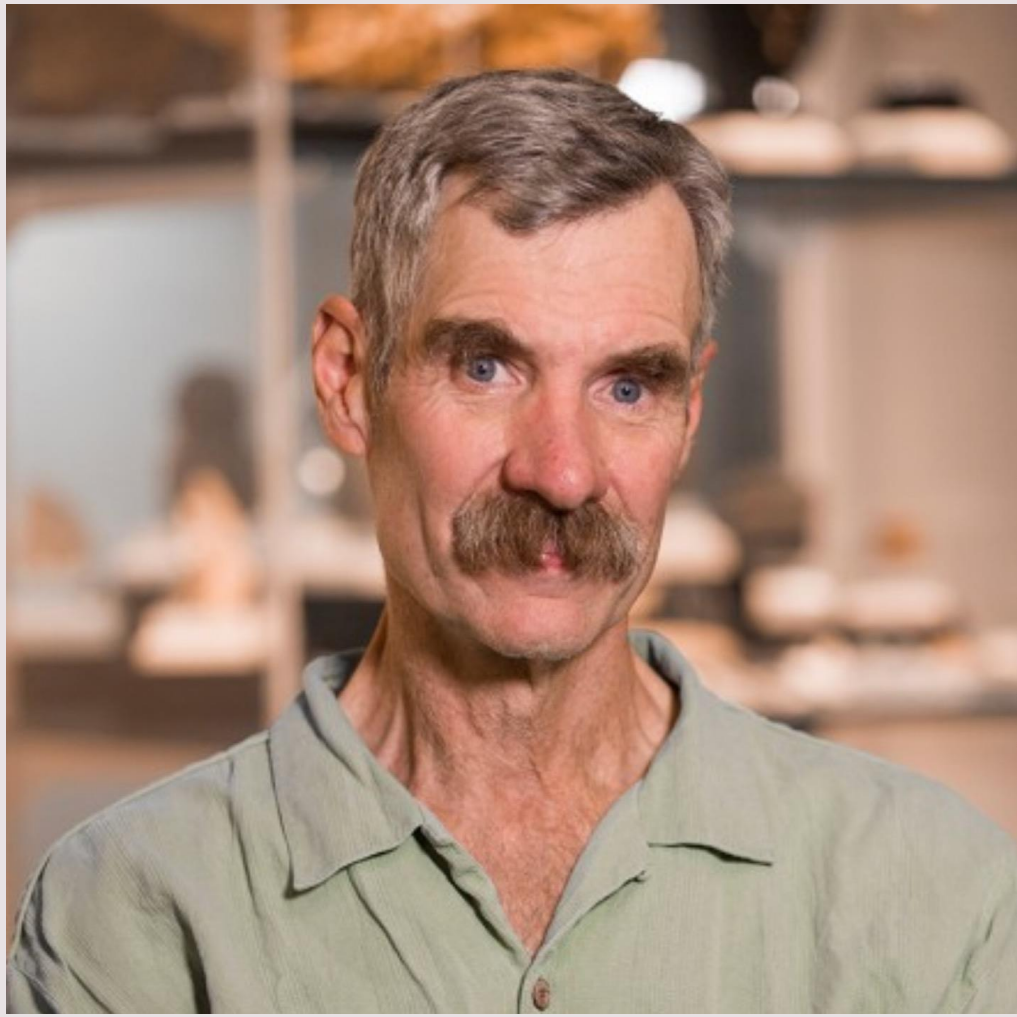
GJH Field Trip to Colorado & New Mexico

Across the Colorado Plateau from the Unita Uplift to the Rio Grande Rift

April 19 - 30, 2022

John Geissman, Our Guide

John Geissman is Professor Emeritus of Geoscience at the University of Texas at Dallas and Professor Emeritus of Earth and Planetary Sciences at the University of New Mexico. John Geissman's research interests lie in the fossil magnetic properties of geologic materials and their use in addressing geologic problems, in structural geology, tectonics, and stratigraphy. He was Editor-in-Chief of the Geological Society of America Bulletin for six years, the Solid Earth Science Editor for Eos for ten years, and, most recently, the Editor-in-Chief of Tectonics for seven years. He has served on several National Science Foundation Earth Sciences and was a Council Member for the Geological Society of America, was Chair of its Publications Committee and became GSA President in 2011. In his capacity as Past President, he served on the Governing Board of the Council of Scientific Society Presidents. He is a Fellow of the American Geophysical Union and the Geological Society of America. John Geissman has published over 275 papers in peer-reviewed journals, and has given hundreds of invited scientific presentations. He was an adjunct Full Professor at the University of Michigan, where he was involved in teaching the capstone Field Geology course at Camp Davis for 45 years.



