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https://fourcornersgeologicalsociety.org

FOUR CORNERS GEOLOGICAL SOCIETY

September 2023

SEPTEMBER 2023 MEETING

SPEAKERS: **Christine Turner and Neil Fishman, USGS retired**

TITLE: **The Four Corners World of the Jurassic Morrison**

DATE: Friday, September 22, 2023

TIMES: 5:30 - 6:30 pm: Social Hour and Dinner - Barbeque!
6:30 pm - 7:30 pm: Society Business / Presentation
7:30 - 7:45 pm: Raffle to raise money for students

Zoom link is: LINK to Meeting
Zoom starts at 6:30 pm

LOCATION **Room 710, Sitter Family Hall** (Geology Building), Fort Lewis College with dinner served @ ~ 6 pm

COST: * $20/person. **Please RSVP by Noon Tuesday, September 19th.** ** **PLEASE go to the website** to pay (preferred) or RSVP (planning to attend). Catering requires advance notice of how many dinners to make and we pay accordingly: https://fourcornersgeologicalsociety.org/event
* **STUDENTS:** email Dr. David Gonzales directly at gonzales_d@fortlewis.edu to RSVP. At least 12 students will be sponsored. Be sure to RSVP to Dr.Gonzales in any event.

Abstract:

THE FOUR CORNERS WORLD OF THE JURASSIC MORRISON FORMATION: Flashy Streams and Ash Clouds and Animas Waters. Oh My!

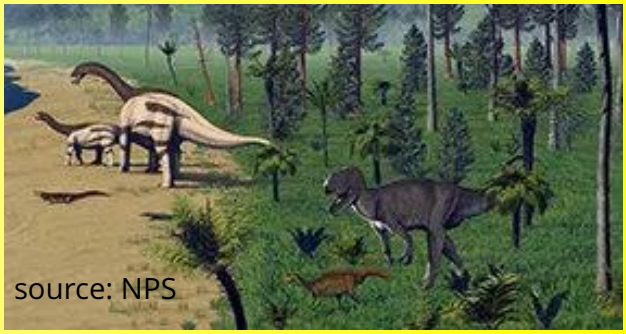
Recognized world-wide for its giant herbivorous dinosaurs, the Upper Jurassic Morrison Formation of the Western Interior has intrigued geologists for centuries. Interest in the formation was also stoked in the last century by several uranium booms. More recent studies of the formation have led to a greater understanding of its stratigraphy and sedimentology, as well as the delineation of a previously unrecognized, areally extensive, alkaline, saline wetland ("Lake" T'oo'dichi') that characterizes the Brushy Basin Member from Gallup, New Mexico to Moab, Utah

Stratigraphic understanding of the Morrison Formation has evolved through time and is essential to accurate paleoenvironmental interpretations. Recognizing the lower and upper bounding unconformities that mark the lower and upper contacts of the Morrison Formation was a crucial step to establishing the time equivalency of units that comprise the formation. In the Four Corners area, the J-5 unconformity underlies the eolian Bluff Sandstone Member of the Morrison Formation and separates it from the underlying Middle Jurassic Wanakah Formation. In addition, interfingering between the Junction Creek Sandstone Member (equivalent to the Bluff Sandstone Member in Utah) and the adjacent and overlying Salt Wash Member and lower Recapture Members has been documented, as well as onlap of the Salt Wash Member onto the Junction Creek Sandstone Member.

In the ancestral conjoined Paradox-San Juan (P-SJ) basin that extended from Gallup, New Mexico to Moab, Utah, an ancient alkaline, saline wetland ("Lake" T'oo'dichi') developed during deposition of the Brushy Basin Member. Groundwater that entered the ancestral P-SJ basin from source areas to the west was ponded downstream by the ancestral Uncompahgre Uplift that lay to the east.

With the addition of significant volumes of silicic volcanic ash that originated in calderas in the western Cordillera and were carried eastward by paleowinds, a unique and extensive wetland system developed. This wetland was characterized by a combination of extreme evaporative concentration of pore waters in response to hot and dry climatic conditions, and hydrolysis of the great volumes of silicic volcanic ash that increased the alkalinity and salinity of the pore waters. Through varying degrees of alkalinity and salinity over time, a concentric pattern emerged across the depositional basin that can be mapped by the dominant authigenic mineral(s) that formed in the tuffs. From the margins of the wetland to the center, the transition from less concentrated to more concentrated pore waters led to a pattern from the margins to the center: Smectite formed from pore waters at the margins, which gave way basinward to the zeolite clinoptilolite, followed by analcime+/- k-spar, and thence albite in the center of the basin.

