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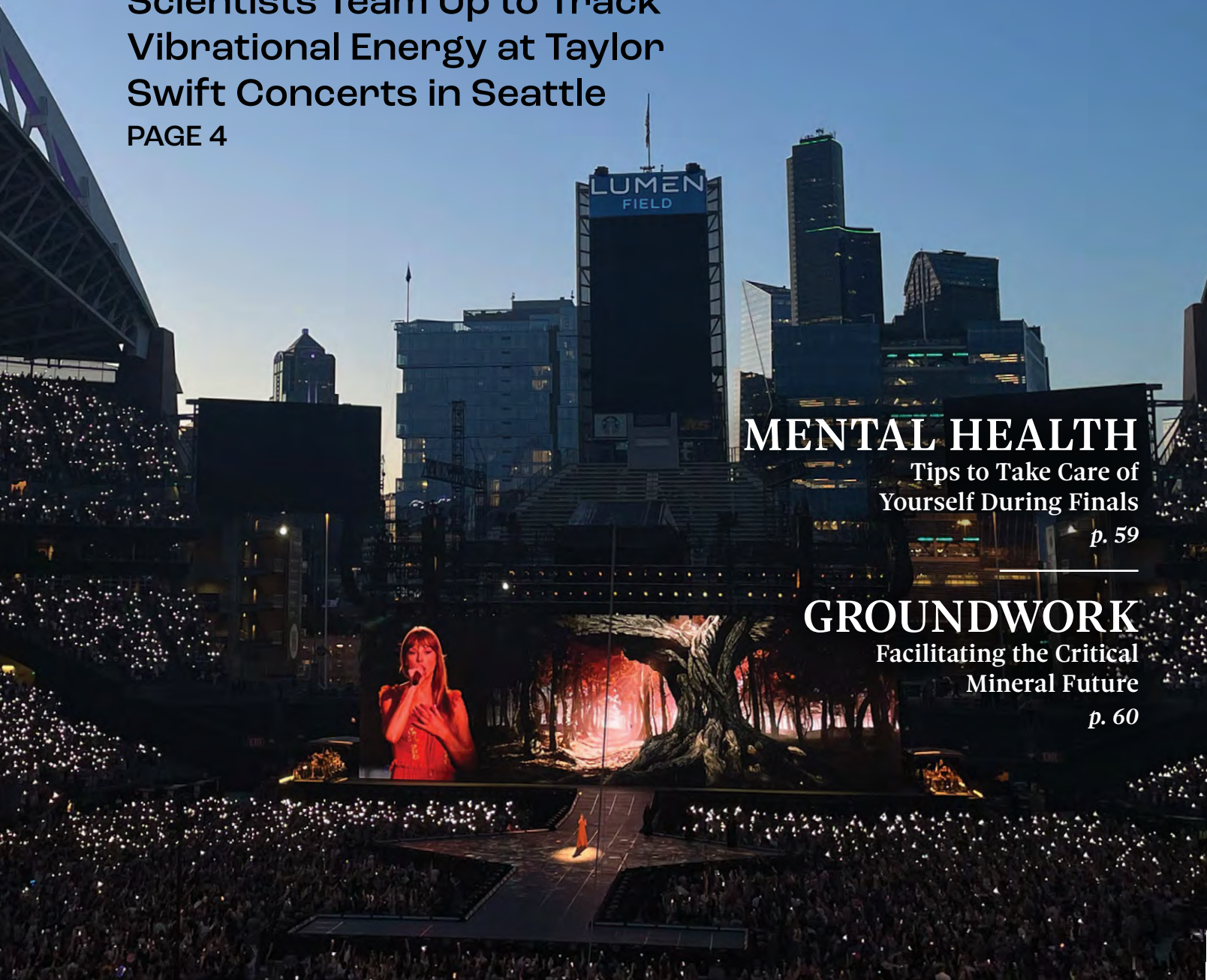
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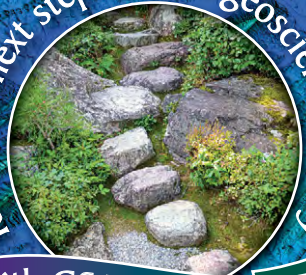
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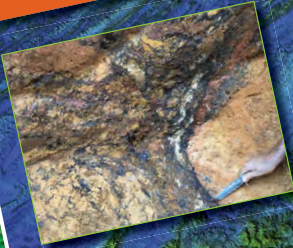
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Taylor Swift performs at Lumen Field, Seattle, Washington, USA, 22 July 2023. See related article on pages 4–10.

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Turn to page 12 for everything you need to know about GSA Connects 2024.



Errata, *GSA Today* February 2024 issue:

On p. 26: Southeastern Section OEST winner Tammie Hodnett Marlow is listed as residing in Missouri. She resides in Mississippi. On p. 29, in a Groundwork article, there is a reference and an in-text citation for Shafer, G., and Viskupic, K., 2022. It should be Shafer, G., et al., 2022.

GSA Today regrets the errors.

Beast Quake (Taylor's Version): Analysis of Seismic Signals Recorded during Two Taylor Swift Concerts in Seattle, July 2023

Jacqueline Caplan-Auerbach,^{*} Kyla Marczewski,² and Gavin S. Bullock²

ABSTRACT

Taylor Swift's concerts at Lumen Field in Seattle, Washington, USA, on 22 and 23 July 2023 were detected by an accelerometer located proximal to the stadium. The signals were nearly identical over the two nights, consistent with a repeated setlist. Ground shaking is recorded in two frequency bands: broadband energy between 30 and 80 Hz, and harmonic low frequencies between 1 and 8 Hz. Discrete songs are clearly visible within the data, with narrow-band low-frequency signals matching the published tempo of each song. Signals recorded during the sound check contain little to no low-frequency energy, suggesting that low-frequency energy is associated with the synchronous motion of a dancing crowd. High-frequency energy is observed only during songs that include a full band, as opposed to solo acoustic performances by Swift. Video data provided by citizen scientists at the concerts allow us to correlate changes in seismic amplitude with observations of crowd motion. The synchronized motion of 72,000 fans created sustained energy that exceeded the iconic "Beast Quake" in 2011.

INTRODUCTION

On 8 January 2011, in the final minutes of an NFL Wild Card Game between the Seattle Seahawks and the New Orleans Saints, Seahawks running back Marshawn Lynch broke through the Saints' defense and scored a touchdown that sealed a victory for the Seahawks. The crowd response was captured on a seismometer deployed proximal to the stadium (then called Qwest Field, now called Lumen Field). The seismic signal became known as the "Beast Quake," in homage to Lynch's nickname, "Beast Mode," and is considered to be among the most iconic moments in Seattle sports history (King, 2015).

That the Beast Quake was detected seismically is likely due to a combination of factors. Most importantly, seismic station KDK is located in close proximity to the stadium (~150 m from the stadium's center). The subsurface geology in the area is primarily artificial fill, sands, and silt (Troost et al., 2005), which amplifies ground shaking at seismic frequencies. Some stadiums have been observed to be set into resonance by crowd behavior and to vibrate nearby buildings (Erlingsson and Bodare, 1996), which could also contribute to the activity observed on the seismometer.

On 22 and 23 July 2023, shaking from Lumen Field was once again detected on KDK, this time during two concerts by pop singer Taylor Swift. The maximum shaking during the concert exceeded that of the Beast Quake by a factor of ~2.5 (Fig. 1). While the two events are substantially different,

the potential for bragging rights between Swifties and Seahawks fans caused us to wonder if, in fact, fan activity was the cause of the seismic activity recorded during the concerts, or if the ground motion was caused by stadium resonance or the sound system.

In this study, we show that seismic energy detected on KDK correlates precisely between the two concerts. Crowdsourced information about the concerts allows us to link the waveform with unique songs and to show that each song's tempo is captured in the data. We present evidence that crowd motion, including dancing, jumping, and swaying, is the primary cause of low-frequency energy recorded seismically, while higher-frequency energy relates directly to amplified music. We show that the strongest seismic signals correlate with fan behavior and conclude that, indeed, fans at the Taylor Swift concert were the chief cause of ground shaking.

BACKGROUND

Anything that shakes the ground has the potential to be detected by seismometers. Observations of non-earthquake-related signals in seismic data include anthropogenic activity, animals, and surf, the primary cause of microseismic energy in seismic data (Gutenberg, 1931). Human activity is ubiquitous in urban data, with seismic signals generated by sources such as trains, cars, aircraft, and pumps (e.g., Diaz et al., 2017; Dean and Al Hasani, 2020).