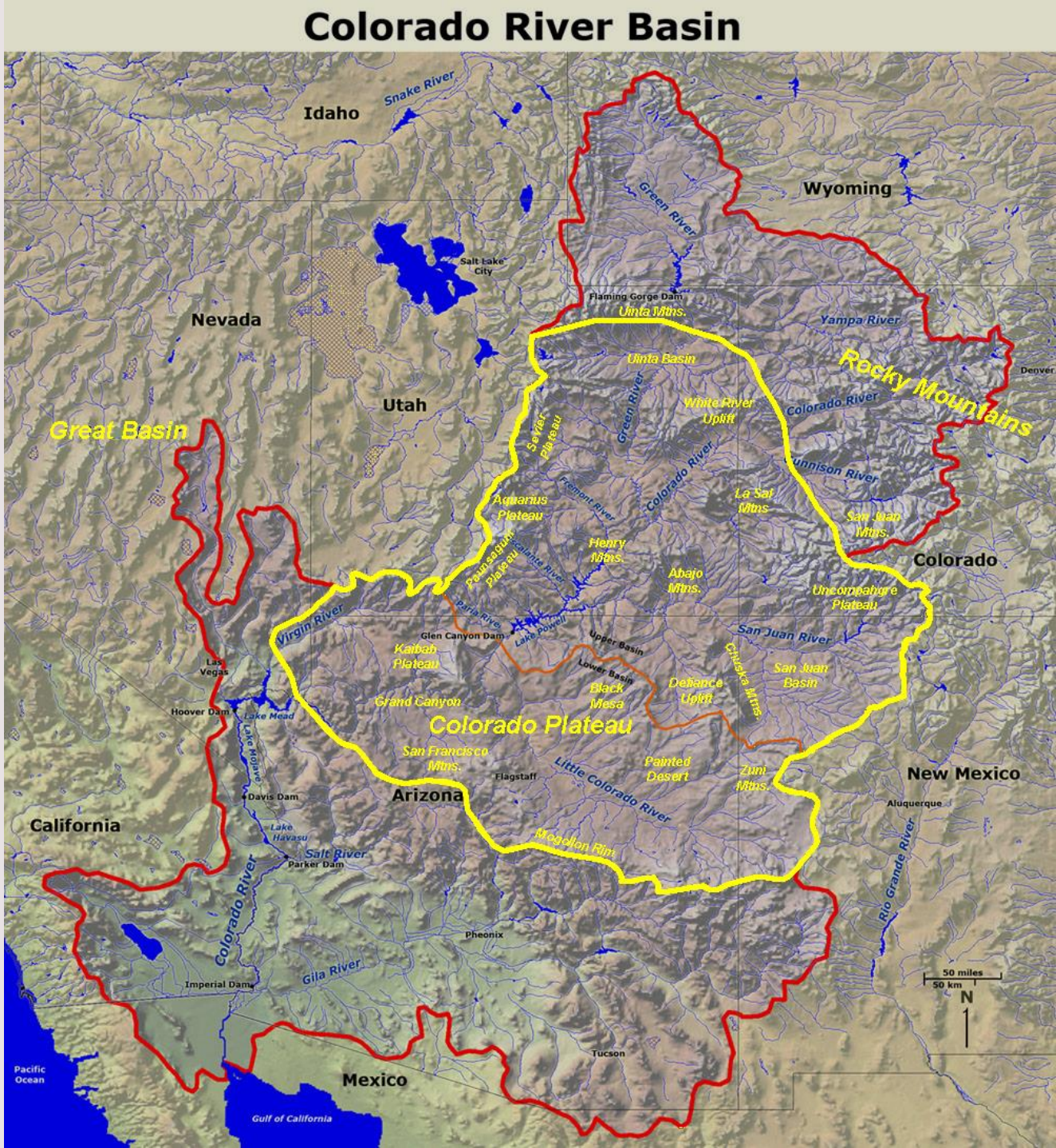
John has studied sequences of sedimentary rocks deposited across the Permian-Triassic boundary, in the Karoo Basin of South Africa, in western China, and in northwest Texas. He has conducted field work in northern Vietnam, in southern Mexico, and throughout the western United States. John and a small number of colleagues organized the Colorado Plateau Coring Project, the first phase of which was conducted in 2013 at Petrified Forest National Park. A second, much more ambitious phase, which will concentrate on Triassic-Jurassic boundary sections, is planned to begin in 2022 or 2023 at the latest.

He is married to Molly and has one adopted son. On the side, he is an avid cook, skilled at basil and pepper growing, and an enjoyer of fine, "old" grape juice in 750 ml bottles. He relishes listening to vinyl on a stellar turntable, is an avid reader and cyclist, and heavily involved in the promotion of sound science education at the K-12 level in New Mexico.

		New Mexico	Field Trip	
	Day		Plan	Lodging
Tuesday 19-April	1	JH to Sheep Canyon 300 miles (5hrs)	Driving from JH; Arrive (2PM) at Sheep Canyon - Uintas	Stay Vernal - Microtel
20-April	2	Vernal to Black Canyon 212 miles (5hrs)	Drive to the north rim of the Black Canyon of the Gunnison	Stay Montrose – Country Lodge
21-April	3	Drive to Crested Butte to Gunnison 90 mi (2hrs)	Drive to the Crested Butte area	Stay Gunnison Holiday Inn Express
22-April	4	Gunnison to Buffalo Pass & return 4 hrs	Drive through NW part of the San Juan Volcanic field	Stay Gunnison Holiday Inn Express
23-April	5	Gunnison to Alamosa 124 miles (2 hr 13min)	Great Sand Dunes NM and Sangre de Cristo Range	Stay Alamosa Holiday Inn Express
24-April	6	Walsenburg - Alamosa 72 miles (1 hr 13min)	Huerfano River Valley	Stay Alamosa Holiday Inn Express
25-April	7	Alamosa - Taos 105 miles (2 hrs)	Northern Rio Grande rift features	Stay Taos Hampton Inn
26-April	8	Taos	Other Geology/Culture	Stay Taos Hampton Inn
27-Apri	9	Taos - Albuquerque 132 miles (2 hrs 20min)	Jemez Mountains and San Ysidro area	Stay Bernalillo Holiday Inn Express Farewell Dinner
28-April	10	Albuquerque - Socorro 75 miles (1 hr)	Depart south....More Rio Grande rift geology	Stay Socorro Best Western
29-April	11	Socorro to Moab 450 miles	Drive to Moab, Utah See Arches NP	Stay Moab, Utah Inca Inn