Outcrops in the Four Corners area exemplify the nature of the extreme evaporative conditions required for the formation of "Lake" T'oo'dichi'. Together with recognition of the eolian Bluff/Junction Creek Sandstones as a part of the Morrison Formation, we infer a drier paleoclimate throughout deposition of the Morrison Formation than was previously thought.



source: NPS

Our Speakers:

Dr. Christine Turner and Mr. Neil Fishman, USGS, retired

Christine Turner

Christine Turner was born on Long Island, N.Y., the "scrapings of New England" according to her geology professor at the College of William and Mary in Virginia, where she obtained her bachelor's degree in geology. She came West to obtain her M.S. in Geology at Northern Arizona University and a Ph.D. at the University of Colorado, Boulder in 1987. As a research geologist for 37 years at the U.S.G.S. in Denver, Colorado, she pursued field studies, largely on the Colorado Plateau. Beginning her research in the Triassic-Jurassic rift basins of the Eastern U.S., she ultimately came back West and spent most of her career studying the Upper Jurassic Morrison Formation throughout the Western Interior. Her studies included elucidating a new model for the genesis of primary uranium ore in the San Juan basin of New Mexico; delineating an alkaline, saline wetland ("Lake" T'oo'dichi') in the Brushy Basin Member that extended from Grants, N.M. to Moab, Utah; and reconstructing the extinct ecosystems of the Late Jurassic dinosaurs of the Morrison Formation in the Western Interior as project lead on a collaborative, interdisciplinary U.S.G.S./N.P.S project. Beginning in 1981, she has enjoyed a long term and productive collaborative partnership with U.S.G.S. colleague Neil Fishman, whose extensive expertise in sedimentary petrology was not only complimentary to her field studies but also was crucial to interpretations in each of their collaborative efforts. She also enjoyed working with her late husband, Dr. Fred Peterson, whose legendary expertise in the stratigraphy and sedimentology of the Jurassic of the Colorado Plateau was indispensable to their joint studies. During the course of her career, Christine was an AAPG Distinguished Lecturer, and a U.S.G.S. Bradley Distinguished Lecturer. She was awarded numerous best paper awards from AAPG and SEPM; and, along with Neil Fishman, was awarded a U.S.G.S. Gilbert Fellowship. She edited several volumes on the Morrison Formation and published numerous scientific papers. Her reluctant forays into management at the U.S.G.S. included serving as Chief of the Branch of Sedimentary Processes and Acting Eastern Regional Geologist. She always was delighted to return to her field studies after these management stints.

Neil Fishman

Neil Fishman, a lifelong Coloradan, earned a BA in geology from the University of Colorado in 1979, and obtained an MS in geology in 1981, again from CU. He worked for over 33 years as a research geologist (sedimentary petrologist) with the U.S Geological Survey, focusing on diagenesis that bears on understanding processes related to accumulations of energy resources such as uranium, coal, and petroleum. He worked collaboratively with Christine Turner on the Jurassic Morrison Formation across the Colorado Plateau, as well as on other energy-related projects in the U.S. In 2012, he left the USGS to become a Senior Geological Advisor in the Unconventional Technology Team for Hess Corporation, Houston. At Hess, the focus of his work was on evaluating unconventional petroleum systems, both domestically and internationally, and performing research

on these complex systems. Fishman worked collaboratively with a select team of industry scientists in development of new analytical workflows to obtain accurate and reliable lab data, particularly on cores taken from low porosity/permeability oil reservoirs in which pore waters are hypersaline. He also directed research projects ranging from identification of pores and pore types in unconventional reservoirs to acquisition of representative digital rock data to estimate permeability on tight reservoirs.

Fishman is a GSA Fellow and has won awards for presentations at technical meetings as well as for peer-reviewed publications. He has published, as senior or co-author, about 70 technical papers and has co-edited 3 volumes related to energy resources. The last volume he co-edited—AAPG Memoir # 120 on mudstone diagenesis—won the 2022 AAPG Robert H. Dott Memorial Award. Leadership positions Fishman has held include 1) Chair of the AAPG-EMD Shale Gas and Liquids Committee, 2) Councilor for the Geological Society of America, 3) chair of several GSA committees, and 4) Chair of the CU Department of Geological Sciences Advisory Committee. He has also served on the organizing committees for many local, national, and international technical meetings.

