Geology of Ghost Ranch Country

Water Leaders Workshop

May 23, 2024

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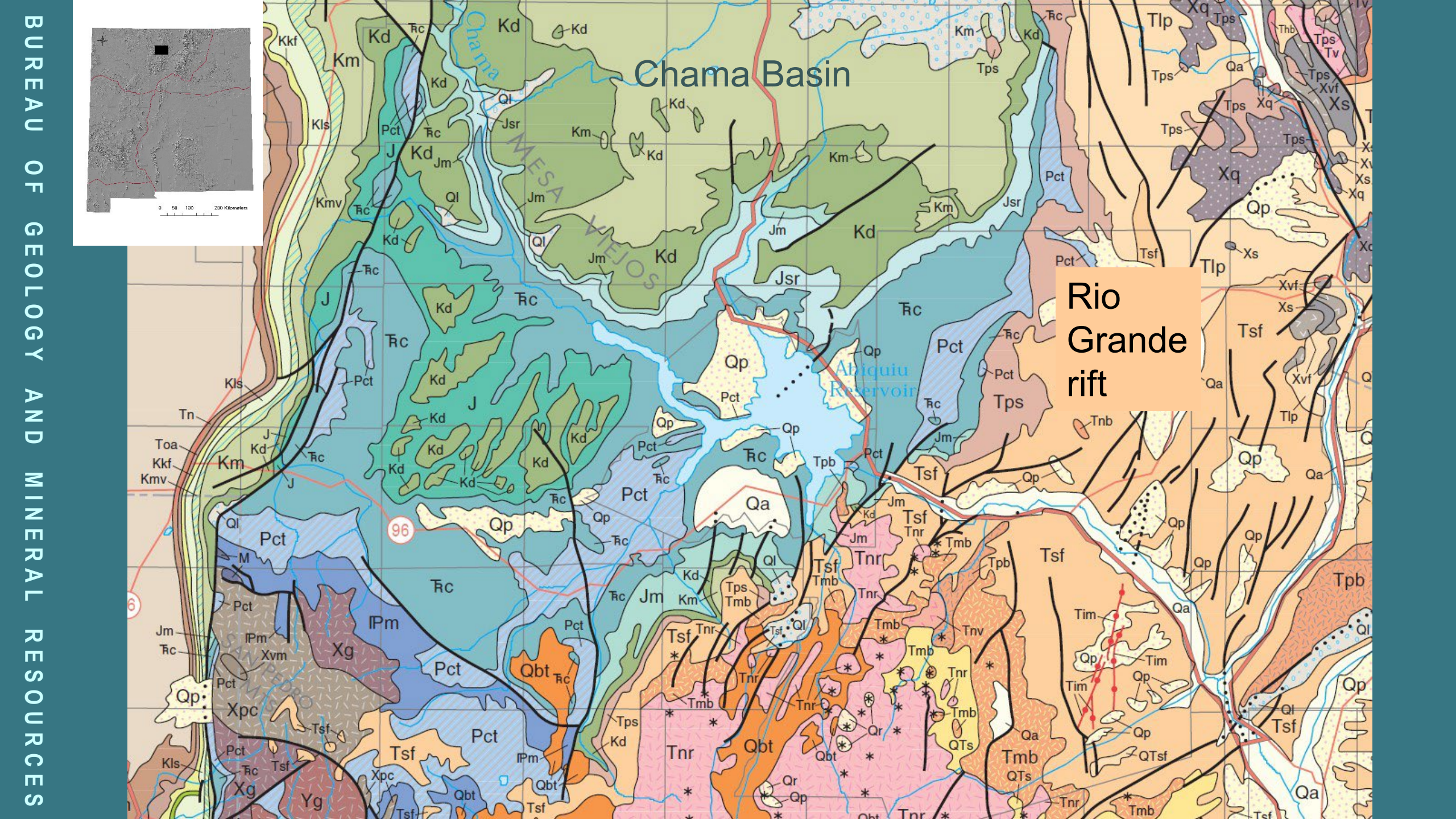
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Chama Basin
Rio Grande rift
Abiquiu Reservoir
MESA VIEJOS
0 50 100 200 Kilometers

An amazing geologic story is preserved at Ghost Ranch

Triassic Period – Chinle Group (~220 Ma)