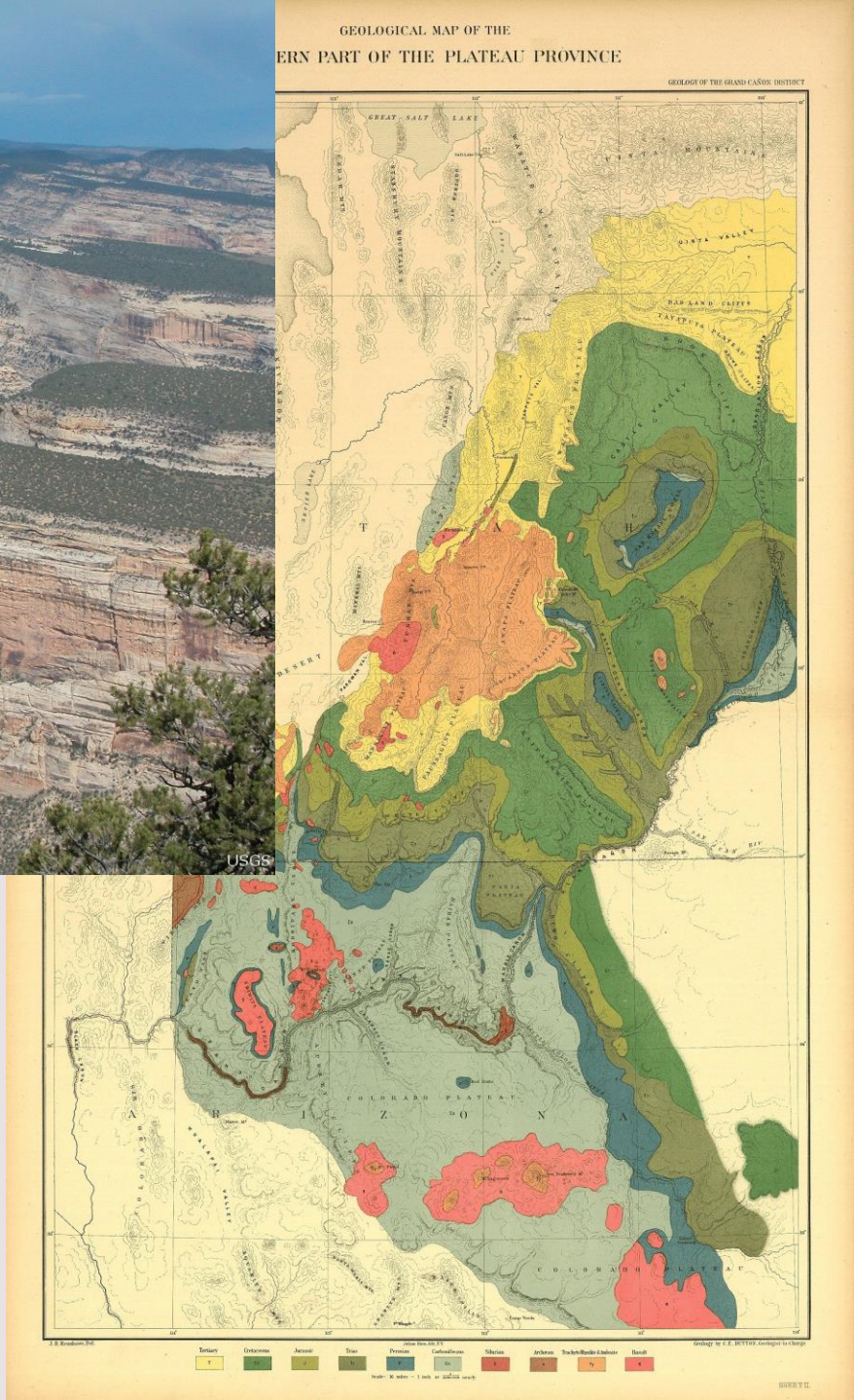
Geology of the Colorado Plateau

- Region of flat lying sedimentary & volcanic rocks west of the Rockies, ~7,000-9,000 feet above sea level
- General area escaped pulses of orogeny (e.g., Sierra Nevada magmatism, Cordilleran fold/thrust belt, and basement-involved crustal shortening forming the Central and Southern Rocky Mountains
- It is floored by ca. 1.8 billion year (Ga) old folded continental margin rocks that were injected by 1.7 & 1.4 billion year old granite
- Bounded by ~2.5 Ga Wyoming Province & Uinta uplift to north, Rio Grande rift to east, and the Basin and Range province to the west & south



Paleozoic Geology of Colorado Plateau

- North America formed the core of Rodinia; in the Neoproterozoic (ca. 780 Ma) the drift history began
- Transgressive Cambrian sandstones well-cemented into quartzite
- Ordovician & Silurian rocks (419-485 Ma) are largely missing
- Devonian & Mississippian limestone formed in shallow seas above the Cambrian
- During Pennsylvanian time shallow seas evaporated leaving thick layers or salt; Permian regression