Montezuma Creek

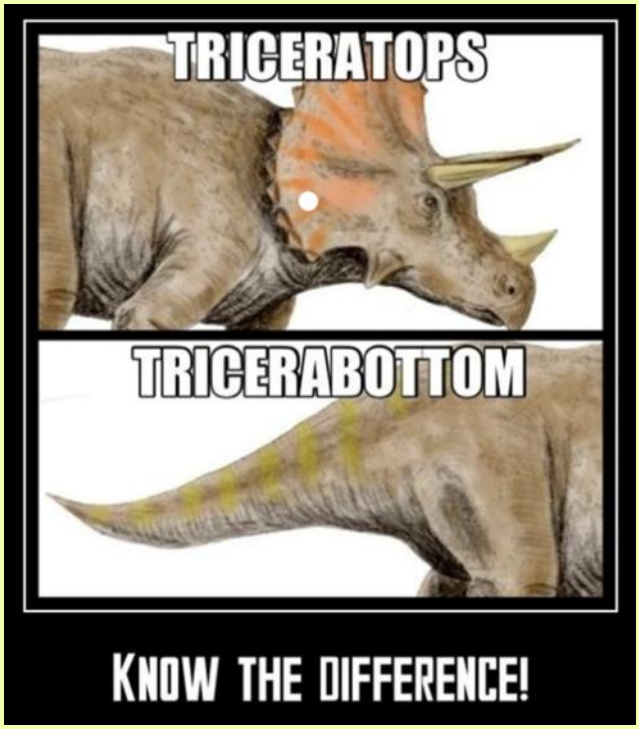
"**PREZ SEZ**" by Chris Heine

Hello FCGS Members!

Welcome to the 2023-24 FCGS monthly newsletter, and to answer the all-important question 'What rock formation is green, purple, orange, blue and known for dinosaur fossils and hosts uranium? I know it sounds like the start of a bad joke, but it's not… The answer is, the Morrison Formation. For those of you who will be attending the Morrison Formation field trip September 23-24, you will be treated to a weekend of great outcrop geology, fabulous fall colors and a chance to mingle with your geo-colleagues. This first field-trip of the 2023-2024 season will be preceded by a Friday, 9-22-23 evening talk by trip leaders Dr. Christine Turner and Mr. Neil Fishman, retired USGS. So mark your calendars and get your reservations in early for this Friday dinner meeting and talk.

The annual August picnic held at the Junction Creek picnic area was once again very well attended with around 75 people throughout the day. In addition to great food the picnic had a fund-raising raffle coordinated by Tom Staatz. Well done Tom and thank you! It's beginning to become a little monotonous but Devin Hencmann took home the coveted horseshoe title... AGAIN. I think Devin needs to throw left-handed next year, although with this much lead time, he may still beat us, even wrong handed.

The speaker calendar for the 2023-24 season is now complete. If you have a talk you wish to offer as a back-up just in case there is a last minute cancellation or a weather related no-show, talk to David Gonzales or myself.



Best regards,

Chris

Pun of the month:

What do you call a can of soda found in a conglomerate?

Coca-Cola Clastic.

FIELD TRIP COMMITTEE NEWS

Main Street, Ironton in Ouray County, Colorado. Photo (between 1880 and 1920) courtesy of the Denver Library.

Join Fort Lewis College Alumni & Students on a Field Trip to Red Mountain!

Dr David Gonzales, Trip Leader

Oct 7th, 2023

Society Members who are not Fort Lewis College alumni have been invited to join a field trip hosted by Dr David Gonzales and the FLC Alumni Office on a ~2-mile roundtrip hike just north of Red Mountain Pass on Saturday October 7, 2023. Dr Gonzales will discuss the geology and rich mining history of the area. Participants will arrange their own transportation and will meet in the parking area near the old townsite of Ironton, just off of HW550N on the east side of the road. The pull off is at 37.939290°, -107.671888°, near mile marker 85. The Alumni office will provide lunch after the hike. There will be a $10 fee.

