



Grand Junction Geological Society

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This Month's Presentation

Student Presentations

Ava Marso

Colton Zinke

Grant Barnes

Jacob Kitchens

Adam Tuck

Jordan Ruffner

Haley Grange

Michael Longworth

And

Braden Bensley

will present their projects

The speakers will present in person although we will also have Zoom available.

Guests Are Always Welcome

Abstracts of the talks are attached

Meeting Time and Location

May 6, 2026

Joint meeting with the CMU Geology Students

6:00 p.m.

Please note the early starting time.

Saccomanno Lecture Hall (Room 141) in the Wubben Science Building at Colorado Mesa University

Zoom Details

Andres Aslan is inviting you to a scheduled Zoom meeting.

Topic: May 6 GJGS meeting with student presentations

Time: May 6, 2026 05:30 PM Mountain Time (US and Canada)

Join Zoom Meeting

<https://coloradomesa.zoom.us/j/83036858471>

Meeting ID: 830 3685 8471

Zoom meeting starts early to allow time to connect before talks.

Important Announcements

The GJGS Council is pleased to announce that the GJGS Foundation is awarding four \$800 scholarships to students attending this summer's field camp. As of this announcement, the winners have not yet been notified.

The Foundation also plans to award cash prizes to the first, second, and third best student presentation, as determined by a panel of judges.

Abstracts

Assessing geomorphic change of the Dolores River downstream of McPhee Dam

Ava Marso

Abstract

This study evaluates geomorphic change along the Dolores River downstream of McPhee Dam by analyzing variation in channel geometry over a four-year period. The goal of this project was to understand how flow regulation has impacted channel morphology, and how the Dolores River compares to a nearby unregulated system, the San Miguel River. Data collection and analysis included RTK-based cross-sectional surveys, GIS-derived raster calculations, zonal statistics, aerial imagery, and stream gage records from multiple locations along both rivers.

Results show that geomorphic change is present at both study sites but is highly variable and largely localized rather than uniform across the channel. At Big Gypsum, zonal statistics indicate net erosion, with a mean elevation change of -0.154 m and a large negative sum (-94.48), while raster data show a wide range of elevation change up to approximately 2.44 m. These results suggest that erosion is concentrated in specific areas rather than occurring evenly across the channel. In contrast, Salt Creek exhibits more balanced conditions, with mean values near zero and more evenly distributed changes, although variability still exists between years. Aerial imagery supports these findings, showing bar development and channel narrowing at Big Gypsum, while Salt Creek shows more gradual adjustments such as side channel loss and minor bank buildup.

Hydrograph analysis reveals that while the Dolores River experiences high-magnitude flow events, these flows are short-lived and followed by extended low-flow periods. These limits sustained sediment transport and results in more episodic and localized geomorphic change. In comparison, the San Miguel River maintains longer periods of elevated discharge, allowing for more continuous sediment transport and more evenly distributed channel adjustment. This study suggests that flow duration has much control over geomorphic processes, and although the changes cannot be solely attributed to McPhee dam, there are differences in the regulated versus unregulated system, make this a topic to be considered when considering the life of a regulated river

Analysis of U-Pb Detrital Zircon Data of the Late Oligocene to Miocene Browns Park Formation, northwestern, Colorado

Colton Zinke

Abstract

Much of the Browns Park Formation in northwestern Colorado is represented by up to 670 m of fluvial and eolian sandstone, but locally it is represented by a basal conglomeratic unit that ranges from 0 to 90 m in thickness. While ash beds within the predominantly sandstone-rich portion of the Browns Park Formation are well dated, the age of the conglomeratic basal unit is poorly defined. This study uses U-Pb detrital zircon (DZ) data and tools including kernel density estimates (KDE), maximum depositional ages (MDA), and multidimensional scaling (MDS) to interpret the age and provenance of the basal conglomerate. Cross-correlation analysis of the DZ data was used to differentiate between zircons derived from specific Laramide uplifts including the Park and Sawatch ranges as well as from distal volcanic airfall. It was determined that the San Juan volcanic field is likely the dominant source of DZ grains for many areas of the Browns Park Formation. This analysis employs software tools including dzToolBox, and IsoplotR to determine more accurate MDAs. For the Browns Park Basal conglomerate a DZ MDA 29.88 ± 0.69 Ma was produced, older

than the most recent previous studies 24.5 ± 1.1 Ma (Aslan et al, 2018). It's possible this new value may be close to the absolute age due to corresponding data following the law of superposition and Late Oligocene to Early Miocene ash deposits.