Mostly red muds and and tan sands

Fossil-rich

Mississippi-River scale rivers running from Texas to Nevada

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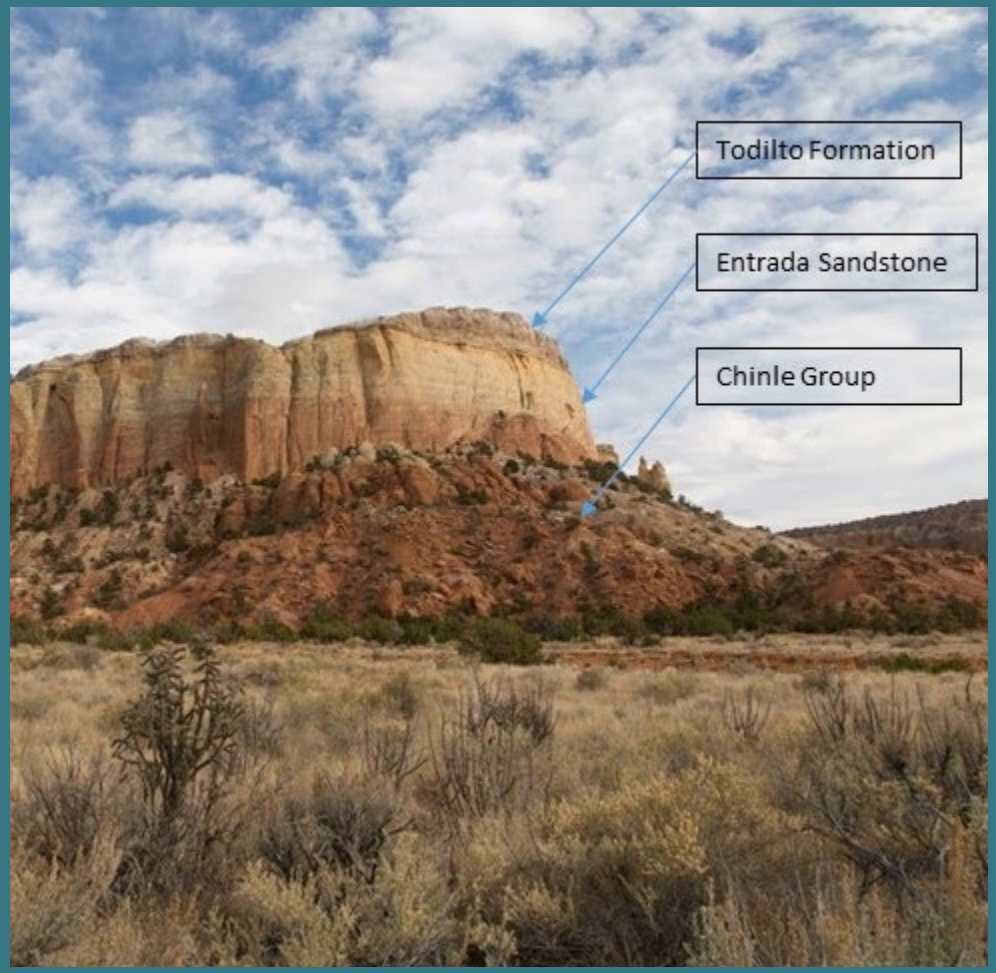
Jurassic Period – Entrada Sandstone (~165 Ma)

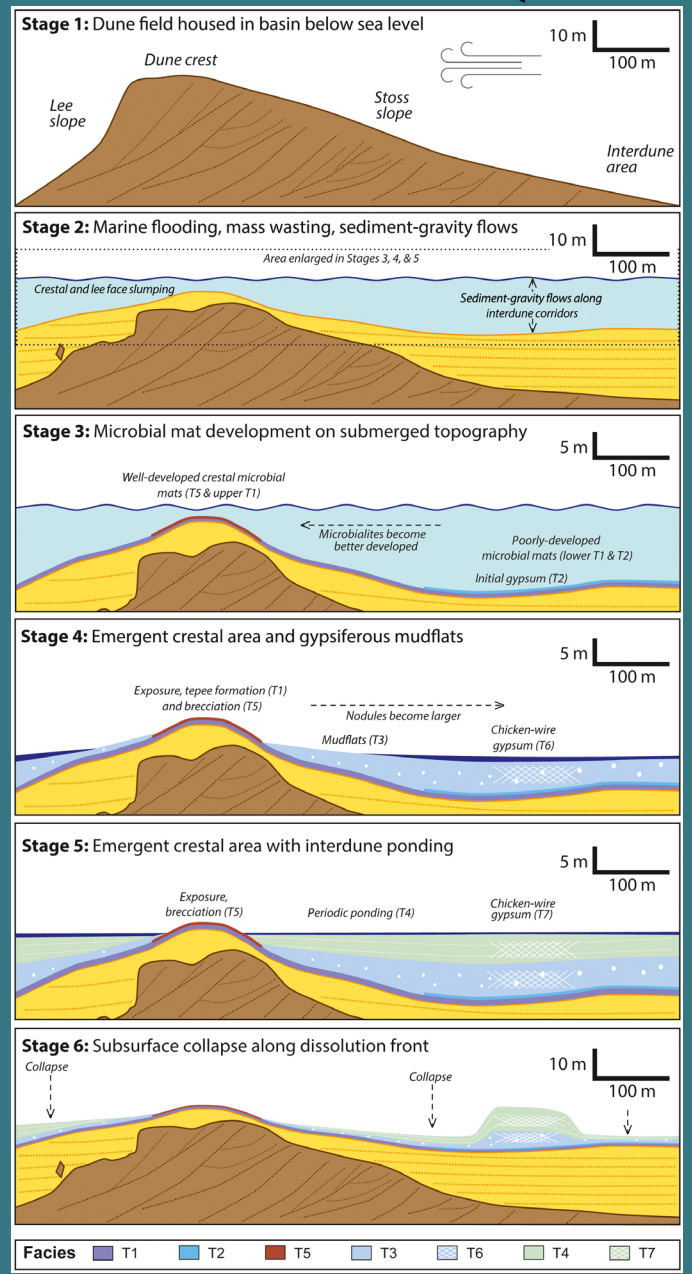
White, yellow, and red sandstone

Deposited in large dunes near sea level



Jurassic Period – Entrada Sandstone (~165 Ma)

from Kocurek et al. (2019)
"Antecendent aeolian dune topographic control on carbonate and evaporite facies: Middle Jurassic Todilto Member, Wanakah Formation, Ghost Ranch, New Mexico, USA"