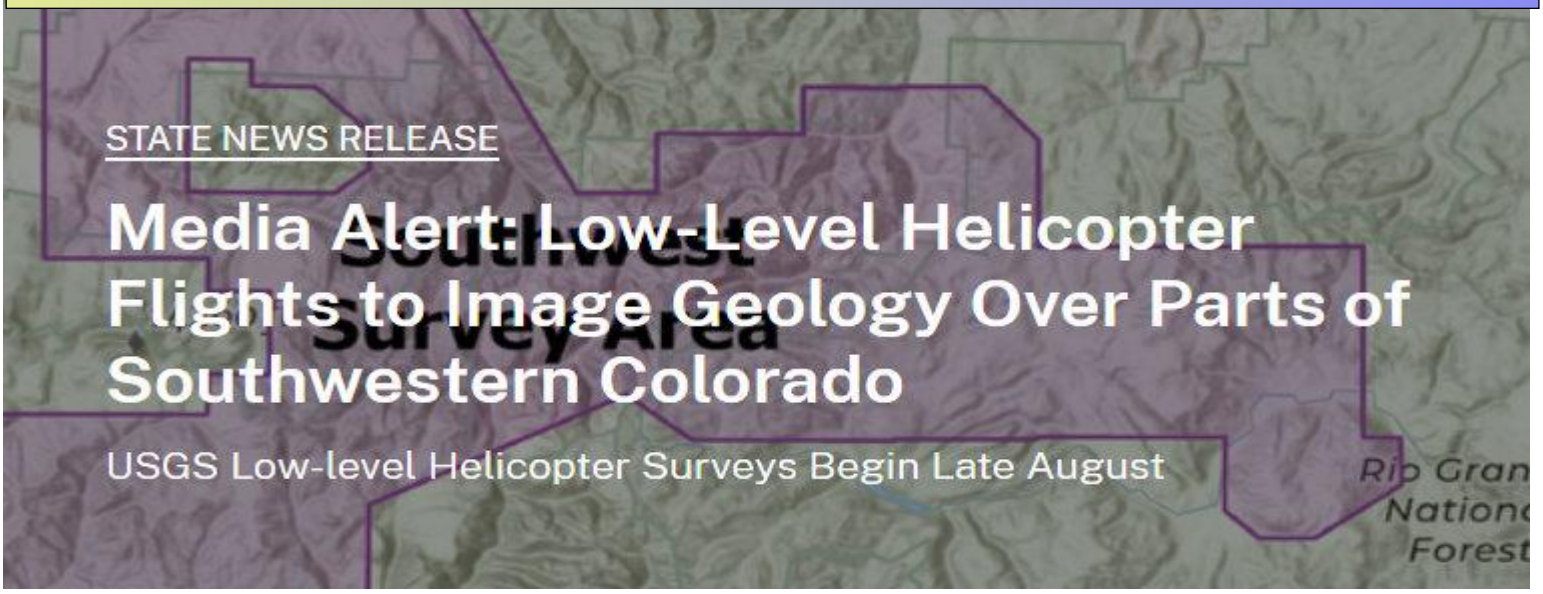
The tentative schedule is:

1. Meet in Ironton townsite parking area at 10 am
2. Brief introductions and discussion till 10:20.
3. Hike and discussions till 1 pm
4. Lunch and socializing till 2:30 or 3:00 pm.
5. Leave at 3:00 pm

Signup will be announced soon.

For More information Contact Jim Corken rjcork@aol.com or 970-759-2567

FCGS NEWS YOU CAN USE



Low-level helicopter flights are planned over a broad region in southwestern Colorado to image geology using airborne geophysical technology. The survey will be conducted from late August 2023 for approximately 3 months, then resume in spring 2024 for about 6 months, weather and wildfire restrictions permitting. Flights will cover areas within Chaffee, Gunnison, Saguache, Hinsdale, Ouray, San Miguel, San Juan, Dolores, Montezuma, and La Plata Counties.

The flights will be based out of assorted regional airports, beginning in the southwest survey area and operating out of Durango. The flights could shift with little warning to other parts of the survey area as necessitated by adverse flying conditions.

The link is:

https://www.usgs.gov/news/state-news-release/media-alert-low-level-helicopter-flights-image-geology-over-parts

Membership dues for 2023-2024 were due on June 1st. We will send another email advising our members of their status. If you are behind, please please pay your dues. If you wish to be dropped, please let us know.

https://fourcornersgeologicalsociety.org/membership/

17th Annual VAP Fall Celebration!

Tuesday, October 24, 2023, 5:30 p.m. - 7:00 p.m.
Student Union Ballroom, Fort Lewis College

FORT LEWIS COLLEGE VILLAGE AID PROJECT DURANGO, COLORADO

FCGS NEWS YOU CAN USE

LOOKING FOR A LITTLE GEM OF AN ESCAPE FROM DURANGO?

September 23-24, Annual Gem & Mineral Show: Grand Junction, Colorado, Sponsored by the Grand Junction Gem and Mineral Club, Inc.

