GEOLOGIC MAP OF THE CONTINENTAL DIVIDE QUADRANGLE, McKINLEY COUNTY, NEW MEXICO

Morris W. Green

1971

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

GEOLOGIC MAP OF THE CONTINENTAL DIVIDE QUADRANGLE, McKINLEY COUNTY, NEW MEXICO

By

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Open-file report
1971

Geologic Map of the Continental Divide quadrangle, McKinley County, New Mexico

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EXPLANATION

QUATERNARY — Pleistocene and Holocene

Qal	Qc	Qt	Qb
Alluvial and eolian deposits	Colluvial deposits	Talus and landslide deposits	Residual boulder deposits

UNCONFORMITY

CRETACEOUS — Upper Cretaceous

Km

Main body of Mancos Shale

Dark-olive-gray friable, silty shale; minor thin-bedded to laminated, yellowish-brown, sandy siltstone interbedded locally. Upper part of unit not exposed

Kdt

Twowells Tongue of Dakota Sandstone

Yellowish-brown to buff, medium- to fine-grained, well-sorted, siliceous sandstone; contains a few thin lenticular beds of silty shale in the lower third of the unit. 4-15 feet thick

Kmw

Whitewater Arroyo Tongue of Mancos Shale

Yellowish-brown to yellowish-gray fossiliferous shale; locally contains thin beds of yellowish-brown sandy siltstone and limestone. 50-75 feet thick

Upper Cretaceous

Kml

Lower part of Mancos Shale

Olive-gray to pale-yellowish-gray shale interbedded with yellowish-brown sandy siltstone and silty sandstone containing dark-gray, fossiliferous, lenticular limestone beds; thins westward and grades into the Dakota Sandstone. 0-20 feet thick

Lower(?) and Upper Cretaceous

Kd

Dakota Sandstone

Yellowish-brown to buff, fine- to medium-grained, well-sorted, siliceous sandstone; locally contains beds of pink and white sandstone; thin-bedded black to dark-gray carbonaceous shale at base and interbedded locally; grades laterally into lower part of the Mancos Shale. 90-160 feet thick

CRETACEOUS

UNCONFORMITY

Jmb
Jmw
Jmr

Morrison Formation

Upper Jurassic

JURASSIC

Jmb, Brushy Basin Member; greenish- to purplish-gray claystone and sandy siltstone containing lenses of yellowish-brown, pink, and white, fine- to coarse-grained, poorly sorted feldspathic sandstone. 60-120 feet thick

Jmw, Westwater Canyon Member; light-red, fine- to coarse-grained, poorly sorted, fluvially crossbedded feldspathic sandstone. Intertongues with the Recapture and Brushy Basin Members. 165-230 feet thick

Jmr, Recapture Member; interbedded reddish-brown clayey siltstone and light-gray to white very fine to medium grained, well-sorted sandstone. Intertongues with the Cow Springs Sandstone. 45-145 feet thick

Upper Jurassic

JURASSIC

Jcse
Jcsf

Cow Springs Sandstone

Jcse, eolian facies; light-greenish-gray to gray, fine- to medium-grained, well-sorted sandstone with high-angle eolian cross-bedding; intertongues with the fluvial facies. 60-90 feet thick

Jcsf, fluvial facies[1/]; light-reddish-brown, pale-orange, and light-greenish-gray, fine- to medium-grained, well-sorted sandstone and silty sandstone; beds alternately cross-bedded and flat bedded. Contains many interbedded eolian sandstone units. The lower part is interbedded with the Summerville Formation. 100-185 feet thick

Js

Summerville Formation

Reddish-brown to light-orange, fine-grained, flat-bedded, silty sandstone and sandy siltstone. Contact with Todilto Limestone is gradational locally. 60-75 feet thick.

Jt

Todilto Limestone

Light- to dark-gray, thin-bedded limestone. Upper 8 inches to 1 foot largely recrystallized. Lower part locally composed of light-yellowish-gray limy sandstone and siltstone reworked and altered from upper sandstone member of Entrada. 10-40 feet thick.