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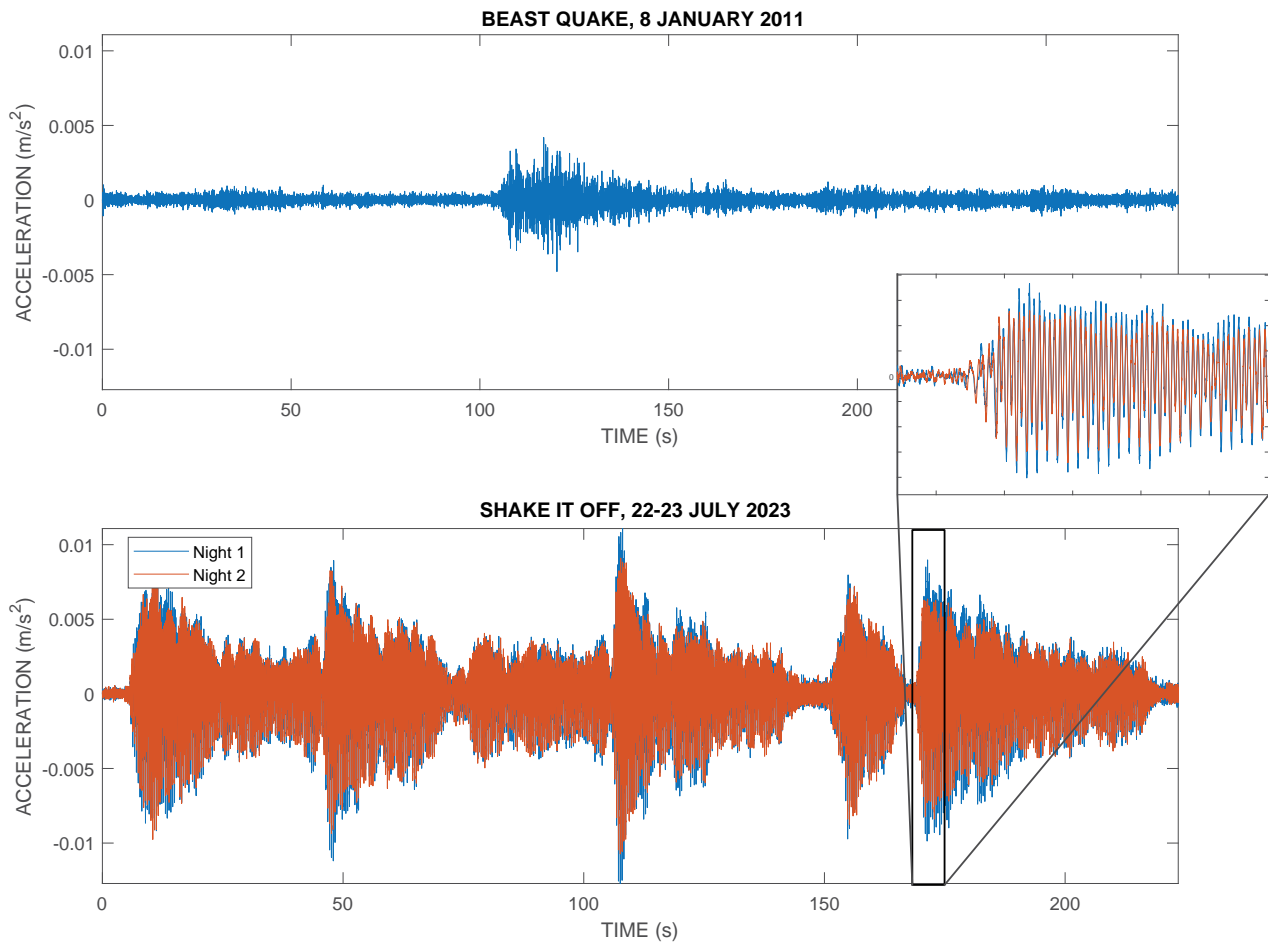


Figure 1. Waveforms for the 2011 Beast Quake (top panel) and a portion of the two Taylor Swift concerts (bottom panel). The Beast Quake is shorter in duration and $\sim 2.5\times$ weaker in amplitude. Waveforms for the song “Shake It Off” are shown for the two nights, offset in time to align the waveforms. A small portion of the song is inset as an example of the high degree of similarity. The correlation coefficient for the full song is 0.95.

Of interest are seismic signals recorded during large concerts; researchers have debated whether such signals are caused by crowd motion, stadium vibration, or the sound system. For example, Erlingsson and Bodare (1996) modeled shaking in Nya Ullevi Stadium in Sweden and suggested that crowds dancing during concerts set both the stadium and the underlying clays into resonance. Green and Bowers (2008) attributed narrow-band signals recorded during two electronic dance music (EDM) festivals to energy imparted into the ground by the loudspeakers. Yabe et al. (2022) used crowd jumping during soccer games to examine subsurface structure below the stadium.

The behavior of a crowd can generate two types of seismic noise: synchronous motion causes single-frequency shaking, while random energy generates a noisy, broadband signal (Parkhouse and Ewins, 2006). Malone et al. (2015) analyzed crowd noise at football games and showed that the original Beast Quake, caused by unsynchronized crowd motion, resulted in strong broadband shaking, whereas the same crowd jumping in time to the chant of “defense now!” was captured seismically as a narrow-band signal with a rhythm identical to that of the chant.

Other studies focus on crowd dancing and swaying. Denton (2014) examined seismic signals generated by the audience at

a Madness concert and concluded that the shaking was caused by the audience dancing in time to the music. Diaz et al. (2017) examined seismic signals recorded during a Bruce Springsteen concert in Barcelona and showed that seismic spectra correlated with song tempos. Diaz et al. (2017) further suggested that synchronized crowd motion may trigger resonance in the stadium itself.

THE CONCERTS

Taylor Swift’s Eras Tour began in the summer of 2023. Nightly attendance at the Seattle concerts averaged $>70,000$, which at the time set the stadium’s attendance record. Fans were allowed to enter the stadium at 4:30 p.m. PDT, and the concert was slated to begin at 6:00 p.m. PDT. The concert began with two warm-up acts: singer Gracie Adams played six songs, after which the band HAIM played six songs. Taylor Swift then played for ~ 3.5 h (Fig. 2A).

As implied by the tour title, the setlist was broken into segments, or “eras,” each relating to a musical period in the artist’s history. The character of the music changed throughout the eras; some eras consisted of energetic and upbeat numbers that inspired more dancing, and others had a slower beat and more subdued nature. Other forms of entertainment, including videos, choreographed dancing, and

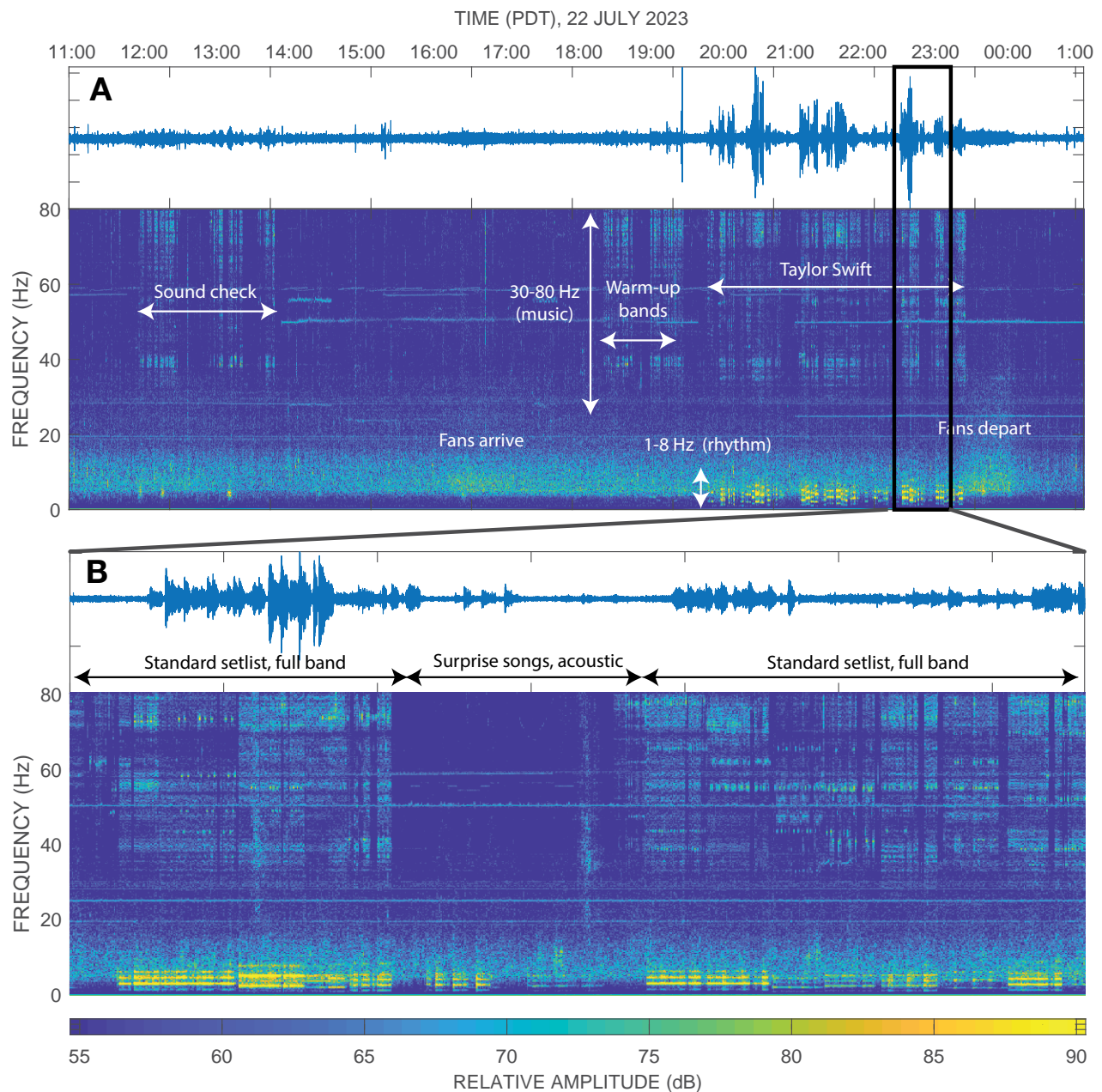


Figure 2. (A) Spectrogram for the 22 July 2023 concert. Energy is visible as high-frequency broadband (30–80 Hz) and low-frequency (1–8 Hz) signals. The time period includes both the sound check and the concert. Both have high-frequency broadband signals, interpreted as the music and sound system, but low-frequency signals were only recorded when fans were in attendance. The venue opened to attendees at 16:30 (4:30 p.m. PDT) and the concert ended at ~23:30 (11:30 p.m. PDT). We attribute the diffuse low-frequency signals at these times to the arrival and departure of the crowd. (B) Spectrogram for ~1 h of the 22 July concert, including songs from the standard setlist and the two “surprise songs.” Songs with 30–80 Hz signals were performed by the full band, while surprise songs included only Taylor Swift on guitar (song 1) and piano (song 2). Patterns in the high-frequency broadband signal vary over ~3–5 min time periods, consistent with the typical length of Taylor Swift’s songs.

changes in set design, accompanied each of the eras as well. Sets and costumes were changed between eras, resulting in times in which sound production was greatly reduced.

The setlist for all concerts in the tour was nearly identical, with both the order and choreography of songs scripted. Each concert, however, included two “surprise songs,” which were different on the two nights at Lumen Field. This allowed us to compare songs that were repeated over the two nights with songs that were not.

STADIUM

Lumen Field is reputed to be among the loudest stadiums in the National Football League; during a 2013 football game, fans broke a Guinness World Record for sound volume (Associated Press, 2013). The stadium is located on the site of the former Kingdome, destroyed by controlled demolition in 2000. Seismic analysis of that implosion, as well as drill holes in the region, reveals that the stadium is underlain by thick alluvial sediments, including sands and muds (Brocher

et al., 1999; Troost et al., 2005). The stadium's capacity is ~69,000 for events in which spectators are restricted to permanent seating but can be increased if attendees are permitted on the field. The crowd at the Taylor Swift concerts was estimated to be ~72,000 on each of the two nights.