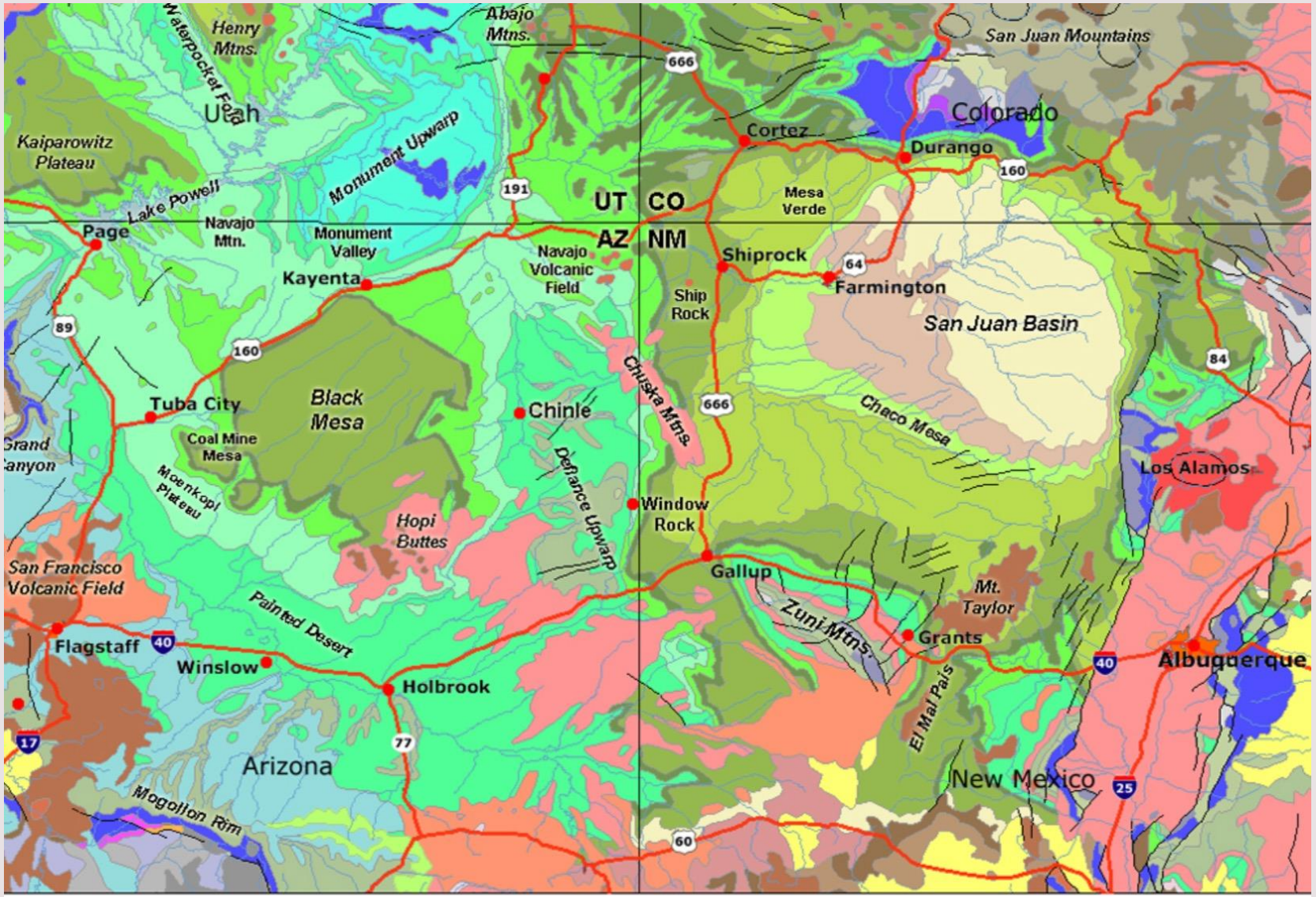
Mesozoic Geology of Colorado Plateau

-Triassic rivers spread floodplain & delta sediments

-During Jurassic time subduction off the west coast built the Sierra Nevada mountains that blocked moisture creating a broad dune-swept region similar to the Sahara Desert that deposited the Wingate, Navajo, & Entrata dune sandstones

-As the plate drifted further north the climate changes and the deserts were replaced by lush, swampy lowlands depositing mud, sand and volcanic ash of the Morrison Formation, famous for dinosaur fossil

-The Cretaceous saw more mountain building in the west causing the land to rise and the seas to retreat leaving sand, mud and swamp deposits of the Mesaverde Formation