Upper Jurassic

JURASSIC

Jeu
Jem
Jel

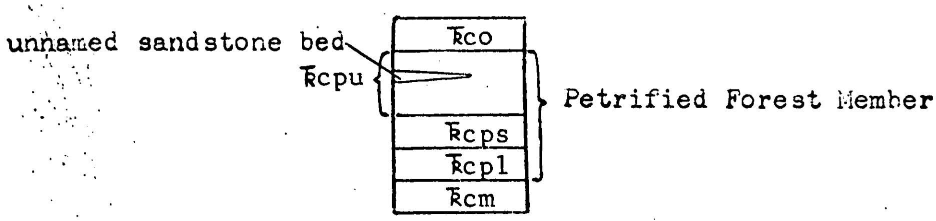
Entrada Sandstone[2]

Jeu, upper sandstone member; reddish-orange to reddish-brown, medium- to fine-grained, well-sorted, eolian crossbedded sandstone. Locally contains lenticular beds, 1 to 4 feet thick, of grayish-orange calcareous sandstone in the upper half. 200-230 feet thick

Jem, medial siltstone member; dark-reddish-brown clayey siltstone and very fine grained silty sandstone. Lower part generally interbedded and gradational with the lower sandstone member. Upper 6 inches bleached white. 40-60 feet thick

Jel, lower sandstone member[3]; reddish-orange, medium- to fine-grained, well-sorted, eolian crossbedded sandstone, contains randomly oriented calcite-filled joints. Contains fine- to medium-grained, angular, white chert grains concentrated along cross-laminations. The upper 15 to 25 feet is flat bedded locally and is interbedded with the medial siltstone member. Angular, white chert and quartz grains up to pebble size occur in the basal 6 to 12 inches. 45-60 feet thick

UNCONFORMITY



Chinle Formation

Upper Triassic | TRIASSIC

TRco, Owl Rock Member; purplish- to greenish-gray mottled, nodular clastic limestone interbedded with reddish- to greenish-gray and purple claystone and siltsone. 15-40 feet thick

Petrified Forest Member:

TRcpu, upper part; poorly exposed, dark-to light-purplish-gray and reddish-gray, clayey siltstone; thin medium- to fine-grained sandstone interbedded locally. 650-800 feet thick

TRcpu, (unnamed sandstone bed); light-to dark-purplish-gray, medium- to fine-grained, fluvially crossbedded, siliceous; locally contains lenses of light-brown and purplish-gray limestone-pebble conglomerate. 35-45 feet thick

TRcps, Sonsela Sandstone Bed; composed of from 2 to 4 beds of yellowish-brown, tan, and light-purplish-gray, medium- to coarse-grained, locally conglomeratic, fluvially crossbedded and channeled sandstone; contains lenses of reddish- to purplish-gray slope-forming claystone and siltstone. Intertongues with the upper and lower parts of the Petrified Forest Member. 90-130 feet thick

Upper Triassic

TRIASSIC

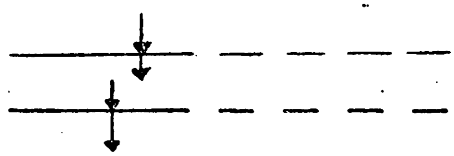
Ꞧcpl, lower part; reddish-purple, and bluish- to reddish-gray clayey siltstone. Locally contains reddish-gray, medium- to coarse-grained, thin, lenticular sandstone beds. 60-80 feet thick

Ꞧcm, Monitor Butte Member; red to grayish-red clayey siltstone and interbedded, fine- to medium-grained sandstone and brownish-gray conglomerate. The sandstone beds range from a few inches to 25 feet thick, and are more numerous in the upper half. Grades upward into, and intertongues with, Petrified Forest Member. Base not exposed

Contact

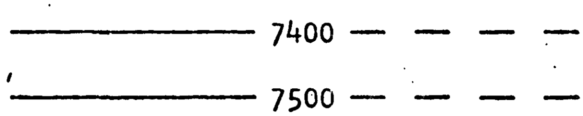
Dashed where approximately located or indefinite

Strike and dip of beds



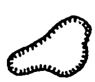
Monocline

Composed of an anticlinal bend and a synclinal bend; longer arrow indicates flatter dip. Dashed where approximately located



Structure contours

Drawn on base of Dakota Sandstone. Dashed where projected above ground surface. Contour interval 100 feet.



Limestone quarry

Mined primarily for road metal.