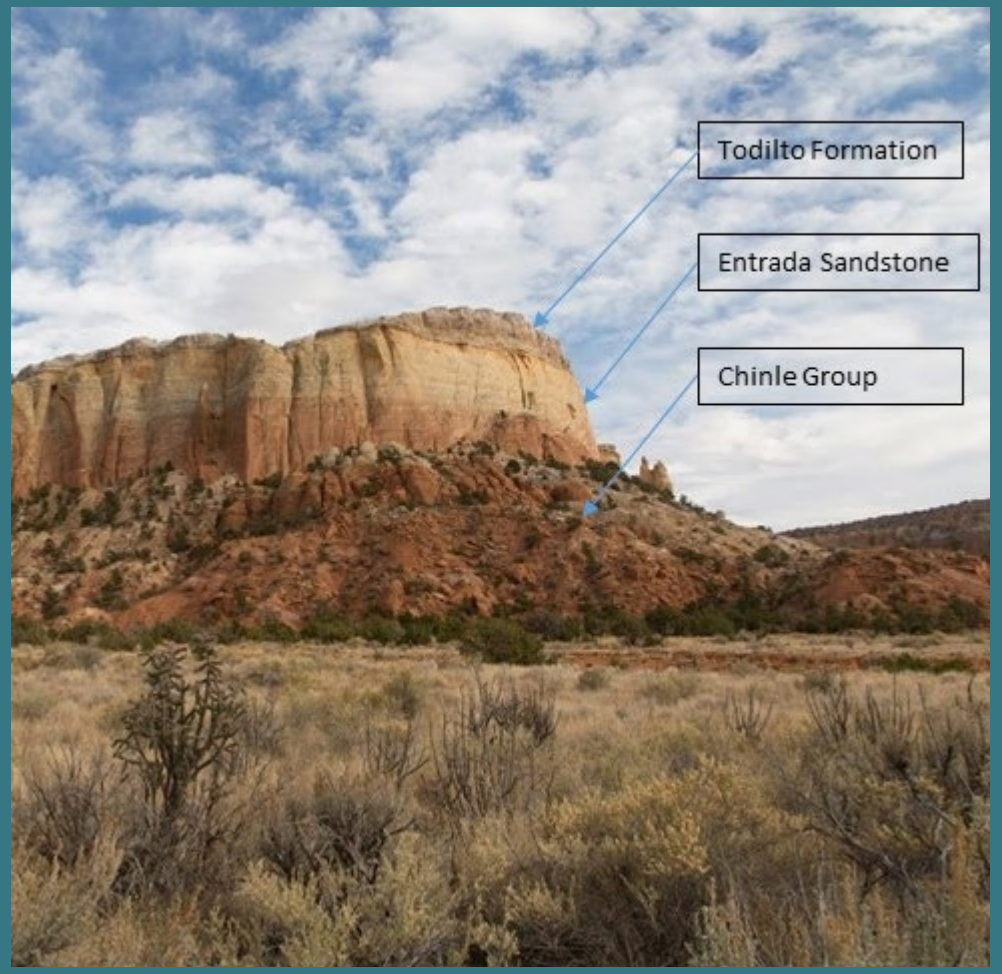


Jurassic Period – Todilto Formation (~159 Ma)