October 6-8: Albuquerque Fall Gem, Mineral and Jewelry Show: Albuquerque, New Mexico

ZOOM INFO to join meeting:

US: +17193594580,,98379420669# or +12532158782,,98379420669#

https://fortlewis.zoom.us/j/98379420669?pwd=Y01md3NrTkxndXlpTnFTL2RyT2N0dz09

Meeting ID: 983 7942 0669 Passcode: 447503

A Big Thank you to Dr. Jeff Geslin, Metallic Resources, Tom Staatz and the FCGS for sponsoring Students this month!

STUDENTS: email Dr. David Gonzales directly at gonzales_d@fortlewis.edu to RSVP. for the meeting. At least 10 students will be sponsored. Be sure to RSVP to Dr.Gonzales in any event.

THANK YOU SO MUCH TO ALL WHO MADE THE FALL PICNIC A HUGE SUCCESS!

Chris Heine
Tom Staatz
Kim Gerhardt
Devin Hencmann
David Schiowitz
Jeff Geslin
Jim Corken

The Cooks & Much Appreciated Help: Kern Rucker & Samantha, friends of Chris

SAVE THE DATES!

October 19, 2023:	Steve Keller
November 16, 2023:	Bethany Burke
December 7, 2023:	FLC Geology Students

2024

January 18:	Kitty Milliken
February 22:	Peter Vrolijk
March 28:	Chip Head
April 18:	FLC Student Presentations
May 16:	Doug Bartlett

FCGS ANNUAL FALL PICNIC

THANKS TO EVERYONE WHO CAME AND ESPECIALLY THOSE WHO HELPED AND BROUGHT FOOD TO SHARE.
IT WAS GREAT FUN!

REGIONAL NEWS

September GJGS Meeting
Wednesday, September 20, 2023; 7:30 PM Mountain Time; In-person and Zoom
Saccomanno Lecture Hall (Room 141 in the Wubben-Science Building), Colorado Mesa University, Grand Junction, CO
Joint meeting with the CMU Geology Students

Dr. Thomas Wright, Emeritus Scientist-in-Charge, Hawaiian Volcano Observatory
"History of Studies at Kilauea Volcano, Hawaii"

Abstract:
The earliest study of Kilauea began with a visit by missionaries in 1823, when they viewed erupting lava covering the entire floor of Kilauea Caldera and heard from the Hawaiians of the explosive eruption in 1790 that killed a passing Hawaiian army. Systematic study of Kilauea began with the founding of the Hawaiian Volcano Observatory in 1912, now part of the U.S. Geological Survey. I will describe the insights of the early observers into the volcanic processes at Kilauea, and the progress of our modern understanding, up to the destruction of communities when lava covered a significant part of the southeast coast of Kilauea in 1989 and 1990.

Zoom access opens at 7 PM. Zoom link: https://coloradomesa.zoom.us/j/91976079672
Meeting ID: 919 7607 9672

DREGS SEPTEMBER FIELD TRIP
September 23, 2023
Jay Temple, CGS trip leader.

This is a one day trip on thorium/REE in the Wet Mountains, Custer County, CO.; limited to 12 participants, with 3 spots already filled.

The Wet Mountains are located south of the Arkansas River between Canon City and Huerfano Park, CO. They are composed primarily of Proterozoic granites, migmatites, gneisses, and schists at the core and flanked by Phanerozoic sedimentary rocks along the fault-bounded margins. Tertiary volcanics are numerous at the Silvercliff and Westcliffe volcanic centers. Of recent interest are three late Cambrian and early Ordovician alkaline intrusions located near the central part of the range. USGS investigations during the 1960's through the 1980's focused on Thorium mineralization in these complexes but recognized rare earth element associations. The Colorado Geological Survey was assigned the task of mapping, sampling, and describing these deposits as part of the USGS Earth MRI project to determine the concentration and extent of these now strategic elements. This field trip will highlight some of the results of our project.

Please contact: Phil Persson (philip.m.persson@gmail.com) or secretary@dregs.org , to sign up for this trip.

REGIONAL NEWS

Inflation Reduction Act: Impact on North America metals and minerals market

To what degree will the massive Inflation Reduction Act of August 2022 (IRA) achieve its goal of accelerating the US energy transition? In significant part, that hinges on minerals — will the US be able to secure a sufficient supply of the minerals needed for the move towards net zero?