X

Uranium prospect

X

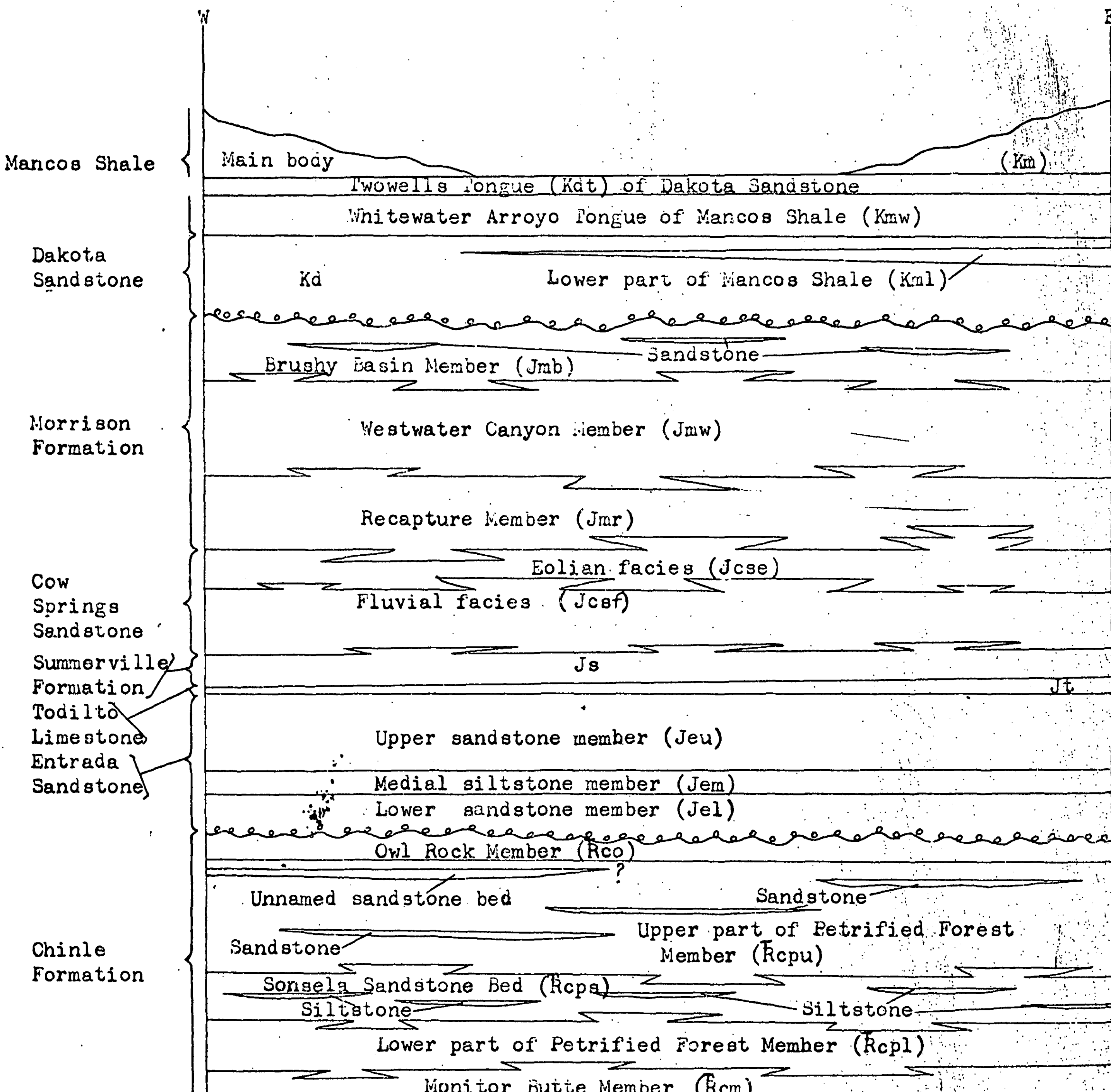
Sand and gravel pits

Correlation diagram of the upper part of the San Rafael Group and Morrison Formation showing stratigraphic names previously assigned to the units in the area of this map