Limestone and gypsum

Deposited in restricted ocean basin with high salinity

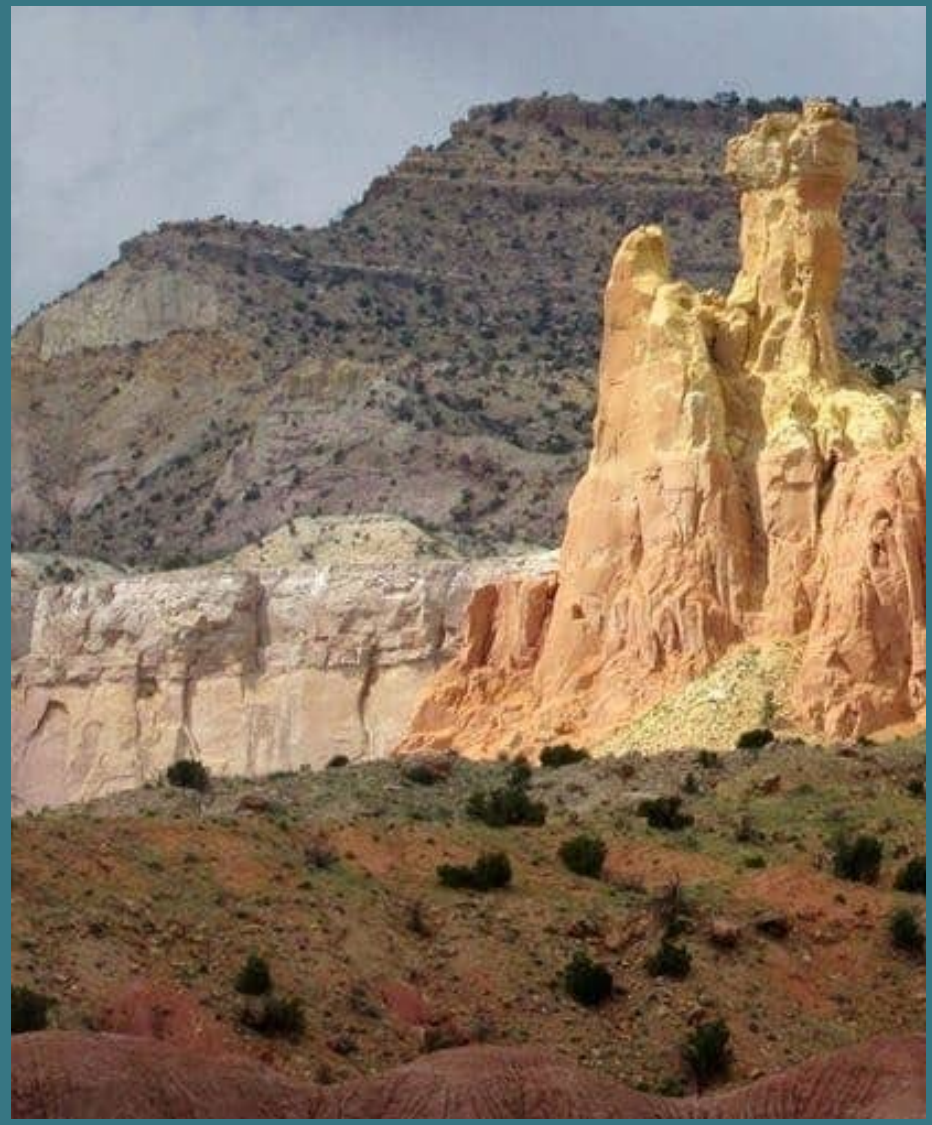
Found exclusively in NM

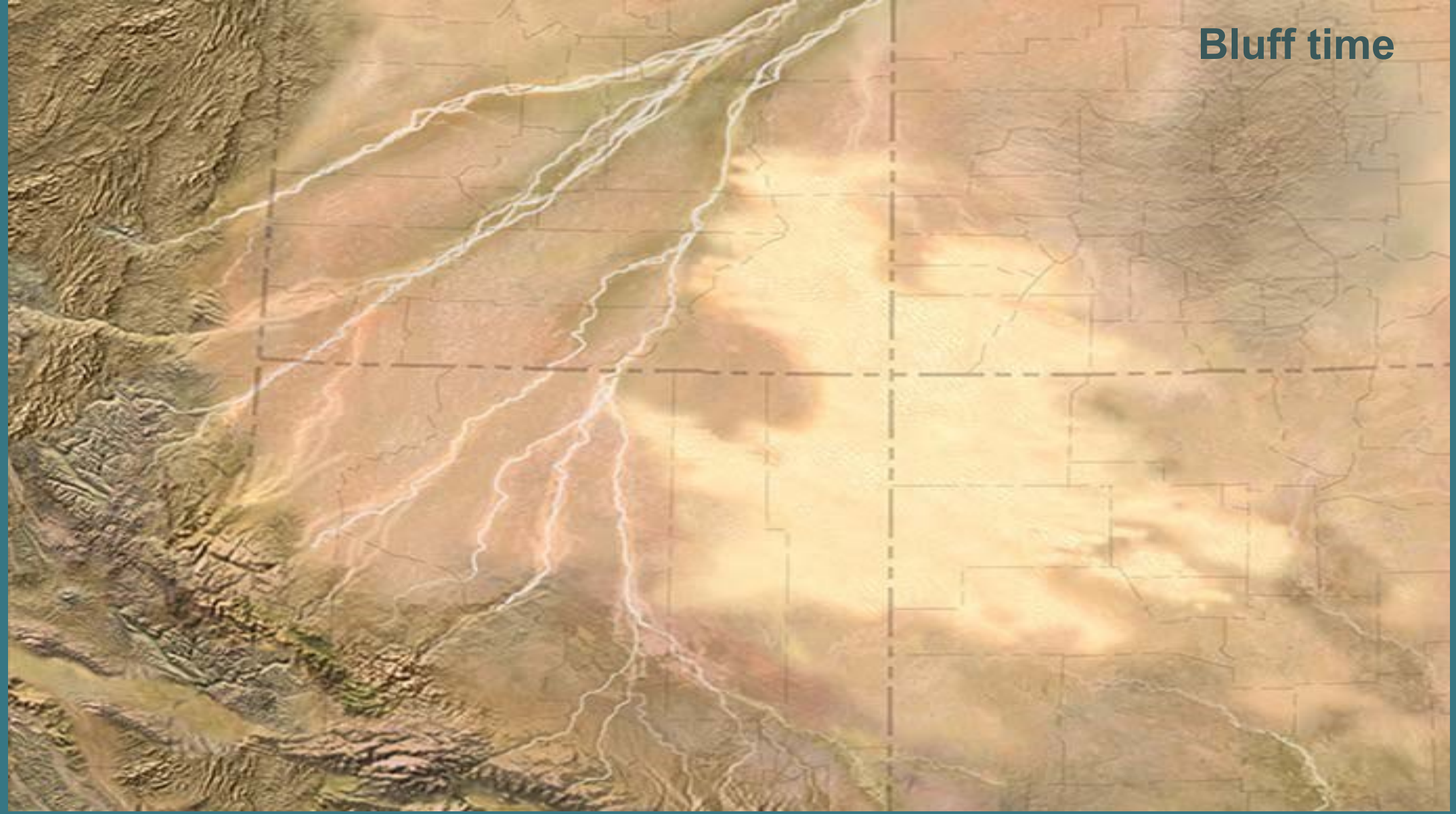


Jurassic Period – Summerville Formation, Bluff Sandstone, and Morrison Formation (~155-148 Ma)

Mix of sandstones and mudstones; red and pistachio-green colored

Deposited in rivers and dunes – rivers flowed toward the northeast.