Paleogeography and Provenance of the Eocene-Oligocene Telluride Conglomerate, western Colorado, USA

Grant Barnes

Abstract

The Telluride Conglomerate records an Eocene fluvial system that drained the western margin of the southern Rocky Mountains. The deposits form a clastic wedge that thickens east to west to ~250 m near Lizard head Pass and Sheep Mountain, Colorado. Despite a century of study, uncertainty regarding the age, provenance, and paleogeography of the Telluride Conglomerate remains. This study uses paleocurrents, clast counts of conglomerate lithologies, and U-Pb Zircon geochronology to gain insights into these uncertainties. A relatively thick, undeformed section at Sheep Mountain and nearby outcrops show variable gravel lithologies, indicating a mosaic of tributaries and trunk rivers draining distinct bedrock regions.

Gravel clasts fall into two main groups: (1) Precambrian quartzite and granite, and (2) Late Cretaceous(?) volcanic or shallow intrusive rocks with Precambrian quartzite. Clasts of Paleozoic and Mesozoic limestones and sandstones are present in both groups. Clast distributions suggest tributaries sourced uplands in the Needle Mountains uplift to the south and the Ouray area to the north. The Needle Mountains supplied Precambrian crystalline rocks and Paleozoic sedimentary clasts, whereas the Ouray region contributed volcanic and shallow intrusive rocks in addition to quartzite. At Sheep Mountain and Lizard Head, interbedded gravelly sandstone and sandy conglomerate represent a distal setting, likely deposited by a trunk river fed by both source areas. Paleocurrent data ($n=60$) indicate west-southwest directed flow (mean vector = 246°) from eastern and northeastern source areas.

Geochronologic analyses provide new constraints on both provenance and depositional timing. Detrital zircon (DZ) U-Pb data yield variable maximum depositional ages (MDA) consistent with deposition immediately prior to San Juan volcanism. A basal Telluride Conglomerate sample from Deep Creek resulted in an MDA of 36.11 ± 0.29 Ma, and the upper Telluride Conglomerate sample from Sheep Mountain resulted in an MDA of 34.81 ± 0.15 Ma with a youngest single grain (YSG) age of 32.2 ± 1.24 Ma. These MDA results are consistent with the Oligocene age of the overlying San Juan Formation. Plagioclase $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology dated volcanic clasts at Deep Creek and Lizard Head which range in age (~45-60 Ma), which supports an Ouray source terrain. DZ age spectra from across the study area are consistent with reworking of Precambrian, Paleozoic, and Mesozoic rocks including Late Cretaceous intrusive rocks near Ouray and supports provenance interpretations based on clast compositions. The Telluride Conglomerate is a key tectonic archive that records the transition from Laramide uplift and regional erosion to the initiation of widespread magmatism and volcanic burial in the southern Rocky Mountains.

Petrogenesis of Grand Mesa Basalts: Use of Petrography and Geochemistry to Understand Magma Production and Differentiation

Jacob Kitchens

Abstract

The genesis of Tertiary intraplate volcanism in western Colorado is not well understood. It remains uncertain whether crustal contamination or other magmatic processes occurred while magmas rose from the upper mantle, transited the lithosphere, and erupted onto the surface. Previous work on the ~10 Ma basaltic lava flows of the Grand Mesa Volcanic Field has suggested that magmatic differentiation (e.g. fractional

crystallization) and magmatic recharge occurred to produce these basalts. This study focuses on the ~22 basalt flows of the Skyway Road Cut. Complete geochemical data (XRF and ICP-MS) and four rock thin sections were used to investigate the petrogenesis of these flows. Petrographic and geochemical data suggest that these magmas are partial melts of upper mantle rock that was previously enriched by subduction-derived fluids. This agrees well with previous studies of other regional basaltic eruptions of similar age. Regional uplift in the area could have reactivated some of the Laramide structural features found near the Grand Mesa which could have been used by the magmas as easier routes to the surface.