<table>
<tr><th colspan="2">O'Sullivan and Beaumont, (1957), OM-190</th><th colspan="2">Smith (1959), Geologic map of the Foster Canyon quadrangle, New Mexico*</th><th colspan="2">Cooley and others (1969), Professional Paper 521-A, plate 1 (sheet 8 of 9)</th><th colspan="2">This map</th></tr>
<tr><td rowspan="3">Morrison formation</td><td>Brushy Basin member</td><td rowspan="3">Morrison formation</td><td>Brushy basin member**</td><td rowspan="3">Morrison Formation</td><td>Brushy Basin Member</td><td rowspan="3">Morrison Formation</td><td>Brushy Basin Member</td></tr>
<tr><td>Westwater Canyon member</td><td>Prewitt member</td><td>Westwater Canyon Member</td><td>Westwater Canyon Member</td></tr>
<tr><td>Recapture member</td><td>Chavez member</td><td>Recapture Member</td><td>Recapture Member</td></tr>
<tr><td colspan="2">Zuni sandstone</td><td colspan="2" rowspan="3">Thoreau formation</td><td colspan="2">Cow Springs Sandstone</td><td rowspan="2">Cow Springs Sandstone</td><td>eolian facies</td></tr>
<tr><td colspan="2" rowspan="2">Summerville formation</td><td rowspan="2">Summerville Formation</td><td rowspan="2">upper sandy member</td><td>fluvial facies</td></tr>
<tr><td colspan="2">Summerville Formation</td></tr>
</table>

* Foster Canyon 15-minute quadrangle includes the Ciniza, Continental Divide, Page, and Cottonwood Canyon $7\frac{1}{2}$-minute quadrangles.

** Brushy Basin Member changed to Casamero member by C.T. Smith (1967, p. 135).



SCHEMATIC DIAGRAM SHOWING STRATIGRAPHIC RELATIONS OF TRIASSIC, JURASSIC, AND CRETACEOUS ROCKS

1/ The fluvial facies as shown on this map is correlative with the unit mapped as the Bluff Sandstone in the Ambrosia Lake-Prewitt area by Thaden and others (1966-1967), and Green and Pierson (1971). The name "Bluff Sandstone" is not applied to the fluvial facies for the following two reasons. First, the contact between facies as shown here and between formations as shown in the Ambrosia Lake-Prewitt area is not mappable in some areas westward of this mapped area due to an inversion in stratigraphic position and mixing of the fluvial and eolian facies within the sequence. Second, the entire Cow Springs sequence in this area and throughout the region is lithologically homogeneous both vertically and laterally. These conclusions are in agreement with Harshbarger and others (1957, p. 43) who state that the Bluff Sandstone is inseparable from the Cow Springs Sandstone in the southeastern part of the Navajo country, and as a mappable unit is restricted to northeastern Arizona, the northwest corner of New Mexico, and southeastern Utah.

2/ Correlation diagram of nomenclature assignments of the Wingate and Entrada Sandstones as used by authors working in the Laguna-Grants-Gallup region, northwest New Mexico.

Dutton (1885)	Wingate sandstone	Wingate sandstone	Wingate sandstone	Wingate sandstone
Baker, Dane, and Reeside (1947)		Entrada sandstone	Carmel formation equivalent	Carmel formation equivalent
Silver (1948)	Wingate sandstone	Upper cliff-forming member	Middle slope-forming member	Lower cliff-forming member
Rapaport, Hadfield, and Olson (1952)		Entrada sandstone	Carmel formation	Carmel formation; Wingate formation
Smith (1954)	Entrada sandstone (Jurassic)	upper member	lower member	Wingate(?) formation
Harshbarger, Repenning, and Irwin (1957)	Entrada sandstone (Upper Jurassic); Wingate sandstone (Upper Triassic)	upper sandy member	medial silty member	Lukachukai member (Wingate sandstone (Upper Triassic))
Moench and Schlee (1967)	Entrada Sandstone (Upper Jurassic)	Upper sandstone unit	Middle siltstone unit	Lower sandstone unit
Green and Pierson (1971)	Entrada Sandstone (Upper Jurassic)	upper sandy member	medial silty member	Wingate Sandstone (Upper Triassic)
This map	Entrada Sandstone (Upper Jurassic)	upper sandstone member	medial siltstone member	lower sandstone member