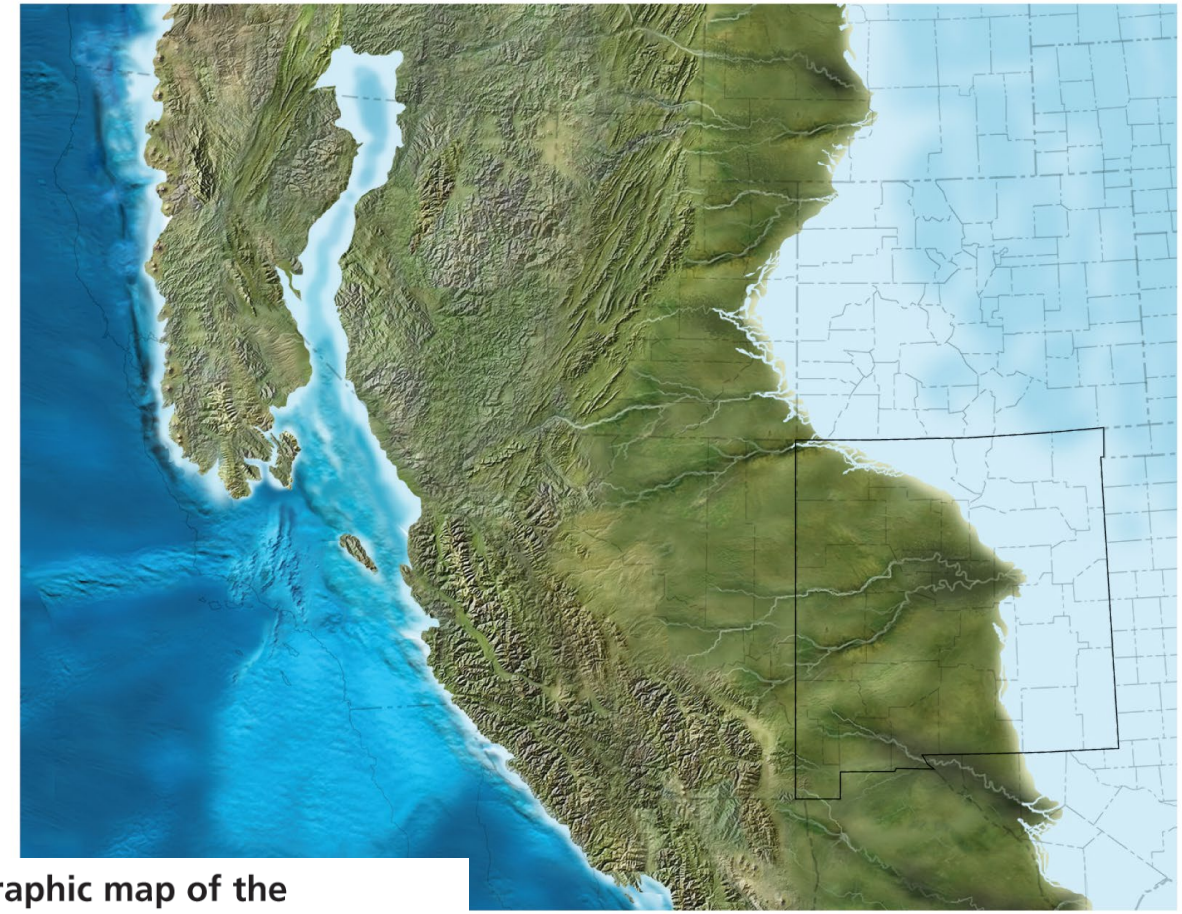




Transition from near sea level to uplift of mountains to the south; NE flow

Burro Canyon Formation

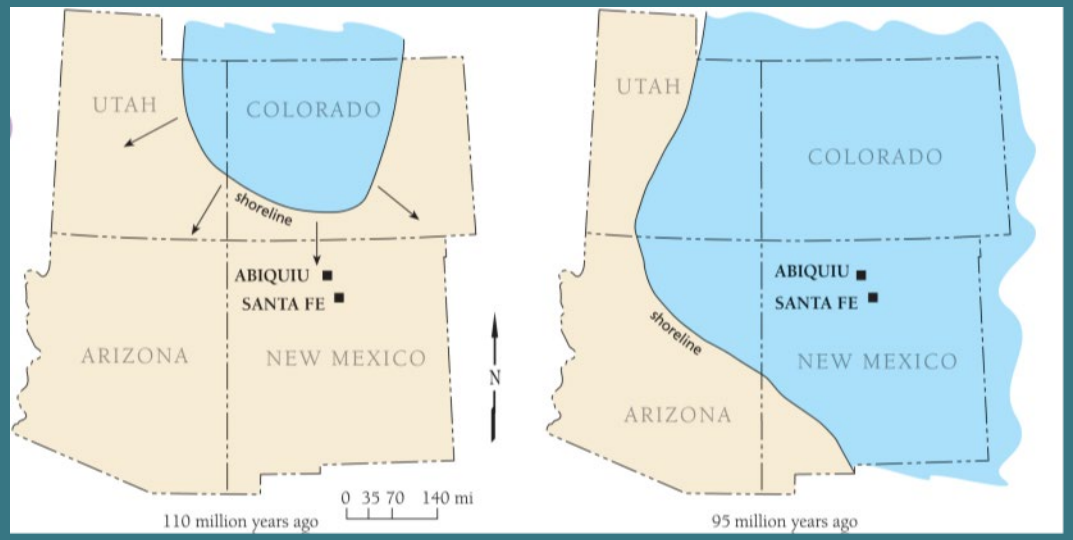
Early Cretaceous conglomeratic, cross-bedded river deposit derived from highlands to the south.