CITIZEN SCIENCE

Taylor Swift has a large number of dedicated fans known as “Swifties.” When a local Seattle news station reported that the concert had been recorded seismically, dozens of Swifties reached out to the lead author. We created a Google Drive to which Swifties could upload concert videos and log song start times and personal observations of the concerts. In total we received ~80 videos and dozens of comments and observations (Supplemental Table S1¹). Time stamps on videos and photos allowed us to confirm song and event timing. The second author attended the second concert.

We received videos from attendees seated in a variety of locations in the stadium. Videos taken from high in the stands allowed us to observe crowd behavior across the field, and images from near the stage provided us with a view of the two bands (located on either side of the main stage). Some Swifties sent videos of the substantial crowd located outside of the stadium, and we were able to use visible landmarks to identify their location.

SEISMIC DATA

Seismograms were recorded during the concerts on station UW.KDK, located ~150 m due west of Lumen Field. KDK is a three-component TITAN accelerometer, with flat response at frequencies < ~30 Hz. Data from station KDK were downloaded from the EarthScope Data Management Center and plotted in both the time and frequency domains. We selected a time period for analysis that spanned the expected time of the concert, plus several hours prior to the venue opening to capture sound checks and several hours after the concert was expected to end.

Waveforms for the two concerts show hours of regular, high-amplitude pulses (Fig. 2A). These can broadly be separated into three segments. The first significant period of increased signal strength lasts 23 min, the second lasts 30 min, and the final sequence lasts ~3.5 h. Each of these periods is composed of shorter-duration (3–6 min) bursts, separated by short periods of quiescence (Fig. 2B). We propose that the first two periods represent performances by the opening acts, and the third represents the headline event. The duration of the shorter bursts is consistent with the length of many pop songs.

Signals generated by concerts can be studied more thoroughly by examining the frequencies at which the ground shook. To do this, we calculated a spectrogram (Fig. 2), which uses color to show the strength of ground shaking at high (30–80 Hz) and low (<10 Hz) frequencies. We observed that signals in the high-frequency band include a variety of patterns; some have short pulses at narrow frequencies, while others are more smoothly broadband (Fig. 2B). In contrast,

the low frequencies are extremely narrow-band, and they exhibit harmonics (integer multiples of a base frequency) at frequencies that vary between songs (Figs. 2B and 3).

Two prolonged diffuse low-frequency (~5–20 Hz) signals are visible in the seismic record, beginning at ~4:30 p.m. and ~11:30 p.m. (Fig. 2A). The venue was opened to the public at 4:30 p.m., and both seismic and video data indicate that the concert ended at ~11:30 p.m. We attribute these signals to fans arriving and departing, either by foot or vehicle.

Even by sight, it is apparent that data recorded over the two nights are highly similar (Fig. 1), consistent with seismic energy generated during a repeated setlist. Cross-correlation of five hours of data between the two nights reveals a maximum correlation when the data are offset by 26 min; subsequent conversations with concert attendees confirmed that the second night of the concert was delayed by an estimated half hour. This provides additional evidence that the seismic signals were generated during the two concerts.

To test that the waveforms represented a predictable setlist played on both nights, we cross-correlated signals from the shorter-duration pulses (interpreted as, and hereafter referred to as, songs). Correlations of a song waveform over both nights were generally high (>0.75), with some exceeding 0.95 (Fig. 1).

At each concert of the Eras Tour, Taylor Swift played two “surprise songs” (Fig. 2A). These differed each night, and thus presented an excellent opportunity to test concert correlations. Indeed, the surprise songs represented the only part of the concert that was not highly similar, with a maximum correlation value of 0.03. Because the two nights’ surprise songs differed in length, the last eras of the concerts were also offset relative to one another.

SONG IDENTIFICATION

That the short-duration pulses were in fact different songs was confirmed by (A) signal duration; (B) song rhythm; and (C) sonification of the seismic signal (Marczewski, 2023). Concert setlists were published online (e.g., Setlist.fm, 2023) and confirmed by videos submitted by attendees.

To first order, waveforms were correlated with songs by comparing their onset times with concert videos sent in by attendees. Most videos shared by Swifties were time-stamped only to the minute, which resulted in some uncertainty in the precise song start times. In many cases, a clear increase in amplitude was visible in the time series near the approximated start time, but in other cases, the onset time was less certain. We also compared song durations to published versions, but some songs were performed with extended intros or shortened for the concert.

For many songs, the seismic data have distinct, narrow-band low-frequency (1–8 Hz) signals with clear harmonics (Fig. 3). The spectral content of these signals is well below what would be expected of music, but precisely matches the rhythms of specific songs. Figure 3 shows that the fundamental frequency, or first harmonic, of each song correlates with the published rhythm of the song. For example, “Ready for It” (Fig. 3) has a published rhythm of 160 beats per minute

¹Supplemental Material. Spreadsheet showing data from the two Taylor Swift concerts, including set lists, song rhythms, and crowdsourced observations of the concerts. Please visit <https://doi.org/10.1130/GSAT.S.25431844> to access the supplemental material, and contact editing@geosociety.org with any questions.

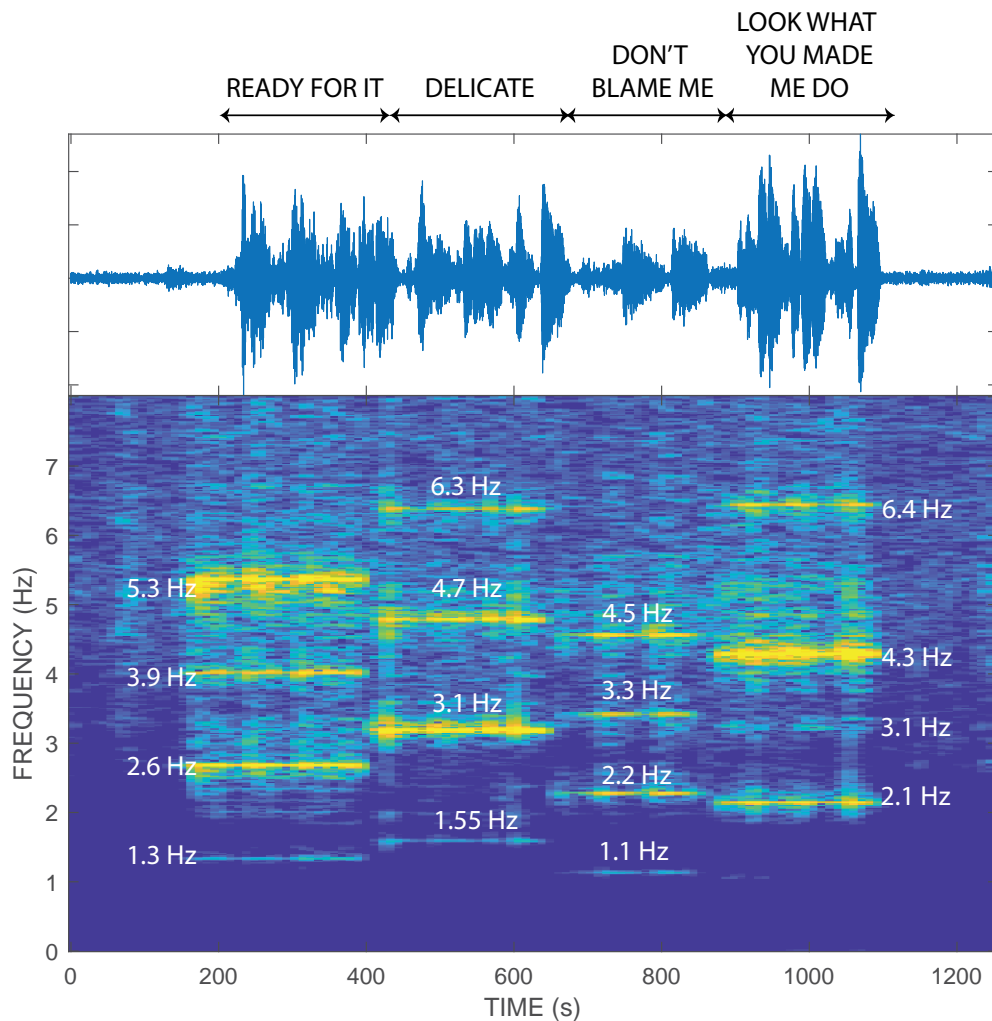


Figure 3. Close-up of the low-frequency seismic signals. Frequencies recorded during each song are consistent with the published beats per minute (BPM) of each song, with overtones. Colors as in Figure 2.

(BPM), or 2.67 beats per second (Hz). The next three songs exhibit strong shaking at 1.6 Hz (96 BPM), 2.2 Hz (132 BPM), and 2.1 Hz (126 BPM), consistent with published values for “Delicate” (95 BPM), “Don’t Blame Me” (136 BPM), and “Look What You Made Me Do” (128 BPM).

All the low-frequency signals exhibit at least one harmonic. It is possible that part of the audience moved with a primary rhythm, whereas others moved in double-time. Studies have shown that crowds jumping as a group are most likely to bounce at frequencies between 1 and 2.3 Hz (Ginty et al., 2001). If a song has a tempo significantly outside of this range, the audience may be most comfortable moving at twice or half of the song’s primary rhythm.

It is most likely, however, that the harmonics result from a Dirac comb effect, in which regularly spaced pulses exhibit a comb-shaped power spectrum. This effect has been invoked for natural signals, such as regularly spaced earthquakes (Dmitrieva et al., 2013; Hotovec et al., 2013) and ocean swell (Aster et al., 2021). Diaz et al. (2017) invoked the same process for harmonic signals recorded during the Bruce Springsteen concert in Barcelona, Spain. It is unlikely that the crowd moved at frequencies much higher than 3 Hz, lending support to a model in which the harmonics are a consequence of the Fourier transform rather than audience motion.