Day 1 April 19, 2022
Depart Jackson to Sheep Canyon, Uinta Mountains

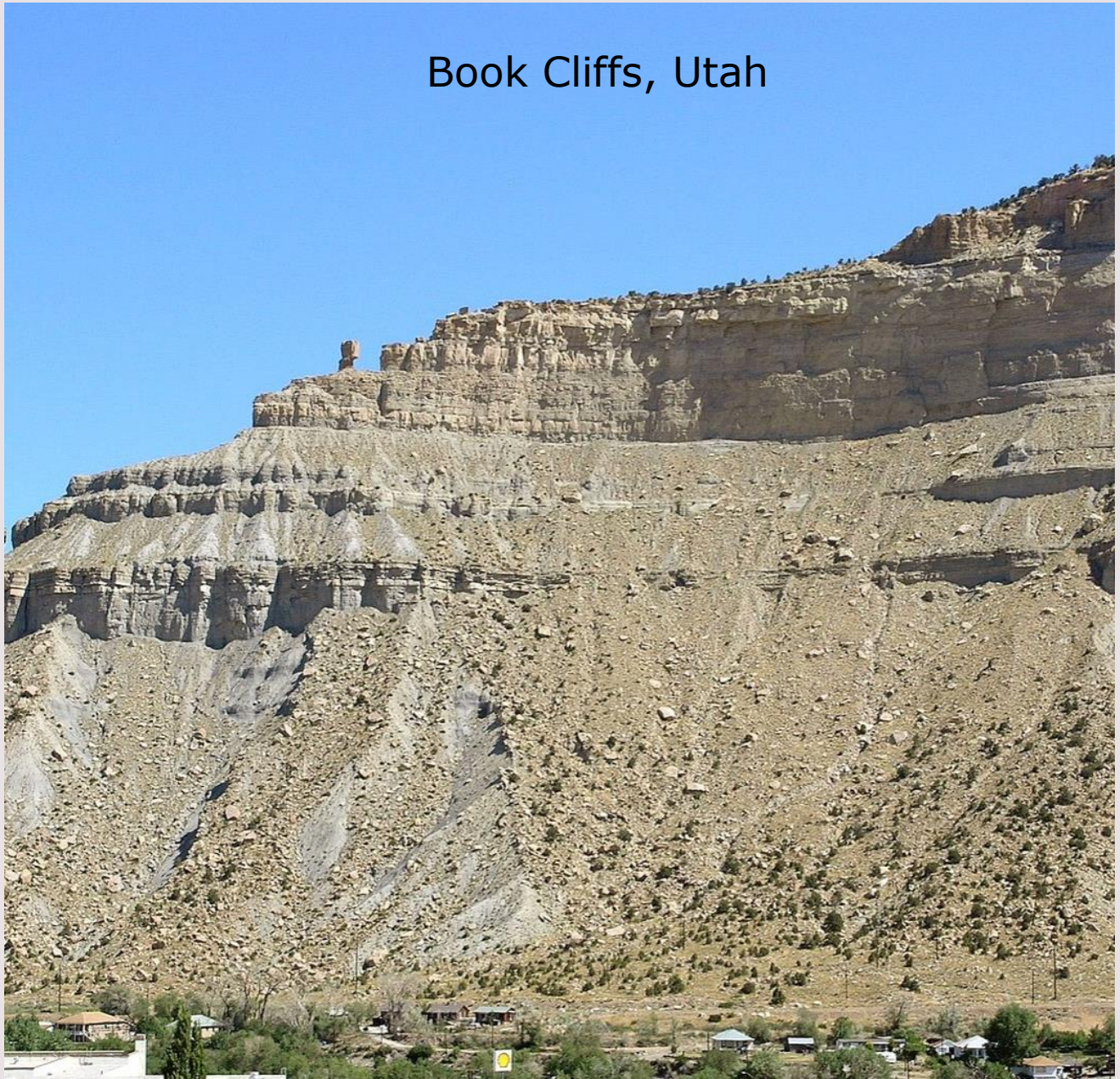
- Leave Jackson by 8 AM
- Phanerozoic section along the north flank of the Uinta Mountains.
- Including the Neoproterozoic Uinta Mountain Supergroup
- If camp can be set up early, will take group on an amazing hike to inspect Uinta Mountain Supergroup stratigraphy

Day 1-2
Sheep Canyon, Uinta Mountains

- Sheep Creek Canyon is a scenic area depicting almost 800 million years of geologic history,
- The oldest rocks were deposited around 770 Ma, first in streams, then in marine environments indicative of an encroaching sea.
- Strata representing the subsequent 410 million years are missing (unconformity).
- Seas flooded this region 350 Ma, and deposited shallow marine and coastal sediments for 65 my
- The seas completely withdrew and a wind-blown sand environment dominated forming sand dunes The youngest rocks in SCCGA were deposited in marine environments
- 70 Ma (Laramide orogeny) the area began to rise causing the seas to retreat forever and the Uinta Mountains to form.
- For the next 30 Ma, the rocks were uplifted, eroded, faulted, folded, and tilted steeply northward.

Day 2 April 20, 2022
Vernal to Black Canyon of the Gunnison

- **Vernal to Rangely to Douglas Pass**
- **Overview of Book Cliffs**, made up of Upper Cretaceous Dakota marine and nonmarine sandstone, the Mancos shale, and the Mesaverde are marine and brackish water, but the upper parts are fluvial non-marine.
- **Stop in Grand Junction**
- **North Rim of the Black Canyon**
- **Stay in Montrose**