Detrital Sanidine $^{40}\text{Ar}/^{39}\text{Ar}$ and Detrital Zircon U/Pb Dating of the Basal Goodenough Unit on Grand Mesa, Colorado

Adam Tuck

Abstract

The Goodenough unit of Grand Mesa, western Colorado, is a poorly exposed sedimentary interval preserved beneath Miocene basalt flows and above the Eocene Green River and Uinta formations. Although previously mapped as the Green River Formation, the Goodenough unit is lithologically distinct, characterized by friable sand-rich facies, volcanic pebble assemblages, and the absence of typical Green River oil shale and fossiliferous lacustrine facies. Its discontinuous preservation beneath the basalt cap and within landslide-affected exposures has made both depositional age and sediment provenance difficult to constrain.

This study uses field observations, petrography, detrital sanidine $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology, detrital zircon U-Pb geochronology, and $^{40}\text{Ar}/^{39}\text{Ar}$ dating of volcanic clasts to evaluate the age and provenance of basal Goodenough exposures at Ella Reservoir and Kaiser Slough Reservoir. Detrital sanidine provides the strongest age constraints, yielding maximum depositional ages of 42.19 ± 0.0093 Ma at Ella Reservoir and 41.64 ± 0.037 Ma at Kaiser Slough Reservoir. An Ella Reservoir detrital zircon sample yields a less precise maximum depositional age of 40.0 ± 1.5 Ma. Volcanic clasts from both sites mostly yield Eocene ages between ~42 and 45 Ma. Petrographic observations identify sandstones at Ella Reservoir as quartz-rich sandstones containing abundant volcanic lithic fragments, common feldspars, and scattered opaque grains. Observations identified sandstones at Kaiser Slough Reservoir as arkosic sandstones containing common volcanic lithic fragments.

These collections of data indicate that the basal Goodenough unit accumulated after ~42 Ma and records a mixed provenance system. Three principal sediment accumulation components are recognized: direct felsic volcanic input represented by high frequency clusters in detrital sanidine populations, erosion of Eocene plutonic source rocks represented by dated volcanic clasts, and older recycled sedimentary and basement-derived input represented by older zircon populations. Comparison of Goodenough clast ages with published Colorado Mineral Belt pluton ages suggest that the most likely volcanic and shallow intrusive source region lies in the Sawatch Range, especially near the Twin Lakes Pluton, with possible input from surrounding intrusive sources. Taken together, these results suggest that the Goodenough unit may preserve indirect sedimentary evidence of middle Eocene volcanism in the Sawatch Range that is no longer preserved in the modern landscape.

Using Detrital Sanidine $^{40}\text{Ar}/^{39}\text{Ar}$ and Detrital Zircon U/Pb Dating to Study the Upper Goodenough Unit, Grand Mesa

Jordan Ruffner

Abstract

The Goodenough unit is an informally named sedimentary deposit located beneath Miocene basalt flows of Grand Mesa and above the Eocene Green River Formation. It is poorly understood and lacks thorough research due to its lack of accessibility. Previously the Goodenough unit has been mapped as the Green River Formation