DATA INTERPRETATION

Seismic amplitudes vary over the course of a given song, and crowd-sourced video and observational data confirm that amplitudes vary between verses, choruses, and bridges. In Figure 4, we present low-frequency (1–8 Hz) waveform data for the song “Love Story.” Text labels along the top denote progression from the verse to the chorus, and to the instrumental sections of the song, with representative lyrics. Lower text labels describe observations from video data of crowd motion and singer/crowd energy levels. The data show a strong correlation between song structure, crowd activity, and amplitude of ground shaking. Video data show that during the chorus (“Romeo take/save me...”) the audience begins to jump synchronously; these periods correspond to sharp increases in ground acceleration at KDK (Fig. 4). Further, seismic amplitudes remain low at the end of chorus 3, while video data show an audible increase in the energy and amplitude of the drums. This provides strong evidence that changes in seismic amplitude are associated with crowd behavior rather than the music or sound system.

We further examined the contribution of crowd behavior to low-frequency seismic amplitudes by considering the sound check, when the band was playing but the crowd was absent. Assuming that we can identify songs by their seismic character,

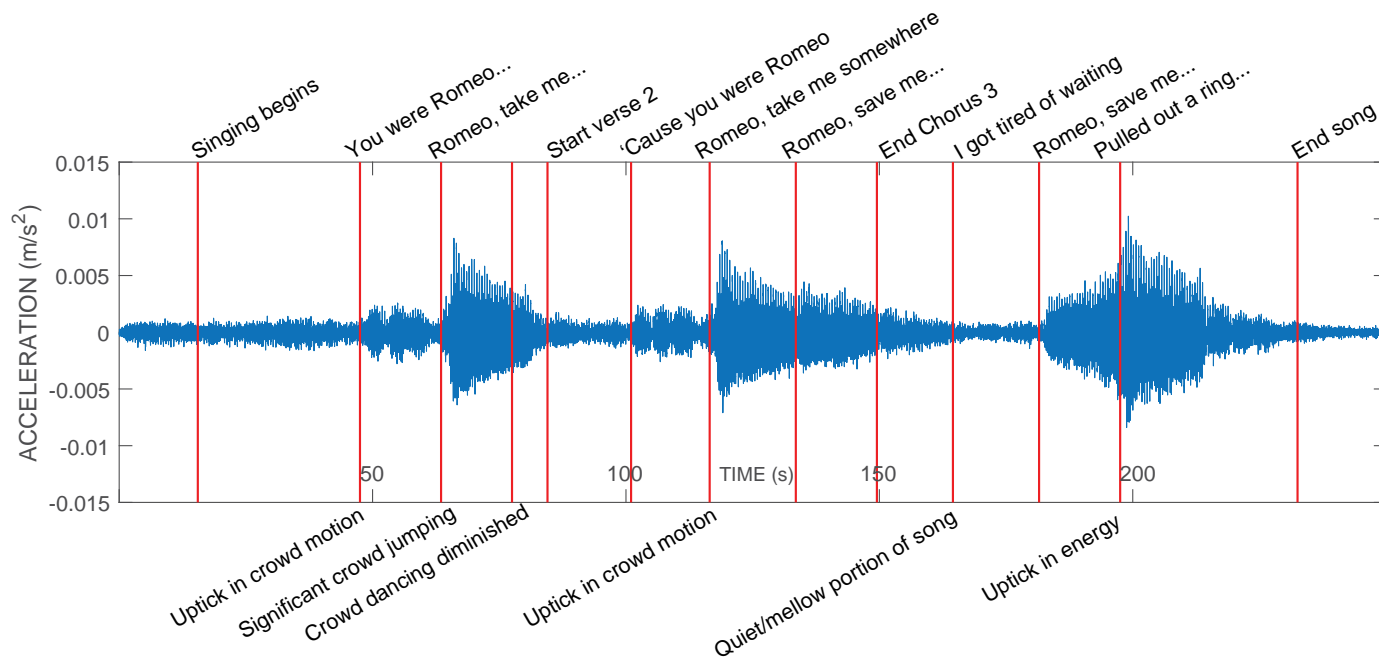


Figure 4. Waveform for the song “Love Story.” Vertical lines and text comments show parts of the song (top) and video-captured changes in crowd behavior (bottom). Highest amplitudes correlate with highest-energy crowd motion.

there were two sound checks prior to the 22 July concert: one at ~5:25 p.m. PDT on 21 July, and one at about noon PDT on 22 July (Fig. 2A). A similar signal appears in the seismic record at 1:15 p.m. PDT on 23 July, several hours before the second concert.

Both the presumed sound-check data and concerts exhibit minutes-long bursts of 30–80 Hz energy (Fig. 2B), but only the songs played during the concerts are also associated with the low-frequency harmonic signals. Although we were unable to find a setlist for the sound checks, cross-correlation of sound-check songs with the broader concert allowed us to identify two songs. The first was played by the warm-up band HAIM and had no low-frequency signals; the second appears to be a portion of the Taylor Swift song “The Man.” Only the version of “The Man” played when fans were in attendance includes the harmonic low frequencies. This provides additional support for our contention that these signals were generated by crowd activity.

The two “surprise songs” played at each concert were distinct from the rest of the setlist in that they were different each night, and Taylor Swift introduced them by saying, “Welcome to the acoustic section of the evening.” During most other songs the singer was accompanied by an amplified band, but the surprise songs were performed solo, on guitar or piano. The different character of these songs is evidenced in spectrograms—the surprise songs contain significant low-frequency energy, but no 30–80 Hz shaking (Fig. 2B). The presence of low-frequency energy in the absence of drums or other low-frequency instruments (e.g., bass guitar) again supports audience motion as its source. Other periods of the concert lack high-frequency energy, but video data confirm that these periods involve Taylor Swift either talking to the audience or playing solo. These observations suggest that the high-frequency signals are specifically associated with amplified music.

BEAST QUAKE (TAYLOR’S VERSION)

Other than noting that the maximum amplitude of shaking was ~2.5× larger during the Taylor Swift concert, there is no simple means by which to compare it to the 2011 Beast Quake. Because stadium events are distinctly different from earthquakes in terms of duration, depth, and source process, traditional magnitude calculations are not meaningful. Per-song magnitudes of –0.5–0.85 were calculated by Tepp et al. (2024) for the Taylor Swift concerts in Los Angeles, California, USA, but these cannot easily be extended to the 2011 event. The original Beast Quake represented <1 min of ground shaking caused by an enthusiastic but randomly moving crowd of ~66,000 people. In contrast, the Eras Tour concerts lasted ~3.5 h and had significantly higher attendance. Further, thousands were on the field for the concert, where their energy could couple directly into the ground, whereas Seahawks fans were mostly confined to the stands. Most importantly, the motion of the Swifties was synchronous, as the crowd jumped and swayed to the beat of the music. This caused constructive interference and amplification of seismic energy at frequencies identical to the beat of the music. Studies of vibrations induced by crowd behavior show that synchronized motion such as jumping or swaying generates energy that is proportional to crowd size, whereas random motion scales with the square root of crowd size (Parkhouse and Ewins, 2006). The larger signals recorded during the concert are likely a function of the type of motion rather than the relative enthusiasm of the fan base.

If credit for the seismic signal is to be given to the fans, we must rule out the contribution to ground shaking from other sources. Studies of seismic data recorded in association with other stadium events have suggested shaking may reflect resonance of the stadium itself and/or the subsurface sediments (Erlingsson and Bodare, 1996). Our data show no common frequencies observed throughout the concert, which might be

expected of resonance, although we cannot rule out contributions from nonresonant stadium shaking induced by the crowd. Green and Bowers (2008) stated that seismic signals recorded during an electronic music festival were caused by the sound system coupling into the ground. They show that, like the Taylor Swift concerts, the spectral frequencies are similar to the music tempo. While sound-system coupling may be a contributor to the signals presented here, the lack of low-frequency energy recorded during empty-stadium sound checks strongly suggests that the primary source of low-frequency energy was crowd motion—a win for the Swifties.

CONCLUSIONS

Using seismic data as a window into crowd behavior can provide more than just bragging rights for fans. The relative contributions of sound system, stadium resonance, and crowd behavior have been debated in the literature, and our results show that at Lumen Field the seismic signal was dominated by crowd behavior. That low- and high-frequency signals stem from different sources had not previously been described for concert-induced shaking. Constructive interference generated by synchronized crowd motion has the potential to shake the stadium at higher amplitude than stochastic crowd behavior, which could have implications for seismic engineering. But perhaps the most important outcome of this study is the enthusiasm for science exhibited by Swifties as they volunteered their observations and videos. Concert seismology proved to be an excellent opportunity to engage the public in science and introduce them to a field of science of which they may not have previously been aware. Ultimately, the Beast Quake (Taylor's Version) may have inspired a new generation both musically and scientifically.

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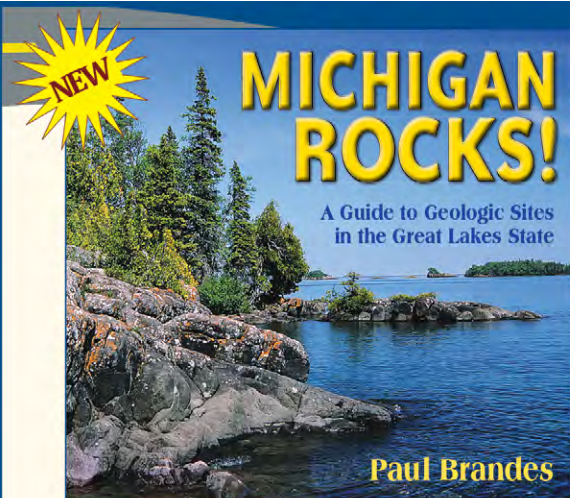
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Paul Brandes

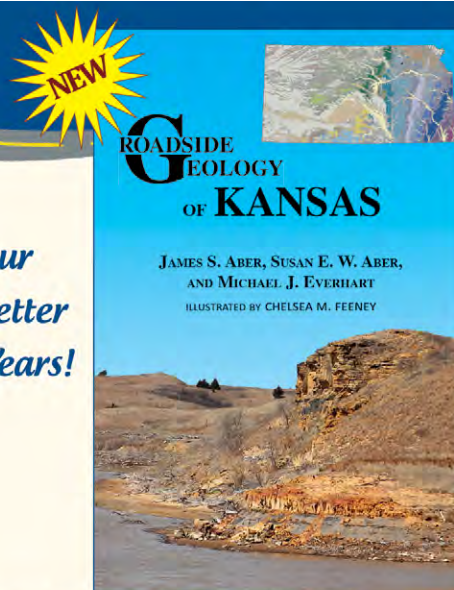
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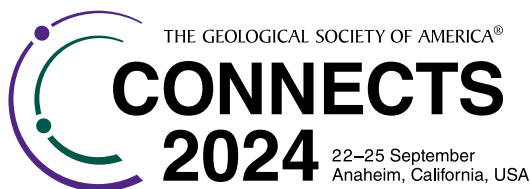
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LETTER FROM THE GENERAL CHAIR

Discover Science and SoCal Geology at GSA Connects 2024

It is a pleasure to welcome you to Anaheim, California, for Connects 2024, GSA's annual meeting! Located just west of the Santa Ana Mountains and a few miles from the Pacific Ocean, Anaheim is home to stunning geology, where an ancient Mesozoic continental arc meets active faults along a modern plate boundary. Anaheim is the perfect embodiment of the two themes of this meeting: **Life Along an Active Margin** and **Water in Our Changing World**. We hope that you will enjoy both the science of the meeting and all of the geology that Anaheim and Southern California have to offer.