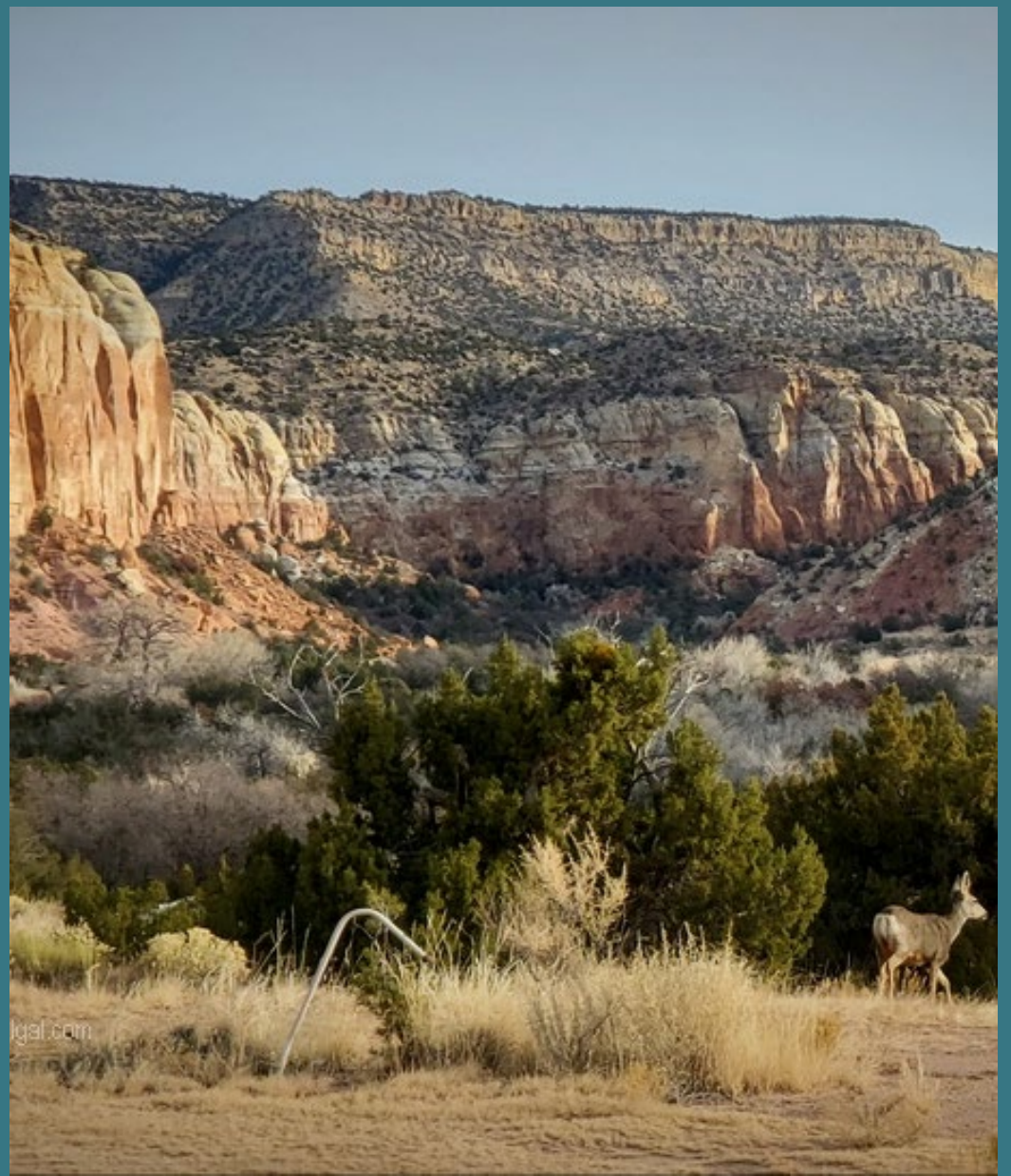


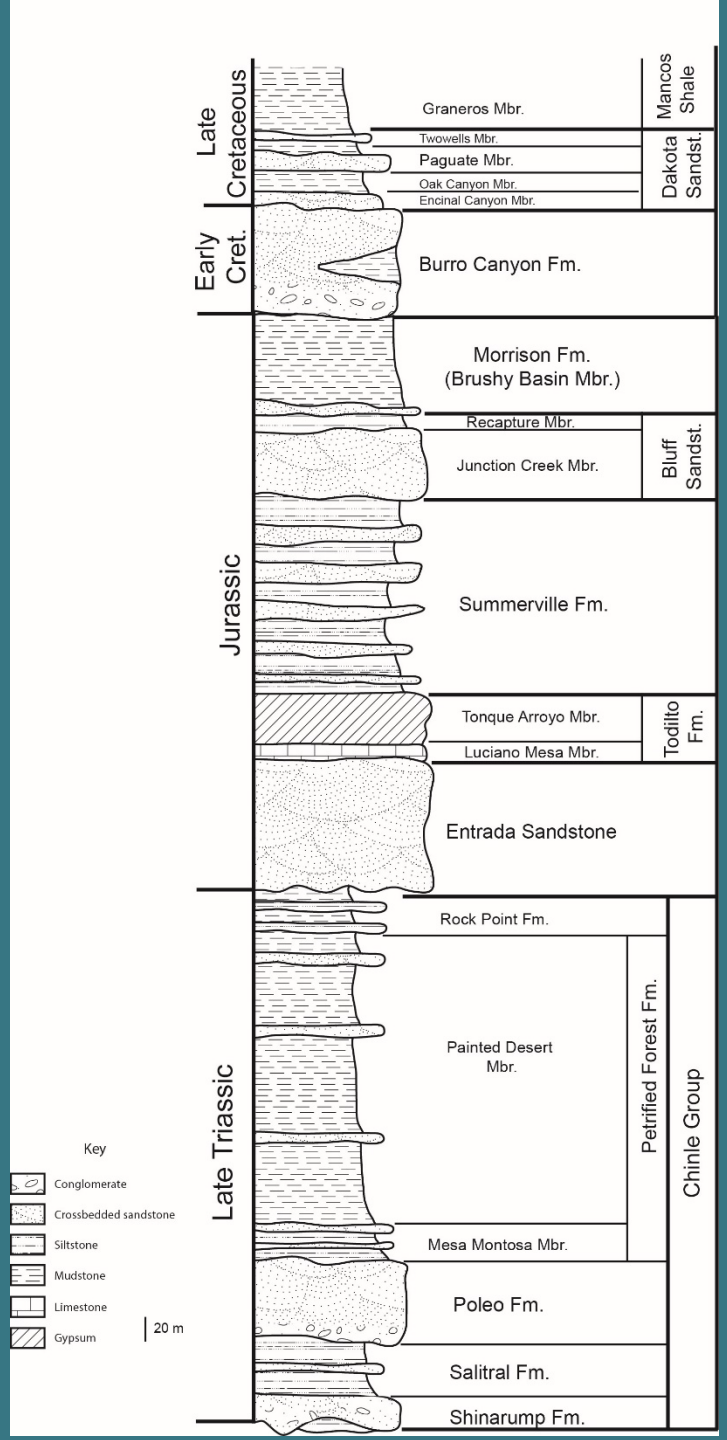
Paleogeographic map of the southwestern U.S. during the Late Cretaceous, approximately 75 million years ago. New Mexico at that time was characterized by predominantly terrestrial environments—rivers, floodplains, and swamps.