Discover how the IRA impact the North American metals and minerals market:
--Demand requirements of the Inflation Reduction Act
--Critical minerals (lithium, cobalt and nickel) market analysis
--Copper market analysis
--Demand and sourcing
--Operational challenges in North America

Report free download available at https://go.spglobal.com/NTY1LUJETy0xMDAAAAGN6xs-xlWL00dPYGClp7Nsx9HNc7Gf8TPKqleP72jag8F7aW5Uwutlmm0l7u1G0yoh1o1OApc=

CGWA Monthly Meeting
Wednesday, September 20; 12:00-12:10 pm Announcements; 12:10-1:00 pm Speaker Presentation; In-person & Virtual In-person at Geotech Environmental Equipment, Inc., 2650 E. 40th Ave., Denver, CO

RSVP here: https://cgwa.co/meetings
If you are joining virtually: https://meet.google.com/zwa-kwpt-tqi
Or dial: (US) +1 413-438-7118 PIN: 503 154 369# See: https://tel.meet/zwa-kwpt-tqi?pin=1897751326785

Speaker: Connor Newman, USGS Colorado Water Science Center, Denver
"Groundwater and Surface-Water Interactions in the Upper Colorado River Basin"

Abstract:
Groundwater discharge to streams (baseflow) likely provides substantial proportions of streamflow in the Upper Colorado River Basin seasonally and during droughts. Previous research indicates that up to 60% of annual streamflow may be sourced from groundwater. Methods for quantifying baseflow differ widely in datasets used, assumptions, and applicability however, and potential biases in these estimates have not been explored for headwater streams. As part of the U.S. Geological Survey (USGS) Next Generation Water Observing Systems (NGWOS) program, a diverse dataset of geochemical and physical data are being collecting in six tributary watersheds within the Upper Colorado River Basin and along the main stem of the Colorado River. The tributary watersheds range from alpine headwaters to high desert and include various amounts of anthropogenic disturbance. Preliminary data evaluation indicate that quantifying baseflow using a two-endmember mass balance model based on specific conductance may not adequately account for mixing from upwelling of deep groundwater, which may be substantial in some locations. These datasets illustrate the utility of isotopic tracers and temperature sensing in identifying and quantifying groundwater discharge to streams.

FOUR CORNERS GEOLOGICAL SOCIETY

P.O. Box 1501, Durango, CO 81302

MEMBERSHIP RENEWAL or APPLICATION: June 1, 2023 to May 31, 2024

NEWSLETTERS SENT BY EMAIL ONLY

*Name: _____

*Address: _____ City: _____ State: _____ Zip: _____

*Email: _____ Phone: _____

*Employer: _____

***Please check your interests:**

- ☐ Sedimentology & stratigraphy
- ☐ Structure & tectonics
- ☐ Mineralogy, petrology, geochemistry
- ☐ Igneous geology, volcanology
- ☐ Ore geology and hard rock mining
- ☐ Other mineral extraction
- ☐ Petroleum geology
- ☐ Geophysics
- ☐ Geological engineering
- ☐ Geomorphology
- ☐ Quaternary geology
- ☐ Hydrology & water resources
- ☐ Environmental geology
- ☐ Geography / GIS
- ☐ Other interest (see box)

Please Identify a Membership Category:

Active Member	$30	Any person engaged in the practice or teaching of geology or who holds a Bachelor's Degree in geological science from a college of acceptable academic standards. Degree requirement may be waived if applicant has adequate professional experience. **Highest Degree, Type and Year:* _____ **College / University:* _____
Associate Member	$30	Any person who is a graduate of a college of acceptable academic standards with major studies related to, or associated with, geology. Degree requirement may be waived if applicant has adequate professional experience. **Highest Degree, Type and Year:* _____ **College / University:* _____
Student Member	Free	Any undergraduate or graduate student majoring in geology at a college of acceptable academic standards. **College / University:* _____ **Year expected to graduate:* _____
Emeritus Member	Free	An Active Member of 65 years old or older who has been a member for 25 years including time spent in military service. **Year emeritus status was awarded*: _____
Honorary Member	Free	An Active Member who has contributed distinguished service to the profession of geology and to the betterment of the FCGS. Determination is made by the FCGS Executive Committee. **Year honorarium was awarded:* _____.

Other Professional Interests or Comments and Concerns.

Are you interested in Volunteering? If so, what is your area of interest?

**** Required information for new members. Current Members, please update.***

Please either print, complete and return this form with your check for dues made payable to: "Four Corners Geological Society" **and mail to the address above or go online to fourcornersgeologicalsociety.org .**

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