GSA Connects 2024 will be held at the **Anaheim Convention Center**, which is one of the largest convention centers on the west coast of the United States. This scientific meeting includes 190 topical sessions, 5 Pardee Keynote Symposia, 26 short courses, and 21 field trips. The GSA team has planned plenty of engaging activities for students, early career geoscientists, and K-12 educators, and we will have a vibrant Exhibit Hall.

The Anaheim Convention Center is located within walking distance of **Disneyland Resort** and the Downtown Disney District. The Anaheim GardenWalk is also a short walk away and has outdoor shopping and dining options. About two miles from the convention center is the **Anaheim Packing District**, a culinary hub housed in a historic citrus packing house, featuring a diverse range of gourmet eateries, artisan shops, and a communal dining area. A few miles southwest of the convention center, **Little Saigon** is home to a vibrant Vietnamese American community with restaurants, bakeries, grocery stores, fashion boutiques, salons, and more.

Want to take a break from the meeting and see some geology? Take a drive to Crystal Cove State Park, **Laguna Beach Tide Pools**, or San Onofre State Beach for stunning examples of coastal landscapes and geology, including sea caves, tide pools, and sedimentary rock formations. Try hiking in the Anaheim Hills or visit Limestone Canyon Regional Park, which is a 30-minute drive from Anaheim and offers scenic hiking trails with amazing geology. The Natural History Museum of Los Angeles has a stunning collection of dinosaur fossils, gems, and minerals. If fossils are your thing, check out the world-renowned **La Brea Tar Pits**, where natural asphalt has seeped up from the ground for tens of thousands of years, preserving the remains of ancient animals. If you are feeling really ambitious and want to cross a plate boundary, take a day trip to the Angeles Crest Highway, where you'll cross the **San Andreas Fault** and traverse from the Pacific Plate to the North American Plate. Along the drive, grab a snack at the Cosmic Café at the Mt. Wilson Observatory, where Edwin Hubble made key observations about the expanding universe. With so much geology and science to explore in Southern California, the choices are nearly endless!



ANAHEIM IS THE PERFECT EMBODIMENT OF THE TWO THEMES OF THIS MEETING.



We look forward to seeing you in Anaheim!

Joshua Schwartz
GSA Connects 2024 General Chair

Important Dates

Now Open: Abstract Submissions

Now Open: Space Requests (Non-Technical & Non-Ticketed Events)

Early May: Hotel Booking Opens

Early May: Registration Opens

Early May: Travel Grant Applications Open

10 May: Space Request First Consideration Deadline
Fees increase after this date

18 June: Abstracts Deadline

Late June/Early July: Student Volunteer Program Opens

31 July: Early Registration Deadline

9 August: Space Request Final Deadline

23 August: GSA Sections Travel Grants Deadline

28 August: Discounted Hotel Reservation Deadline
Fees increase after this date

4 September: Standard Registration and Student Volunteer Cancellation Deadline

18 September: Pre-Meeting Field Trips and Short Courses Begin

22–25 September: Meeting Dates

25–29 September: Post-Meeting Field Trips

Five Reasons to Exhibit at GSA Connects 2024

1. GSA Connects provides a platform for both seasoned experts and emerging geoscientists to shape the future of the field.
2. Elevate your brand's visibility and reach a global audience of geoscience professionals, researchers, and decision-makers.
3. Demonstrate dedication to fostering innovation, research, and collaboration within the geosciences.
4. Support both budding and established geoscientists in their academic and professional journeys.
5. Gain exposure on an international stage, enhance the conference experience, and showcase your latest technology or services to an engaged audience.

Multiple rates are available to reflect the diverse range of GSA Connects 2024 exhibitors. See the Exhibit Space Application within the prospectus (<https://bit.ly/49g0GYK>) for complete rates and exhibit packages. For questions, or to reserve your booth, please contact:

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Exhibit Manager – GSA Connects 2024
Corcoran Expositions, Inc.
+1-312-265-9649
Gavin@corcexpo.com

David Shreve
Member & Customer Services Manager
Geological Society of America
+1-303-357-1004
dshreve@geosociety.org



RISE & Events Code of Conduct

GSA strives for a professional, respectful, and inclusive environment at all our events, including meetings, field trips, short courses, and other GSA-sponsored programs. Creating a positive environment enables full participation and a sense of belonging, which in turn foster open dialogue, networking, and the productive exchange of scientific ideas.

GSA's Events Code of Conduct lists “dos and don'ts” for all events, including a strict prohibition against discrimination, harassment, and bullying. The Events Code of Conduct applies to all participants, including registrants, guests, volunteers, exhibitors, staff, and service providers. Meeting attendees are required to read and sign the Events Code of Conduct as part of the registration process. For additional information, visit www.geosociety.org/ethics.



RESPECTFUL INCLUSIVE SCIENTIFIC EVENTS (RISE)

GSA established RISE in 2016 as a visible way to bring our Events Code of Conduct to life. Conspicuous posters remind participants of our conduct standards and how to report concerns. GSA takes all concerns seriously and has robust procedures to ensure that appropriate follow-up occurs, including ample resources to field complaints. These include having trained RISE Liaisons available to support participants if they receive a complaint or see a potential violation. In 2023, GSA rolled out a new hotline, hosted by a third party, which enables event participants to speak up anonymously. Additional details can be found at <http://geosociety.ethicspoint.com>.

Schedule at a Glance

PRE-MEETING

Get your Connects experience started early and soak up the Anaheim sunshine by attending a pre-meeting field trip or short course! In-person events before the meeting, including a variety of business and social events, will take place Thurs., 19 Sept., through Sat., 21 Sept.

SAT., 21 SEPT.

Field Trips and Short Courses: All day, various times
Icebreaker Reception: 5–7 p.m.

SUN., 22 SEPT.

- Morning Oral Technical Sessions: 8 a.m.–noon
- All-Day Poster Sessions: 8 a.m.–5:30 p.m., with presenting authors at their posters from either 9–11 a.m. or 3:30–5:30 p.m. Presentation times will be listed in the program.
- GeoCareers Day: 9 a.m.–1 p.m.
- GeoCareers Corner: 9 a.m.–5 p.m.
- Lunch Break: Noon–1:30 p.m.
- GSA Presidential Address and Awards Ceremony: Noon–1:30 p.m.
- Afternoon Oral Technical Sessions: 1:30–5:30 p.m.
- Exhibit Hall Opening Reception: 5–7 p.m.
- Exhibits Open: 5–7 p.m.



MON., 23 SEPT.

- Morning Oral Technical Sessions: 8 a.m.–noon
- All-Day Poster Sessions: 8 a.m.–5:30 p.m., with presenting authors at their posters from either 9–11 a.m. or 3:30–5:30 p.m. Presentation times will be listed in the program.
- Pardee 1 Symposium: 8 a.m.–noon
- GeoCareers Corner: 9 a.m.–5 p.m.
- Exhibits: 10 a.m.–6:30 p.m.
- Lunch Break: Noon–1:30 p.m.
- Noontime Lecture: 12:15–1:15 p.m.
- Afternoon Oral Technical Sessions: 1:30–5:30 p.m.
- Pardee 2 Symposium: 1:30–5:30 p.m.
- Afternoon Reception in the Exhibit Hall: 4:30–6:30 p.m.
- Alumni Receptions: Evening, various times

TUES., 24 SEPT.

- Morning Oral Technical Sessions: 8 a.m.–noon
- All-Day Poster Sessions: 8 a.m.–5:30 p.m., with presenting authors at their posters from either 9–11 a.m. or 3:30–5:30 p.m. Presentation times will be listed in the program.
- Pardee 3 Symposium: 8 a.m.–noon
- GeoCareers Corner: 9 a.m.–5 p.m.
- Exhibits: 10 a.m.–6:30 p.m.
- Lunch Break: Noon–1:30 p.m.
- Special Lecture: 12:15–1:15 p.m.
- Afternoon Oral Technical Sessions: 1:30–5:30 p.m.
- Pardee 4 Symposium: 1:30–5:30 p.m.
- Afternoon Reception in the Exhibit Hall: 4:30–6:30 p.m.

WED., 25 SEPT.

- Morning Oral Technical Sessions: 8 a.m.–noon
- All-Day Poster Sessions: 8 a.m.–5:30 p.m., with presenting authors at their posters from either 9–11 a.m. or 3:30–5:30 p.m. Presentation times will be listed in the program.
- Pardee 5 Symposium: 8 a.m.–noon
- Exhibits: 10 a.m.–2 p.m.
- Lunch Break: Noon–1:30 p.m.
- Noontime Lecture: 12:15–1:15 p.m.
- Afternoon Oral Technical Sessions: 1:30–5:30 p.m.
- Closing Reception: 5:30–7:30 p.m.

POST-MEETING

Why stop there? Attend a post-meeting field trip! There are a variety of options from Wed., 25 Sept., through Sun., 29 Sept. See Field Trips section (p. 18–19) for more information.



**Deadline
for first
choice:
10 May**

Non-Technical Event Space Requests

If you are interested in hosting a non-technical event, such as a business meeting, luncheon, reception, or town hall, please submit a space request at <https://bit.ly/3TYf57p>.

Space is reserved on a first-come, first-served basis; in order to avoid increased fees, you must submit your request by Friday, 10 May.