Cretaceous Period – Dakota Formation (~100 Ma)

- Mostly sandstones on highest mesas
- Deposited on coasts of inland sea
- Found across the interior North America







Important Aquifers

Dakota Sandstone

Bluff Sandstone

Entrada Sandstone

Shinarump (Agua Zarca) and Poleo members of the Chinle Group

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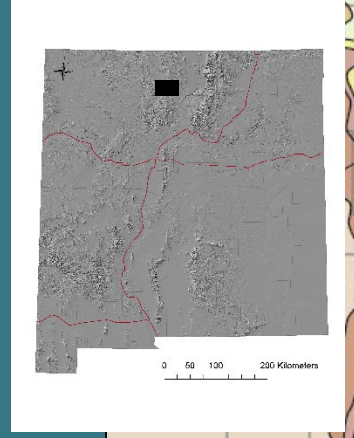

Chama Basin

Rio Grande rift

Abiquiu Reservoir

MESA VIEJOS

Chama

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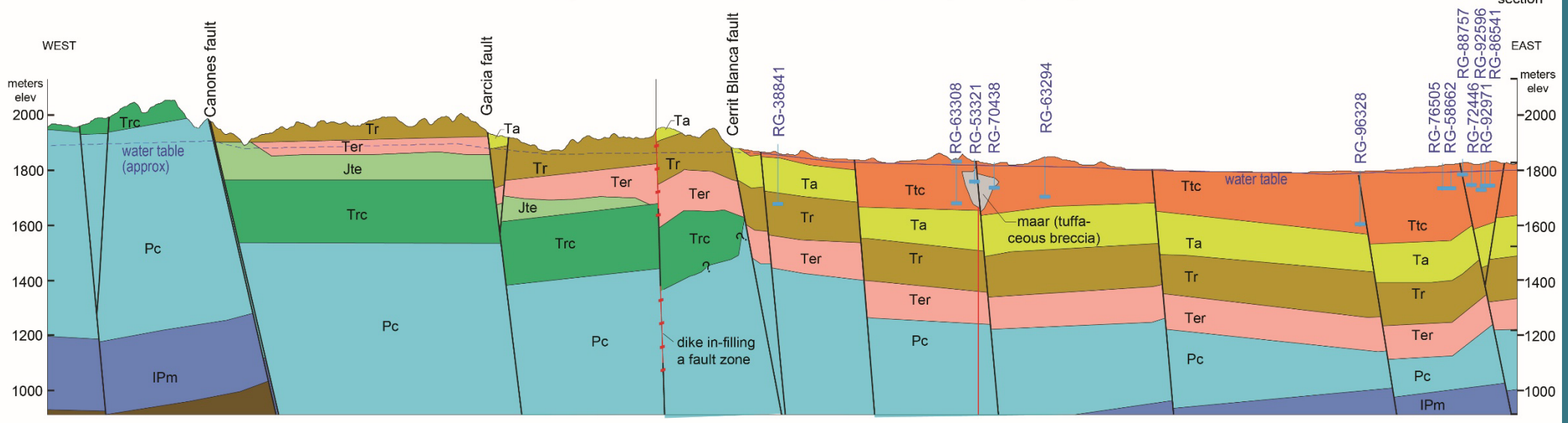
Abiquiu-Medanales cross section (west part)



3X vertical exagggeration

1:40,000 horizontal scale

Potentiometric surface (~ water table)

0 1,000 2,000 3,000 4,000 Meters

0 5,000 10,000 Feet

Potentiometric surface (~ water table)

Potentiometric surface (~ water table); approximate depth

Well; depth not known, projected orthogonal to cross section line from within 1.5 km.

Well; surface elevation and depth is known, projected orthogonal to cross section line from within 1.5 km.