Book Cliffs, Utah

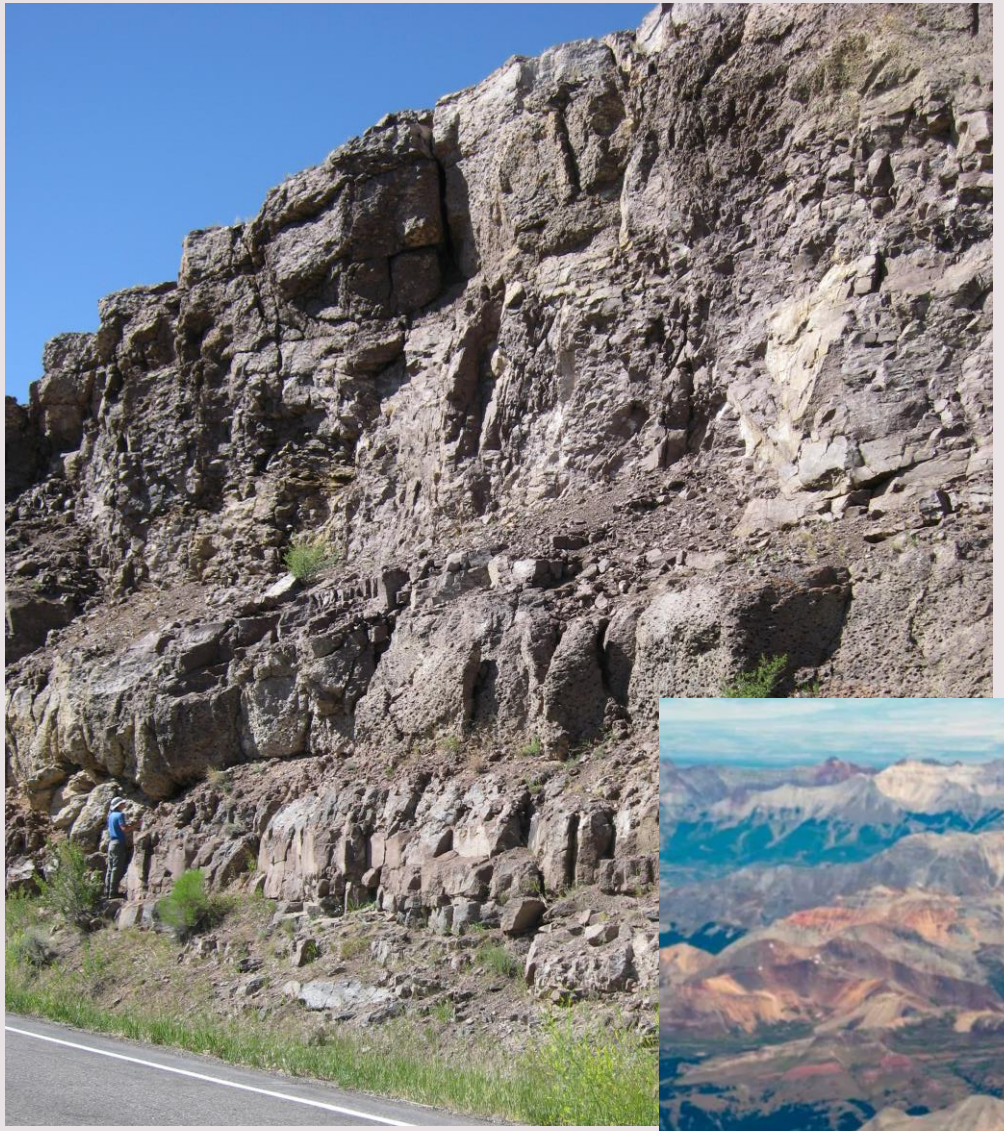
Day 3 - April 21, 2022

Black Canyon to Crested Butte - 90 miles

- **Black Canyon of the Gunnison River** -No other canyon in North America combines the depth, narrowness, sheerness, and somber countenance of the Black Canyon. The canyon is made up of Mesoproterozoic gneiss and schist formed during collisions of volcanic island arcs with the southern end of Wyoming. The lighter-colored pegmatite dikes that crosscut basement rocks formed later during this same period. The entire area experiences several uplifts
- **Blue Mesa reservoir, West Elk Breccia, ancestral Gunnison River deposits**
- **Drive from Gunnison north to Crested Butte** - Crested Butte is a laccolith formed when magma Intruded int Mancos Shale approximately 30 million years ago. The bulk of Crested Butte is composed of quartz monzonite and granodiorite porphyries. Crested Butte is one of over a dozen laccoliths in the Elk and adjacent West Elk Mountains. The magma intrusions associated with these laccoliths resulted in contact metamorphism of the surrounding sedimentary rock and mineralization.

Day 4 - April 22, 2022 - Gunnison
Drive through NW part of the San Juan Volcanic field

- **Gunnison to Crested Butte area**
- **Cochetopa Canyon.**
- **The San Juan volcanic field** is part of the San Juan Mountains in SW Colorado. It consists mainly of volcanic rocks that form the largest remnant of a major composite volcanic field that covered most of the southern Rocky Mountains in the mid-Cenozoic. There are some fifteen calderas the San Juan Volcanic Field. Volcanism initiated with andesitic composite volcanoes active between ~35 and 40 Ma, with peak activity ~35-30 Ma. Around this time the activity began to include explosive ash-flow (ignimbrite) eruptions. Many of these volcanoes experienced caldera collapse.



Road exposure, Carpenter Ridge ash-flow tuff

Day 5 - April 23, 2022 – Gunnison to Alamosa
Great Sand Dunes National Monument and Sangre de Cristo Range