Space requests must be submitted both for events held at the Anaheim Convention Center (ACC) and The Anaheim Marriott (HQ Hotel) and for off-site events (events that are being held at another location in Anaheim that you have arranged on your own) in order to appear in the Program Book. Meeting room assignments will be sent out in July.

Register Now to Secure Your Spot

This year GSA is offering three tiers of registration rates: Early, Regular, and Late. Save big by taking advantage of early registration rates! All rates are in US\$.

Category	Member Status	EARLY PRICE (through 31 July)	REGULAR PRICE (1 August–4 September)	LATE PRICE (after 5 September)
Professional	Member	\$625	\$665	\$755
Professional	Non-Member	\$850	\$890	\$980
Senior Professional	Member	\$350	\$365	\$460
Lifetime	Member	\$580	\$605	\$725
Affiliate	Member	\$625	\$665	\$755
Early Career Professional	Member	\$385	\$400	\$485
Student	Member	\$185	\$200	\$275
Student	Non-Member	\$260	\$275	\$400
K–12 Teacher	Member	\$85	\$85	\$95
K–12 Teacher	Non-Member	\$150	\$150	\$200
Guest/Companion	Guest/Companion	\$120	\$120	\$130

*Looking to register to attend only one day of the meeting? Use the following promo codes at check out to receive 35% off full-meeting prices.

Sunday – OneDaySun
 Monday – OneDayMon
 Tuesday – OneDayTues
 Wednesday – OneDayWed

**The guest or companion registration fee is for non-geologists accompanying either a professional or student meeting registrant. This fee does not include access to technical sessions. Any guest wishing to see a specific presentation should go to the on-site registration desk to request a special pass.

***GSA offers a 50% discount on annual meeting registration fees for individuals who are both residing in and are citizens of low and low-middle income countries as classified by the World Bank. The 50% discount does not apply to the K–12 Teacher, Guest or Companion, or Field Trip/Short Course Only registration categories.

Cancellation Policy: A \$50 processing fee will be charged for cancellation of a registration if received in writing prior to 11:59 p.m. MDT on 8 August. No refunds will be given after the cancellation deadline of 8 August for any registration type or events.





LordRunar/iStock / Getty Images Plus

Official Meeting Locations

Anaheim Convention Center (ACC)

800 W. Katella Ave,
Anaheim, California 92802, USA

Anaheim Marriott

700 W. Convention Way,
Anaheim, California 92802, USA

Hilton Anaheim Convention Center

777 W. Convention Way,
Anaheim, California 92802, USA

Transportation and Travel



BY AIR

You're going to love the convenience of **John Wayne Airport (SNA)**, just a 20-minute drive from the Anaheim Convention Center. Long Beach Airport (LGB) is another great option, though it is smaller than its sibling airports, featuring only one terminal and four commercial airlines. **Los Angeles International Airport (LAX)**, 40 minutes from ACC, serves more than 50 domestic and international airlines, so there's bound to be a flight that fits your needs.



BY RAIL

Head to the **Anaheim Regional Transportation Intermodal Center (ARTIC)**, which provides rail, bus, taxi, and other services for daily commuters, visitors, and leisure travelers. It is walking distance from the Honda Center and Angel Stadium, and you can also catch the Amtrak Pacific Surfliner and Metrolink trains there.



BY CAR

There are many ways to get around Anaheim . . . car, bus, taxi, bike, pedicab, or on your own two feet! Check out all the ways to travel around the city at www.visitanaheim.org/plan-your-trip/transportation/. Public transportation is a breeze with Anaheim Regional Transportation (ART) and Orange County Transportation Authority (OCTA).

Take advantage of **Free Rides Around the Neighborhood (FRAN)**, a free and friendly transportation system that uses energy-efficient vehicles to cover key areas of Anaheim. Download the A-Way WeGo App and request your free ride to anywhere you want to go around the Anaheim Packing District.

Visit <https://bit.ly/4aFlg66> for more information.

Enhance Your Skills by Signing Up for Short Courses

LEARN A NEW TOPIC

Short courses this year offer you the opportunity to learn about forensic geochemistry, modeling detrital geochronology data, geological models, the thermal signature of mountain building, pumped storage hydro projects, and deep learning for paleontologists.

EXPLORE THE LATEST SOFTWARE

Instructors will teach you about alphaMELTS, data visualization in Tableau, planetary image analysis with ArcGIS Pro, mapping minerals with space-based imaging spectroscopy, the OneStratigraphy database platform, and the Water-Organic-Rock-Microbe Portal.

STRENGTHEN YOUR SKILLS

Gain tips on communicating science, using surveys and insights into human subject research, preparing students for top jobs, and teaching the Food-Energy-Water-Nexus. Plus obtain experience with OpenTopography, drones, 3D geological maps, and an intersectional approach to field safety.

"THE COURSE WAS A VALUABLE EDUCATIONAL EXPERIENCE FOR ME BECAUSE...IT OFFERED CAREER-SPECIFIC KNOWLEDGE THAT COULD BE VERY VALUABLE TOWARD HELPING ME SECURE MY DREAM JOB."

EARN CONTINUING EDUCATION UNITS

Meeting attendance, short courses, and field trips qualify for continuing education units (CEUs). One CEU equals 10 hours of participation in an organized continuing education experience under responsible sponsorship, capable direction, and qualified instruction. Obtaining CEUs can help you earn or maintain professional certification or licensure.

For details and course descriptions, go to <https://bit.ly/3UgdTMX>.

Book Your Hotel

Make plans to stay at one of the hotels in GSA's block steps away from the convention center (ACC). Book your hotel reservation through GSA Housing Bureau/Orchid.Events by 28 August to guarantee you receive GSA's special meeting rates.

Hotels	Rate*	Distance to ACC	Parking Per Day
Anaheim Marriott (HQ Hotel)	\$249	200 ft	Self: \$34; Valet: \$44
Hilton Anaheim	\$244	200 ft	Self: \$24; Valet: \$39
Best Western Plus Stovall's Inn	\$219	½ mile	Self: \$20
Homewood Suites by Hilton Anaheim	\$269	¼ mile	Self: \$28
Hyatt Place at Anaheim Resort/Convention Center	\$269	¼ mile	Self: \$28
Residence Inn at Anaheim Resort/Convention Center	\$259	Adjacent	Self: \$28



*Hotel booking opens in early May!
Make your reservation soon to
guarantee a room in your chosen hotel.*

*Rates are in U.S. dollars and do not include the current applicable tax of 15% per room, per night.

PLEASE NOTE: The official GSA housing bureau is Orchid.Events. To receive the GSA group rate at each hotel, reservations must be made through Orchid and not directly with the hotels. GSA and Orchid will NOT contact attendees directly to solicit new reservations. If you are contacted by a vendor who claims to represent GSA, please notify the GSA Meetings Department at meetings@geosociety.org. Please do not make hotel arrangements or share any personal information through any means other than a trusted, reliable source.

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Explore Local Geological Wonders

Discover spectacular landscapes, interact with colleagues, and expand your horizons by registering for a field trip! Read trip descriptions at <https://bit.ly/49qHl1r>.

FT401. Pulling Apart Death Valley's Plio/Quaternary Tectonics. Wed.–Sat., 18–21 Sept.

Leaders: Andrew Dunning, Portland State University, adunning@pdx.edu; Jazzy Graham-Davis, Sammy Castonguay.



FT402. Fracture Development in Magmatic Systems, Tuolumne Intrusive Suite, Sierra Nevada Batholith, California. Wed.–Sat., 18–21 Sept.

Cosponsor: *GSA Structural Geology and Tectonics Division*.

Leaders: Basil Tikoff, University of Wisconsin–Madison, basil@geology.wisc.edu; Kyrsten Johnston, Thomas Shipley, Richard A. Becker, Paul Riley, John M. Bartley.



FT403. An Educator's Look at Southern California Geology. Thurs.–Sat., 19–21 Sept.

Cosponsors: *National Association of Geoscience Teachers (NAGT)*; *GSA Geoscience Education Division*.

Leaders: Edith Carolina Rojas Salazar, College of the Desert, rojasedith86@gmail.com; Callan Bentley.



FT404. Mountain Pass: Rare Earth Elements Exploration & Development. Thurs.–Fri., 19–20 Sept.

Cosponsor: *Society of Economic Geologists*.

Leader: Duncan Proctor, Society of Economic Geologists, Nathaniel.proctor@gmail.com.



FT405. Warren Hamilton Field Trip: Cretaceous through Neogene Tectonostratigraphic Evolution of the Southern California Margin. Fri.–Sat., 20–21 Sept.

Cosponsor: *Pacific Section - SEPM (Society for Sedimentary Geology)*.

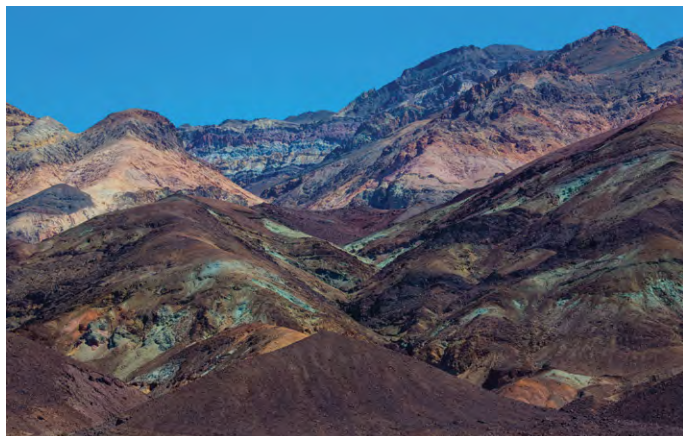
Leaders: Raymond Ingersoll, University of California, Los Angeles, rvingersoll@gmail.com; Peter Bird, David S. Diamond.



FT406. Tar Pits Road Trip. Thurs.–Fri., 26–27 Sept.

Cosponsor: *GSA Hydrogeology Division*.

Leaders: Eric Scott, Cogstone Resource Management, escott@csusb.edu; Regan Dunn, Emily Lindsey.



Death Valley National Park, California, USA.

FT407. Active Tectonics and Geomorphic Development of the Northwestern Transverse Ranges. Fri.–Sun., 20–22 Sept.