or the Uinta Formation. New results produced from detrital mineral geochronology indicate that a major unconformity exists within the uppermost Goodenough unit. At Military Park, two samples, AARC-2 and AARC-37, were dated using both detrital zircon and detrital sanidine. AARC-2 was sampled from the silty sand facies at Military Park and produced a detrital sanidine maximum depositional age (MDA) of 13.294 ± 0.085 Ma. AARC-37 was sampled from the volcanic pebbly sand facies, directly below AARC-2, and produced a detrital sanidine MDA of 41.991 ± 0.011 Ma. Detrital zircon age spectra of these two samples show dramatically different signatures. AARC-2 produced age groups of 36 Ma, 96 Ma, 160 Ma, and 1700 Ma. Major age population groups of AARC-2 are the Southern Rocky Mountain Volcanic Field/Colorado Mineral Belt magmatism (4%), Colorado Mineral Belt magmatism (3%), Cordilleran arc magmatism (17%), Appalachian orogens/Pre-Gondwanan/Grenville orogens (22%), Midcontinent magmatism (16%), Yavapai-Mazatzal orogens (30%), and THW orogens (7%). AARC-37 has detrital zircon age groups of 41 Ma, 1400 Ma, 1500 Ma, and 1700 Ma. Major population groups include the Southern Rocky Mountain Volcanic Field/Colorado Mineral Belt magmatism (49%), Midcontinent magmatism (38%), and Yavapai-Mazatzal Orogens (12%). The detrital zircon MDA of sample AARC-2 is 25.6 ± 1.05 Ma. The detrital zircon MDA of sample AARC-37 is 40.16 ± 0.37 Ma. Volcanic clasts, sample AARC-38B, were also sampled from Military Park and produced ages of 43 to 45 Ma, except for one outlier which produced an age of 30.889 ± 0.060 Ma. AARC-2 produced significantly younger ages as well as different detrital zircon signatures compared to AARC-37. The difference in detrital mineral ages as well as two distinct facies between AARC-2 and AARC-37 at Military Park suggest that there is a major unconformity within the Goodenough unit, and possibly subunits. At Goodenough unit site Ward Creek, sample AARC-1 was re-dated and produced a similar age to AARC-37. AARC-1 was also sampled from the volcanic pebbly sand facies and has a detrital zircon maximum depositional age of 42.92 ± 0.78 Ma, and a detrital sanidine maximum depositional age of 41.52 ± 0.16 Ma. Detrital zircon age groups from AARC-1 are 41 Ma, 1000 Ma, 1400 Ma, 1700 Ma, and 2100 Ma. Age population groups for AARC-1 are 27% Southern Rocky Mountain Volcanic Field/Colorado Mineral Belt magmatism, 2% pre-Gondwanan, 5% Grenville orogen, 48% Midcontinent magmatism, and 17% Yavapai-Mazatzal orogens. Based on sediment ages and clast lithologies, the sediments from the volcanic pebbly sand facies likely came from sills and plutons in the Colorado Mineral Belt, and the silty sand facies sediments are likely from airborne sediments from Yellowstone <16 Ma. Colorado mineral belt dates typically range from 39 Ma to 45.4 Ma. The volcanic pebbly sand facies have volcanic clasts in the unit that reflect these age dates.

Subsurface Interpretations of the Permian Hutchinson Salt Member in McPherson County, Kansas

Haley Grange

Abstract

The Hutchinson Salt Member in McPherson County, Kansas hosts solution mined caverns used for hydrocarbon storage and contributes to subsidence and sinkhole hazards, making its subsurface extent and geometry critical for both resource and risk assessment. Most subsurface interpretations in Kansas still rely on legacy work completed prior to modern GIS, digital elevation models, and digital well-log correlation, so existing maps lack the resolution needed to confidently characterize lateral thickness changes, dissolution margins, and structural complexity near primary storage facilities and adjacent infrastructure. In this study, publicly available raster and digital well logs, formation top-picks, well-location data, and prior mapping were compiled in S&Ps Petra software within a consistent coordinate reference system to build an updated subsurface model of the Hutchinson Salt Member in McPherson County. Gamma-ray, density, neutron, and resistivity logs were interpreted and iteratively correlated, combining manual picks with simple petrophysical cutoffs and log-signature criteria to define salt boundaries and key internal markers. The resulting stratigraphic cross section and structural and isopach maps show a regional west-east thinning of the Hutchinson Salt toward McPherson Valley and reveal a pronounced north-south trending zone of salt thinning this is interpreted as a dissolution corridor. These products provide a more defensible framework for evaluating solution-mining projects and cavern storage feasibility and establish a reproducible digital workflow that can be extended to adjacent areas and other stratigraphic units.