EXPLANATION

Qa Quaternary valley fill alluvium - Weakly consolidated sand, gravel, and minor silt-clay

TESUQUE FORMATION (SANTA FE GROUP)

Tto Ojo Caliente Sandstone - Tan sandstone that is fine- to medium-grained, moderately consolidated, mostly weakly cemented

Ttoc Transitional unit between Tto and Ttc

Ttc Chama-El Rito Member - Lt. orange sandstone interbedded with minor mudstone and conglomerate; becomes increasingly consolidated and cemented with depth.

ABIQUIU FORMATION

Ta Abiquiu Fm - White sandstone and minor mudstone and conglomerate; well consolidated, weakly to moderately cemented, variably tuffaceous.

Tr Ritito Fm - Conglomerate and conglomeratic sandstone; clasts are granitic, meta-volcanic, and quartzitic; weakly cemented and moderately consolidated.

Ter Ritito Fm - Conglomerate and conglomeratic sandstone; mostly cemented; rounded, quartzite gravel is abundant.

Jte Todilto and Entrada Fm = Gypsum (minor, variable limestone) of the Todilto is underlain by medium-grained sandstone of the Entrada Fm.

Trcl Chinle Group - Mudstone-dominated in upper-middle part (Pretrified Forest Fm); lower part is mostly a sandstone to muddy sandstone (Poleo and Salitra Fms).

Pc Cutler Group - Reddish sandstone interbedded with mudstones; minor conglomerate.

IPm Madera Group - Marine limestone and shale; minor intervals with sandstone beds.

XY Proterozoic rocks - Granite, gneiss, schist.

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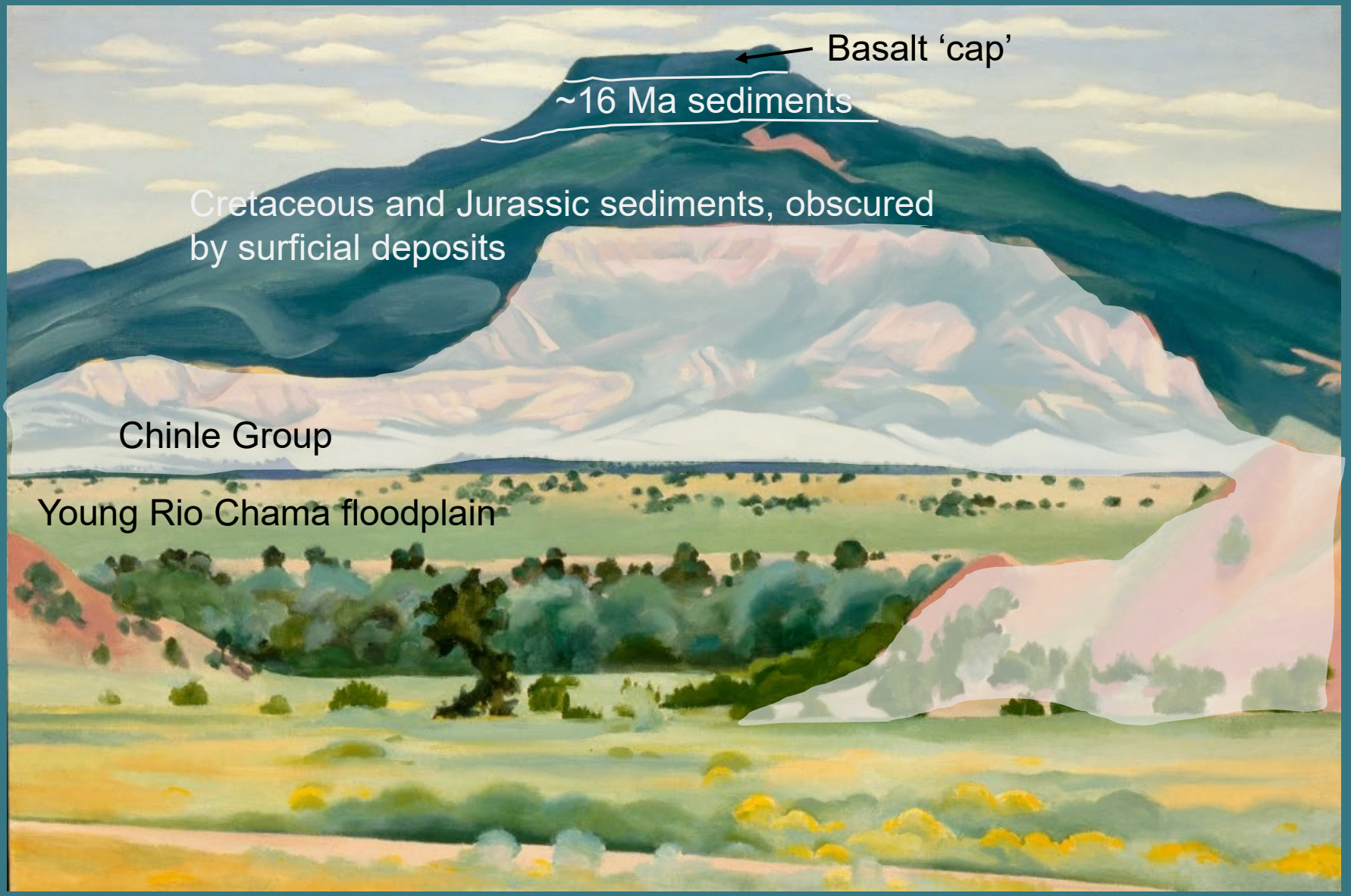
My Front Yard, Summer, 1941



My Front Yard, Summer, 1941