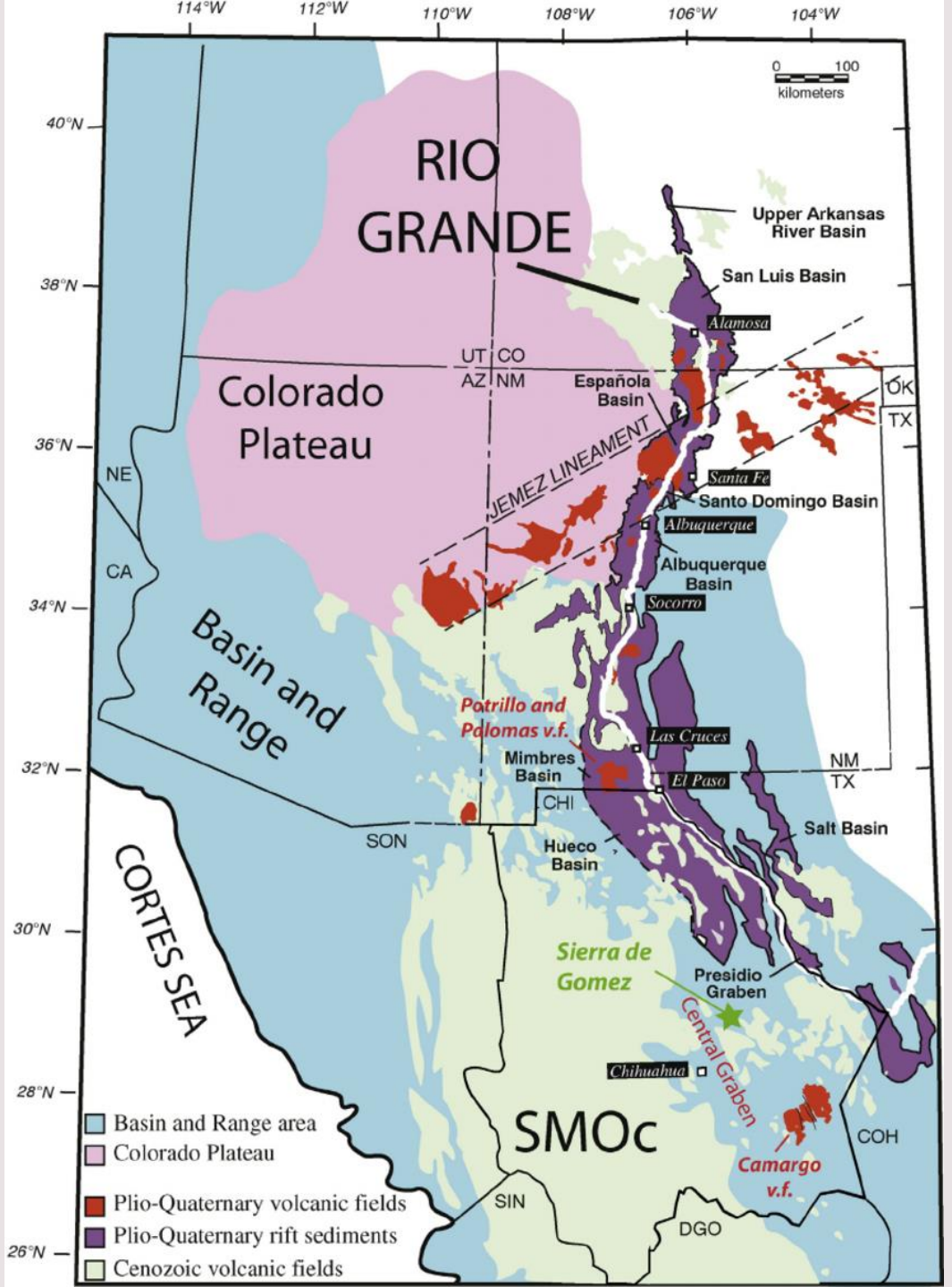
- **Buffalo Pass to Alamosa.**
- **Head north to look at the eastern Flank of the Sangre de Cristo Range**
- **Great Sand Dunes National Monument-** The Sangre de Cristo Mountains were uplifted to the east and the San Juan Mountains were formed through extended and widespread volcanism to the west. Between these two highlands, the San Luis Valley covers an area roughly the size of Connecticut. Sediments and water from both mountain ranges filled the valley forming huge lake "Lake Alamosa" that once covered much of the valley floor. Lake Alamosa receded after it broke through volcanic deposits in the southern end of the valley. The water drained through the Rio Grande, forming Rio Grande Gorge near Taos. Sand behind blew toward a low curve in the Sangre de Cristo Mountains, but during storms the winds blow back toward the valley. This combination of opposing winds, and a huge supply of sand from the valley floor are the reason that these are the tallest dunes (750 feet) and most dramatic in North America.

Day 6 - April 24, 2022
Alamosa –Sangre de Cristo Range - Huerfano River Valley

- **Alamosa across Sangre de Cristo Range. At La Veta Pass, drop down into Huerfano River Valley area. Point of Rocks at Redwing.**
- **East to Gardner and Badito.**
- **Cretaceous Interior Seaway at Badito.**
- **Back to Alamosa**

Day 7 - April 25, 2022
Alamosa – Taos -- Northern Rio Grande rift features

- **Antonito shield volcano**
- **Tres Piedras, Precambrian rocks**
- **Taos George Bridge**
- **The Rio Grande rift** represents the easternmost manifestation of widespread extension in the western U.S. during the past 35 Ma. The rift consists of three major basins. From north to south these are the San Luis, Española, and Albuquerque/Belen basins. Basin width generally decreases to the north in the rift. The Albuquerque/Belen basin is the largest of the three basins, spanning 160 km north-south and 86 km east-west at its widest points. Extension in this basin began by about 28 Ma, making it the oldest of the basins, and contains pre-rift volcanic deposits, while the central and northern parts contain volcanic rocks erupted during rifting.