Evaluation of Geothermal Potential for Low Enthalpy Geothermal Applications in the Piceance Basin, Western Colorado: A Case Study of Rifle

Michael G. Longworth

Abstract

Geothermal energy development has historically been limited to regions associated with active volcanism and their elevated subsurface temperatures. Because these volcanically active areas are rare, the expansion of geothermal applications depends on finding new geologic settings with suitable subsurface conditions. One alternative setting could be sedimentary basins with existing oil and gas production. These sedimentary basins are ideal because they contain extensive subsurface data, evidence of elevated temperatures (cooked hydrocarbons), and potentially abandoned wells that could be repurposed for geothermal applications. The evaluation of sedimentary basins as alternative geothermal-producing geologic settings depends on identifying geothermal gradient anomalies, investigating the controls on these anomalies, and evaluating the potential of suitable reservoir units as hot sedimentary aquifers (HSAs). The Piceance Basin, located in northwestern Colorado, is a great example of a sedimentary basin that could be explored for geothermal applications. The Piceance Basin is a known oil and gas-producing basin that contains thick sequences of sedimentary rocks, with known reservoirs such as the Williams Fork Formation and the uppermost Rollins member of the Illes Formation. The exploration for geothermal potential in the Piceance Basin revealed elevated geothermal gradients, resulting in higher temperatures suitable for low-enthalpy geothermal applications. These elevated geothermal gradients (37°C/km) are controlled by the basin's structure and lithology. The geothermal gradients seem to be highest in the central to southeastern regions, where the basin is thickest. These geothermal gradients are also elevated at depths near 2.2 km, where the Cameo Coal zone is located. The Cameo Coal zone acts as a thermal barrier due to its low thermal conductivity, causing temperatures to increase more rapidly. Reservoirs suitable to be a hot sedimentary aquifer are the connected sandstones with greater than 6-9% porosity values and temperatures greater than 90°C. In the upper Williams Fork interval around 6% of the connected sandstones met our conditions to be considered an HSA. In the lower Williams Fork interval around 8% of the connected sandstones met our conditions to be considered an HSA. The Rollins interval contains nearly 11% of connected sandstones with porosity values between 9 and 15% that contain temperatures greater than 90 °C. These findings indicate that the Rollins is more prospective for low-enthalpy geothermal production than the Williams Fork intervals. This study has shown that it is possible to find conditions in sedimentary basins that contain suitable conditions for low-enthalpy geothermal production.

CSI Glaze: Geochemical reverse engineering of an unfired ceramic glaze's Unity Molecular Formula

Braden Bensley

Abstract

Ceramic glazes are complex mixtures of inorganic, non-metallic materials derived from mineral and rock sources which, under high temperature firing, form glassy coatings with variable color and surface properties. Ceramic glazes typically start with simple compositions. Major element oxides: SiO₂, Al₂O₃, CaO, K₂O, and Na₂O make up the basis of a recipe with supplementary oxides changing the coloration and melting points of the glaze. This study focuses on "Sevis," a glaze formed over a decade from accumulated, excess, wet glaze materials. Sevis exhibits a distinctive high gloss, green-blue coloration with red-brown breakage and iron speckling. To reproduce this glaze, an unfired powder sample of Sevis was analyzed using X-ray diffraction (XRD) and induction coupled plasma optical emission and mass spectrometry (ICP-OES and ICP-MS) to determine its mineralogical and geochemical composition. XRD results identified common glaze-forming minerals including feldspars, quartz, dolomite, kaolinite, and nepheline, while geochemical data quantified the weight percent of major oxides and trace element colorants. These were used to construct a geochemical

model based on the Unity Molecular Formula (UMF) approach, generating iterative calculations of plausible glaze recipes using materials from the CMU ceramics studio. Multiple possible base recipes were generated using a least-squares misfit minimization equation and were subsequently tested through kiln firing. Sixteen experimental glazes were produced across two firing suites, including base-recipes and colorant line blends. Results demonstrated that geochemically derived recipes successfully reproduced key physical characteristics of the original Sevis glaze, including gloss, clarity, melt behavior, and overall glaze fit. However, exact glaze color replication remained sensitive to small variations in colorant concentration and measurement precision, with cobalt and iron exerting dominant control over color expression. This study demonstrates that geochemical analysis combined with UMF modeling is an effective way for reverse engineering complex ceramic glazes, while also highlighting the importance of color calibration and isolating variables to achieve a fully reproducible recipe.