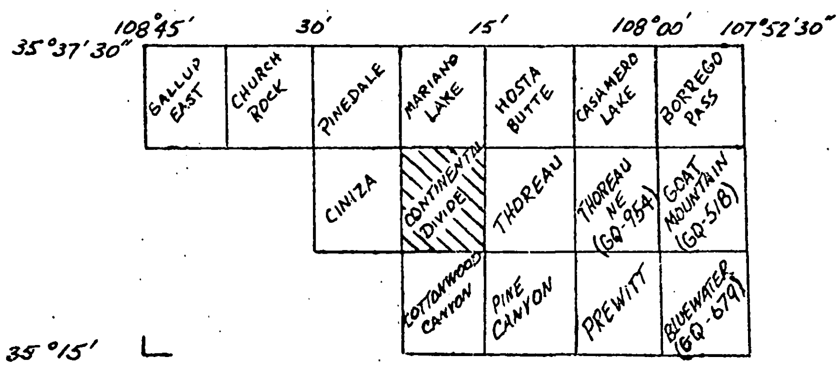
3/ The lower sandstone member as shown on this map has previously been mapped in the Grants-Gallup region as the Wingate (?) formation of Jurassic age by Smith (1954) and the Wingate Sandstone of Triassic age by O'Sullivan and Beaumont (1957), Smith and others (1959), Thaden and others (1967), Cooley and others (1969), and Green and Pierson (1971). The reassignment here of the "Wingate" to the "lower sandstone member" of the Entrada Sandstone of Late Jurassic age is based on (a) the absence of an unconformity between the lower sandstone member and the medial siltstone member, and (b) the close lithologic similarities and relationships between the lower member and the upper members of the Entrada. The implication is that the Wingate Sandstone is absent in the Grants-Gallup region.

Previous usage of "Wingate" for the lower member had necessitated the assignment, in the Grants-Gallup region, of an unconformity at the top of the lower member representing a hiatus, which is partially filled in northeastern Arizona by the Moenave Formation, Kayenta Formation, Navajo Sandstone, and the Carmel Formation. In the area of this map and westward to the limit of exposures in the Gallup area, the contact between the lower sandstone member and the medial siltstone member is gradational and interbedded. No features, such as a basal conglomerate, sandstone dikes, angular relationships between members, or an erosion surface were found to suggest the presence of such an unconformity. Commonly the contact is gradational from a medium- to fine-grained sandstone of the lower member to a very fine grained silty sandstone of the medial siltstone member. In the western part of the Grants-Gallup area the contact is marked by an interval 20-45 feet thick, in which lithologic units characteristic of both members are interbedded, clearly demonstrating that deposition was continuous from one member to the other.

Eastward toward Grants the contact is more distinctive. At some places the top of the lower member consists of a 6-inch to 1-foot zone of white to greenish-white calcareous sandstone, composed of from one to several discontinuous thin lenses that have been bleached of the red color of the lower member. These lenses or zones are interpreted as being primary features of deposition which were formed by precipitation of calcium carbonate in ponds in the interdune areas of a paleodune field and probably mark a laterally discontinuous surface of nondeposition on which little or no erosion or deposition was taking place; i.e., an intraformational disconformity. The crossbedding of the lower member is generally undisturbed in the altered zones at the top of the unit indicating a minimum of reworking. Previously this intraformational break has been interpreted as evidence for the Triassic-Jurassic unconformity, but since it is restricted to the eastern part of the area it has had little significance as such.

Concerning lithologic similarities, all three members are related in composition, angularity of grain, and sorting, even though grain size is finer in the medial siltstone member. Grain size is comparable in the lower and upper sandstone members, and both exhibit high-angle (20°-35°) wedge-planar type cross-stratification that is eolian in origin. Both units exhibit some flat, parallel-bedded intervals. These flat beds are most commonly found in the western part of the area in the upper part of the lower member. The finer grained medial siltstone member is homogeneous, massive, and shows no primary bedding features. The unit is interpreted as having been deposited subaqueously.

Addition of the unit previously called "Wingate Sandstone" as a third member of the Entrada Sandstone is in keeping with the three member division which Moench and Schlee (1967, p. 6) have used in the Laguna, N. Mex. area.



INDEX SHOWING QUADRANGLE LOCATIONS AND

PUBLISHED GEOLOGIC QUADRANGLE MAPS

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