
<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
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<td>Colometric, general, limestone</td>
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<tr>
<td></td>
<td>Poor exposure</td>
</tr>
<tr>
<td></td>
<td>Ne 3-2</td>
</tr>
<tr>
<td></td>
<td>Ne 2-6</td>
</tr>
<tr>
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<td>Ne 2-5</td>
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<tr>
<td></td>
<td>Ne 2-1</td>
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<td>Ne 1-3</td>
</tr>
<tr>
<td></td>
<td>Ne 1-2</td>
</tr>
</tbody>
</table>

**Location:** Midget, Mass.  
**Sec.: 6, T.: 4N, R.: 15, W.: 14

**State:** Massachusetts  
**County:** Berkshire

**U.S.G.S. Core Library Number:** 100942000

**API Well Number:** 4-5
Figure 6. Location of Pinedale Monocline section.
## Stratigraphic Section Description

### Vertical Section

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Unit No.</th>
<th>Fm/MBR.</th>
<th>Rock Type</th>
<th>Footnotes</th>
<th>Color</th>
<th>Bedding</th>
<th>Sedimentary Structures</th>
<th>Organelles</th>
<th>Sorting/Roundness</th>
<th>Cements</th>
<th>Percent Feldspar</th>
<th>Accessory Minerals or Fragments</th>
<th>NOTES: (Alteration, Attitude, Clasts, Mineralization, &amp; Misc. Info.)</th>
</tr>
</thead>
</table>

**Examples:**
- **Sample No.**
- **Unit No.**
- **Fm/MBR.**
- **Rock Type**
- **Footnotes**
- **Color**
- **Bedding**
- **Sedimentary Structures**
- **Organelles**
- **Sorting/Roundness**
- **Cements**
- **Percent Feldspar**
- **Accessory Minerals or Fragments**

**Notes:**
- Lenses of pebbles, clay, and mud PM25 up to 2" of relief on scour.
- High energy, braided.
- Overbank/Abandoned channel fill.

### Location

- **State:** New Mexico
- **County:** Kirtland
- **Quadrangle:** (Topographic or geographic information)
<table>
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<td>220</td>
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<td>NW 5-6</td>
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Figure 7. Location of East Thoreau section.
**STRATIGRAPHIC SECTION DESCRIPTION (STRAT. INTERVAL TOP TO BOT.)**

<table>
<thead>
<tr>
<th>THICKNESS</th>
<th>SAMPLE NO.</th>
<th>SITE</th>
<th>RADAR</th>
<th>STRAT. INTERVAL</th>
<th>CORE</th>
<th>POSTURES</th>
<th>COLOR</th>
<th>BEDDING</th>
<th>REGIMENTARY STRUCTURES</th>
<th>BIOLOGICAL</th>
<th>ORGANIC</th>
<th>CEMENT</th>
<th>PERCENT FELDSPAR</th>
<th>ACCESSIBLE MINERALS</th>
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</tr>
</tbody>
</table>

High energy alluvial channel.

Overbank.

Carbonate.'n

Caliche nodules throughout; locally burrowed.

Small-scale scours & fills, clay rip-ups. Carbonates cementing stringers of gypsum, crosscut bedding.

PEBBLES AT BASE. ET 25.

ET 24. White clay rip-ups.

ET 23.
<table>
<thead>
<tr>
<th>Location</th>
<th>State</th>
<th>County</th>
<th>U.S.G.S. Core Library Number</th>
<th>API Well Number</th>
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<tbody>
<tr>
<td>East Thoreau</td>
<td></td>
<td></td>
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</tbody>
</table>

**Diagram Description**

- **Cow Springs Sandstone**

- **Legend**
  - Sediment Type: Sand, Clay, Muds, Org
  - Structures: Crossbedding, Silt, Ripples, Ripples
  - Notations: UC, SC, SP, VC, NC, ER, OR, P, SR

**Table Content**

<table>
<thead>
<tr>
<th>Layer</th>
<th>Sediment Type</th>
<th>Structure</th>
<th>Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Note:** The table and diagram depict various sedimentary layers and structures, indicating the geological analysis of the area.
Figure 8. Location of Andrews Ranch section.
### Stratigraphic Section Description (Strat. Interval: X to Y)

<table>
<thead>
<tr>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>320</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Upper part of Jmr not measured due to inaccessible cliffs. Estimated thickness to Xrecapture = 60 ft, most of which consists of dolian domes, with foresets dipping northeasterly.</td>
</tr>
<tr>
<td>310</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Abt. white chert. Alternating fine- and coarse-grained laminations. ARQ.</td>
</tr>
<tr>
<td>300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Less white chert than below.</td>
</tr>
</tbody>
</table>
Figure 9. Location of Haystack Mountain section.
| STRATIGRAPHIC SECTION DESCRIPTION (STRAT. INTERVAL: J.... TO J....) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| THICKNESS | SAMPLE NO. | LOCAL | REMARKS | BEDDING | SEGMENTARY STRUCTURES | BIOLOGY/ORGANICS | SORTING/ROUNDNESS | PERCENT FELSISPER | PERCENT CEMENT | NOTES: (ALTERATION, ATTITUDE, CLASTS, MINERALIZATION, ETC. MISC. INFO.) |
| 530 | T | | | | | | | | | white clay nests |
| 520 | T | | | | | | | | | caliche at contact |
| 510 | T | | | | | | | | | laterally flows out |
| 500 | T | | | | | | | | | a 7' of Jmr |
| 490 | T | | | | | | | | | HM18 caliche nodules |
| 480 | T | | | | | | | | | caliche |
| 470 | T | | | | | | | | | HM17 clay rip-ups |
| 460 | V | | | | | | | | | clay rip-ups |

LOCATION: Jemez Mountains, Sec. 16, T. 33 S., R. 1 W., QUADRANGLE (72) Gila Wilderness Geology, Cond. Date May 13.
**LOCATION:** Haystack Mounts, Socorro Co., S.E. 1/4 T. 18 N. R. 11 W.  
**STATE:** New Mexico  
**COUNTY:** Socorro  
**U.S.G.S. CORE LIBRARY NUMBER:**  
**API WELL NUMBER:**

---

**Eolian dunes and interdunes; both reworked by burrowing**

---

<table>
<thead>
<tr>
<th>Unit from 300.5 ft to 408 ft</th>
<th>Previous modified as Corrosion SB. Summary Table 4, and others.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recapture Member</td>
<td></td>
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</tbody>
</table>

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<table>
<thead>
<tr>
<th>380</th>
<th>390</th>
<th>400</th>
<th>410</th>
<th>420</th>
<th>430</th>
<th>440</th>
<th>450</th>
<th>460</th>
<th>470</th>
</tr>
</thead>
<tbody>
<tr>
<td>370</td>
<td>380</td>
<td>390</td>
<td>400</td>
<td>410</td>
<td>420</td>
<td>430</td>
<td>440</td>
<td>450</td>
<td>460</td>
</tr>
</tbody>
</table>

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59
<table>
<thead>
<tr>
<th>Depth</th>
<th>Location</th>
<th>Member</th>
<th>Formation</th>
<th>Textual Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>Strike N 35 W, Dip 2 NE</td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>Possible algal met rip-ups</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td>Thick limestone lens, pinches out, northward</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td>Calcareous nodules</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td>Layers of nodules of limestone, rip-up clasts, slightly rippled, Hm 1, Bi, Org</td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td>Upper surface covered by algal heads, organics, marine, very organic, chalk, recently crystalline</td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td>Coastal sediment, inner shelf marine</td>
</tr>
</tbody>
</table>
Figure 10. Location of Mesita section.