Day 8 - April 26, 2022
Taos –Rift and Sangre de Cristo Range Geology/Culture

- **Half day in the field; geology of the Sangre de Cristo Range east of Taos**
- **Half day in Taos, cultural features.**

Day 9 - April 27, 2022
Taos to Bernalillo, including Jemez Mountains and San Ysidro area

- **Drive to Espanola & west to Los Alamos & spectacular basal section of Bandelier pyroclastic sequence**
- **Through Los Alamos to the Valle Grande - stop in the Valle Grande Preserve, drive up Jaramillo Creek.**
- **Leave Jemez Mountains along San Diego Canyon - Spectacular Permian Abo/Yeso Fm and Bandelier Tuff disconformity.**
- **White Mesa near San Ysidro, if time permits.**
- **End in Bernalillo.**

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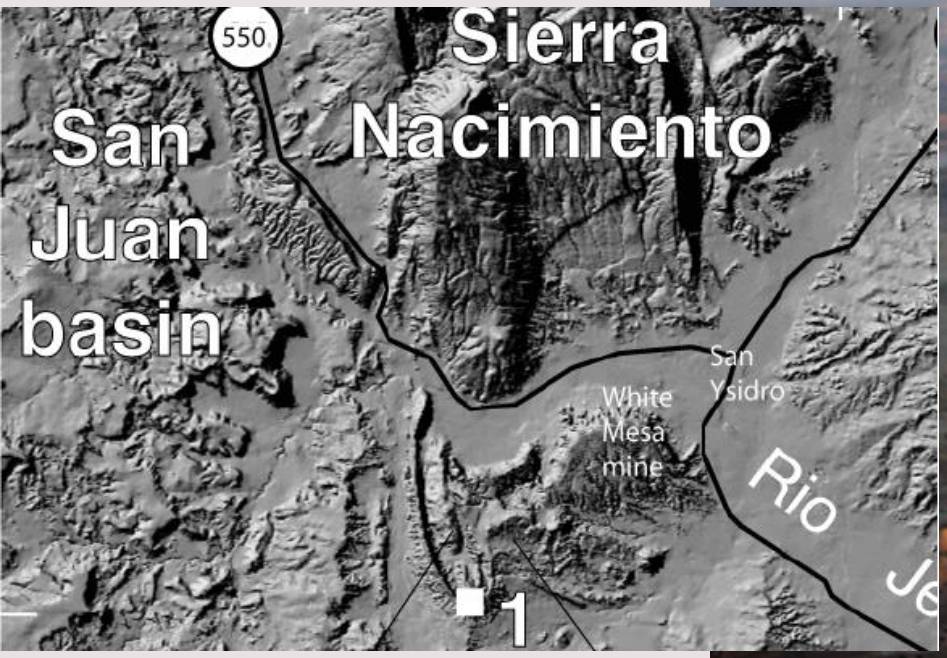
Taos to Bernalillo, including Jemez Mountains and San Ysidro area

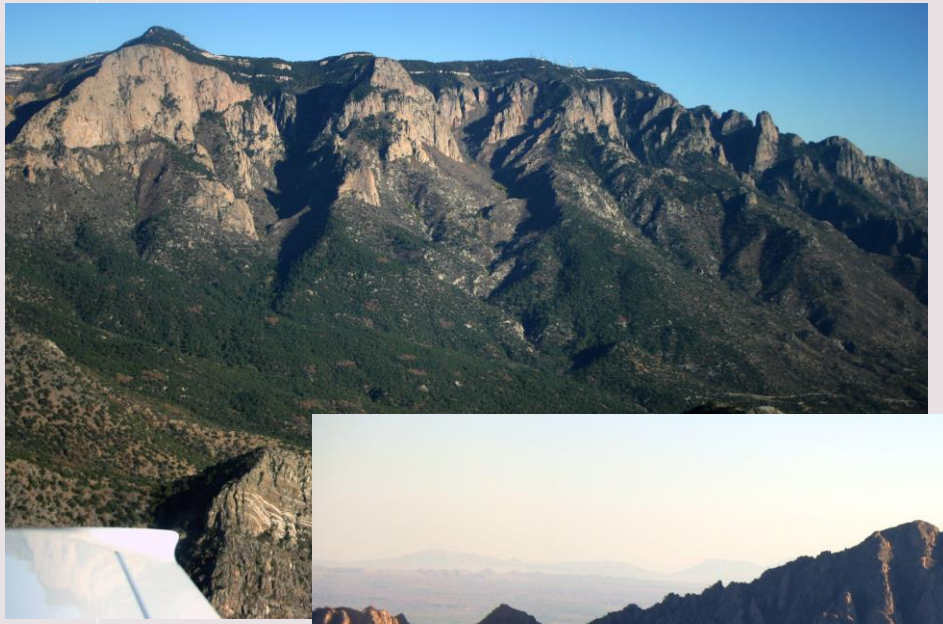


White Mesa area,
SW of San Ysidro

Arial image looking south on the White Mesa folds, Courtesy of Professor Grant Meyer

Day 10 - April 28, 2022
Bernalillo – Socorro -- Southern Rio Grande rift geology

Albuquerque/Belen basin rift geology. Heading South, back way to Socorro, via Riley and Magdalena, circling around the Sierra Ladrones. Perhaps dinner at the Owl Bar and Café, just south of Socorro.



Sandia Mountains and Sierra Ladrones, from the air, courtesy of Professor Grant Meyer

Day 11 - April 29, 2022
Socorro to Moab, Utah

The Way Home!

You can plan your own route home.

Stops along the way could include:

- **Mesa Verde National Park**
- **Monument Valley**
- **Arches National Park**

Day 12 - April 30, 2022
Moab to Jackson

- **Spend the morning in Dead Horse Point State Park**
- **Return to Jackson**

View from Dead Horse Point