Leaders: Nate Onderdonk, California State University, Long Beach, nate.underdonk@csulb.edu; Antonio F. Garcia, Ian McGregor.



FT408. Debris Flows and Sediment Transport at Yucaipa Ridge and Impacts to Oak Glen and Forest Falls Area, Southern California, Following the 2020 El Dorado and Apple Fires. Sat., 21 Sept.

Cosponsors: *GSA Environmental and Engineering Geology Division*; *GSA Quaternary Geology and Geomorphology Division*; *California Geological Survey*.

Leaders: Brian Swanson, California Geological Survey, brian.swanson@conservation.ca.gov; Kerry Cato, Don Lindsay, Roman DiBiase, Alexander Neely.



FT409. California's OIL Coast: Conflicted History of Natural Resources, Early Exploration, and Environmental Justice. Sat., 21 Sept.

Cosponsors: *History of Earth Sciences Society*; *GSA History and Philosophy of Geology Division*.

Leaders: Renee Clary, Mississippi State University, rclary@geosci.msstate.edu; Stephen Testa.

INDUSTRY TRACKS

GSA's technical program offers field trips relevant to applied geoscientists. Look for these icons, which identify field trips in the following areas:



Economic Geology



Energy



Engineering



Hydrogeology and Environmental Geology



Bathrooms Available



1-mile+ Walking



1-hour+ Drive




Steep Terrain










Wheelchair Accessible




ACCESSIBILITY

GSA strives to plan inclusive, accessible field trips for all attendees. Look for these icons, which indicate field trip accessibility:



 FT410. **Kirk Bryan Field Trip: The Holocene Trace of the San Andreas Fault through San Geronio Pass.** Sat., 21 Sept.
Cosponsor: *GSA Quaternary Geology & Geomorphology Division*.
Leaders: Richard Heermance, California State University, Northridge, richard.heermance@csun.edu; Nathan D. Brown, Andrew Cyr.




    FT411. **From Flooding to Faulting: The Dynamic Geology of Coastal Orange County.** Sat., 21 Sept.
Cosponsor: *Association of Engineering Geologists (AEG)*.
Leaders: Brian Olson, California Geological Survey, brian.olson@conservation.ca.gov; William Godwin, W. Paul Burgess.


   FT412. **Exploration of North American Quaternary Geology at the La Brea Tar Pits.** Sat., 21 Sept.
Cosponsors: *GSA Geoarchaeology Division; GSA Quaternary Geology and Geomorphology Division*.
Leaders: Rebecca Taormina, National Park College, rebecca.taormina@np.edu; Laura Murphy.

   FT413. **Public Tour of the Jet Propulsion Laboratory.** Wed., 25 Sept.
Cosponsor: *GSA Planetary Geology Division*.
Leader: Nicholas Lang, NASA, nicholas.p.lang@nasa.gov.

FT414. **Geology, Coastal Geomorphology, and Soils of Eastern Santa Cruz Island: Tectonics and Sea-Level History.** Thurs., 26 Sept.
Cosponsors: *GSA Marine and Coastal Geoscience Division; GSA Quaternary Geology & Geomorphology Division*.
Leader: Daniel Muhs, Geoscience and Environmental Change Science Center, dmuhs@usgs.gov.




  FT415. **Field Trip to the Coyote Mountains.** Wed.–Sun., 25–29 Sept.
Leaders: George Morgan, georgemorgan@cox.net; J.R. Morgan.



   FT416. **San Andreas Fault at Wallace Creek and Parkfield, California.** Thu., 26 Sept.
Leaders: Sinan Akciz, California State University, Fullerton, sakciz@fullerton.edu; Julian J. Lozos.

 FT417. **How Geology and Paleontology Helped Build the Magic of the Disneyland Resort.** Thurs., 26 Sept.
Cosponsors: *Geosciences ASCEND; Pacific Section - SEPM (Society for Sedimentary Geology); GSA Hydrogeology Division*.
Leaders: Daniel Sturmer, University of Cincinnati, Daniel.Sturmer@uc.edu; Stuart Sumida, Garrett S. Vice, Michelle Mary.



San Andreas Fault, California, USA.

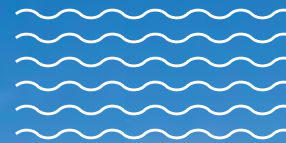
   FT418. **Outcrop Expression of Confined Deep-Water Slope Systems.** Thurs.–Sat., 26–28 Sept.
Leaders: Kirt Campion, North Coast Geoscience, campion.geoscience@gmail.com; Anthony R.G. Sprague, Morgan D. Sullivan, Barrett T. Dixon.

  FT419. **Hazards and Hilltops: The San Andreas Fault and Mount San Jacinto IAGD Accessible Field Trip.** Thurs., 26 Sept.
Cosponsor: *International Association for Geoscience Diversity (IAGD)*.
Leaders: Anita Marshall, University of Florida, anita.marshall@ufl.edu; Michele Cooke, Bryan Castillo, Katherine Scharer.

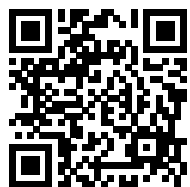
FT420. **Volcanism and Tectonics of Young Basaltic Fields in the Eastern California Shear Zone, California.** Thurs.–Fri., 26–27 Sept.
Cosponsors: *GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; GSA Structural Geology and Tectonics Division; GSA Geochronology Division; Geochemical Society*.
Leaders: David Buesch, Geology, Minerals, Energy, and Geophysics Science Center, dbuesch@usgs.gov; David M. Miller.

   FT421. **The Changing Landscape on Hawaii Island: Multiple Eruptions at Two Volcanoes in the Past 6 Years.** Thurs.–Sun., 26–29 Sept.
Leaders: Steven Lundblad, University of Hawaii at Hilo, slundbla@hawaii.edu; Elisabeth Gallant, Kendra Lynn, Michael H. Zoeller, Ashton Flinders.

Your Next Geological **ADVENTURE** Begins Here!



The GSA/Chevron Field Trip Grant fuels funding for geology students and early career professionals to explore impactful field trips. So, pack your curiosity, grab your compass, and get ready for the adventure of a lifetime!



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the application
process.



Engage with Big Ideas in Geoscience

Invited speakers cover a broad range of topics in the Pardee Keynote Symposia.

P1. Redefining Wildfire in the Anthropocene

Endorsers: GSA Quaternary Geology and Geomorphology Division, GSA Hydrogeology Division, GSA Environmental and Engineering Geology Division, GSA Soils and Soil Processes Division, GSA Geology and Society Division

Disciplines: Geoscience and Public Policy, Hydrogeology, Environmental Justice

Advocates: Jen Pierce; Christopher Carlson; Natalie Collar; James Guilinger; Andrew Graber

This session brings together leading scientists, fire managers, and policymakers to discuss and debate the topic of wildfire in the Anthropocene and consider the question: Can we adapt to a fiery future?

P2. Sustainable Groundwater in a Changing World

Endorsers: GSA Hydrogeology Division, GSA International, GSA Geology and Society Division, GSA Geology and Health Division, International Association of Hydrogeologists, International Society of Groundwater for Sustainable Development (ISGSD)

Disciplines: Hydrogeology, Geoscience and Public Policy, Environmental Geoscience

Advocates: Abhijit Mukherjee; Prosun Bhattacharya; Christopher Carlson; David Kreamer; Arpita Mandal

The increasing influence of climate change, land-use modifications, and deterioration of water quality have highlighted the nexus of groundwater, environment, and society. Thus, this Pardee session reinforces the need to understand the meeting's theme, "Water in a Changing World."

P3. 130 Years of Research in the Turkana Basin, Kenya: Insights into Earth, Climate, and Life in Eastern Africa

Endorsers: GSA Geoarchaeology Division, GSA Geobiology and Geomicrobiology Division, GSA Limnogeology Division, GSA Quaternary Geology and Geomorphology Division, GSA Sedimentary Geology Division, GSA Structural Geology and Tectonics Division, GSA Continental Scientific Drilling Division, SEPM (Society for Sedimentary Geology)

Disciplines: Stratigraphy, Paleontology, Paleoecology/Taphonomy, Tectonics

Advocates: Christian M. Rowan; Catherine Beck; Craig Feibel

Commemorating the 130th anniversary of the first scientific publication on the Turkana Basin, Kenya, our goal is to showcase diverse research in archaeology, geology, paleoclimatology, paleontology, seismology, and tectonics.

These sessions are named in honor of GSA Fellow and benefactor Joseph Thomas Pardee (1871–1960) via a bequest from Mary Pardee Kelly.



P4. Attracting and Educating a Twenty-First-Century Mining Workforce: Addressing the Need for a Resilient Domestic Supply of Critical Minerals

Disciplines: Geoscience Education, Economic Geology, Environmental Geoscience

Advocates: James Kubicki; Emma Hunt; Marek Locmelis; Antonio Arribas

This workshop will focus on methods for attracting and educating students in resource exploration, extraction, and purification. We seek experts from related fields to address the human resource bottleneck in achieving critical minerals security.

P5. Mining and Sustainability: Geological, Sociological, Environmental, and Cultural Standards for Resourcing a Path to Our Future, Views from the Field

Endorsers: GSA Energy Geology Division, GSA Geology and Society Division, GSA Geology and Health Division, Association of Environmental & Engineering Geologists

Disciplines: Environmental Geoscience, Geoscience and Public Policy, Environmental Justice

Advocates: Gregory Wessel; James Heller; Etzigueri Gongora Ubeda

This session will consider steps the mining industry can take to transition from responsible mining to true sustainability, by bringing those affected together around a modern protocol that values place, people, justice, and legacy.



Jumpstart Your Career with GSA

Connect with a mentor and network with industry professionals!

GEOCAREERS DAY

Career insights from industry and government representatives.

- Résumé and USAJobs Workshop
- Company Connection
- Mentor Roundtables
- Career Panel

GEOCAREERS CENTER

Take your career to the next level.

- Career Presentations
- Résumé Review Clinic
- Drop-in Mentoring
- Early Career Professional Coffee
- Geology Club Meet-Up
- Networking Reception
- Women in Geology Program
- Post or View Jobs



Share Your Science with a Global Audience

What to expect when preparing and presenting your research at GSA Connects 2024.

Submit Your Abstracts: <https://bit.ly/3VDhuWt>



*Abstract submissions relating to the meeting themes **Life Along an Active Margin** and **Water in Our Changing World** are encouraged.*

FAQS

Submission guide: <https://bit.ly/3VFv37K>

NUMBER OF ABSTRACTS

- You can submit up to two abstracts if:
 - One is for a poster presentation.
 - Both cover different content.
- Invited submissions to Pardee Keynote or topical sessions don't count against your limit!

FEES

- GSA Members: Professionals \$60, Students \$25
- Non-Members: Professionals \$80, Students \$50

POSTER PRESENTERS

- GSA provides one free horizontal 8' x 4' (w x h) display board and Velcro to hang your poster.

ORAL PRESENTERS

- Presentation length: 12 minutes + 3 minutes for Q&A.
- Check in at the Speaker Ready Room 24 hours before you present.

- Tech session rooms include a PC with Windows 10/MS Office 2021.
 - Use a 16:9 screen ratio for presentations.
- Recordings** of topical sessions, keynote symposia, and more will be available online after the meeting.

**Abstracts
deadline:
18 June**

KNOW BEFORE YOU GO

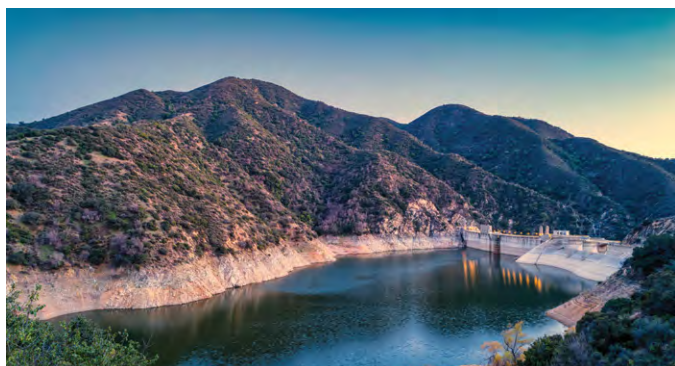
When you submit an abstract to GSA, it's more than just sharing your research; it's a promise to present your findings with integrity and respect. All our authors and presenters agree to:

- Commit to Present:** Submitting your abstract means you're planning to be there, ready to share and discuss your work.
- Maintain Integrity in Research:** Stay true to your abstract's content and conclusions as reviewed, ensuring high quality and honesty throughout.
- Recognize All Efforts:** Celebrate collaboration! Ensure any co-authors are acknowledged, have contributed significantly, are informed of, and consent to their inclusion.
- Ensure Quality:** Craft a presentation that reflects your dedication to excellence in research.

At GSA, we're passionate about fostering diversity among our event speakers and panelists, ensuring a rich, inclusive experience for everyone.

GSA Connects 2024 is an in-person event, and we can't wait to see you in Anaheim, California, USA!

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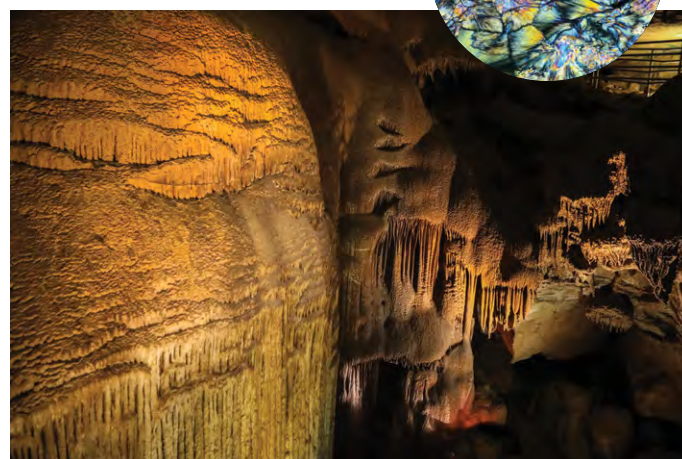
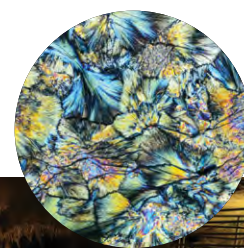
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Share Your Research!

Submit your abstract to any of these exciting topical sessions.

CONTINENTAL SCIENTIFIC DRILLING

T1. Investigating Earth's Past, Present, and Future with Continental Scientific Drilling

Endorsers: GSA Continental Scientific Drilling Division, GSA Limnogeology Division, GSA Energy Geology Division, GSA Geochronology Division, GSA Geology and Society Division, GSA Quaternary Geology and Geomorphology Division, GSA Structural Geology and Tectonics Division, GSA Sedimentary Geology Division, Paleontological Society, GSA Soils and Soil Processes Division

Disciplines: Continental Scientific Drilling, Energy Geology, Limnogeology

Advocates: Michael McGlue; Brett Carpenter; Madison Rafter; Laura Lopera Congote

This session is intended to be a showcase for multidisciplinary research that explores Earth's dynamic history using subsurface geological data sets acquired through continental scientific drilling and coring techniques.

T2. Mesozoic Earth System and Timescale

Endorsers: GSA Continental Scientific Drilling Division, Geological Society of London, GSA Geochronology Division

Disciplines: Continental Scientific Drilling, Stratigraphy, Geochemistry

Advocates: Stephen Hesselbo; Linda Hinnov; Jessica H. Whiteside; Kenneth Miller; Crispin T. Little

This session aims to bring together researchers from disparate disciplines to understand how the course of Mesozoic Earth history has been determined by both intrinsic (Earth) and extrinsic (solar system) processes.

ECONOMIC GEOLOGY

T3. Porphyry Copper Systems: Advances and Sources of Materials for the Energy Transition

Endorsers: Society for Mining, Metallurgy & Exploration, Inc., Society of Economic Geologists, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

Disciplines: Economic Geology, Energy Geology, Geoscience and Public Policy

Advocate: Mark D. Barton

Porphyry copper systems, in the U.S. and elsewhere, contain huge amounts of many elements relevant to the energy

transition; few are recovered. This session focuses on advances in system-scale geological/geochemical understanding and the potential for recovery.



T4. Seafloor Hydrothermal Systems and Their Ancient Analogues

Endorsers: Society of Economic Geologists, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

Disciplines: Economic Geology, Geochemistry, Petrology, Igneous

Advocates: Marta Codeco; Andrew Martin; Maria C. Figueroa

This session aims to assess the role of seafloor mineral deposits and their ancient analogues as future mineral resources for the green energy transition. We invite contributions that investigate the ore-forming processes from micro-to-crustal scales in all geodynamic settings.

T5. Linking Mineral Resources and Their Geologic Framework: The USGS Earth Mapping Resources Initiative (Earth MRI) and Related Critical Minerals Research

Endorsers: GSA Geophysics and Geodynamics Division, GSA Environmental and Engineering Geology Division, GSA

Structural Geology and Tectonics Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

Disciplines: Economic Geology, Geophysics/Geodynamics

Advocates: Anjana Shah; Douglas C. Kreiner; Benjamin Drenth; Nora K. Foley; Jamey Jones III

Knowledge of the geologic framework and mineral resources is improving through new geologic mapping, airborne geophysics, geochemistry, and lidar acquisition, especially through Earth MRI. We welcome submissions linking framework geology and mineral resources.

T6. Attracting and Educating a Twenty-First-Century Mining Workforce: Addressing the Need for a Resilient Domestic Supply of Critical Minerals

Endorsers: GSA Geology and Society Division, Society of Economic Geologists, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

Disciplines: Economic Geology, Geoscience Education, Geoscience Information/Communication

Advocates: Marek Locmelis; Emma Hunt; James Kubicki; Antonio Arribas

INDUSTRY TRACKS

GSA's technical program offers sessions relevant to applied geoscientists.

Look for these icons, which identify sessions in the following areas:



Economic Geology



Energy



Engineering



Hydrogeology and Environmental Geology



Life Along an Active Margin



Water in Our Changing World

MEETING THEMES

Sessions that align with the themes are indicated by these icons:

This session will focus on attracting and educating students in responsible mining and mineral processing practices that are key to supply chain resilience. We seek experts from mining-related fields to discuss the human resource bottleneck in critical minerals security.

T7. Critical Minerals in Canada

Endorsers: GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Geology and Society Division

Disciplines: Economic Geology, Energy Geology, Geoscience Information/Communication

Advocates: Levi Knapp; Mastaneh Liseroudi

This session will explore the critical mineral potential of Canada, showcasing the latest government, academic, and industry studies on geoscience and mineral potential modeling, as well as cutting-edge analytical methods and application of AI tools to support exploration and assessment.

T8. Advances, Progress, and Challenges in Utilizing Hyperspectral Remote Sensing for Characterizing Tailings and Abandoned Mine Lands

Endorser: GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

Disciplines: Economic Geology, Energy Geology, Environmental Geoscience

Advocates: Sanaz Salati; Dean Riley

Mine tailings and abandoned mine lands characterization are required for sustainable mining and the green energy transition. Hyperspectral remote sensing is underutilized; however, it is important for critical mineral characterization, vegetation mapping, acid mine drainage assessment, and temporal analysis.

T9. Ore Genesis in Extensional Tectonic Environments

Endorsers: GSA Geophysics and Geodynamics Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Structural Geology and Tectonics Division, Society of Economic Geologists, Geological Association of Canada, Geological Society of Australia, Geological Society of Africa

Disciplines: Economic Geology, Tectonics, Geophysics/Geodynamics

Advocates: Julia McIntosh; Chelsea Amaral; Micah Mayle

This session explores the formation of various ore deposits in extensional tectonic environments. We welcome interdisciplinary submissions, including but not limited to airborne geophysics, mineralogy, geochemistry, geologic mapping, and lidar acquisition. Both students and professionals are encouraged to submit.

T10. Lithium Clays, Brines, and Pegmatites in the Americas: Challenges of a Critical Metal for the Energy Transition

Disciplines: Economic Geology, Energy Geology

Advocates: Jorge Crespo Mena; Simon M. Jowitt; Michael H. Darin; Thomas R. Benson

The increasing demand of metals associated with the green energy transition has generated a new wave in exploration and extraction of lithium deposits. This session aims

to address topics related to Li deposit models, structural controls, and geochemical and petrological aspects.

ENERGY GEOLOGY

T11. Geologic Energy Resources and Storage for Now and the Future

Endorsers: GSA Energy Geology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Geology and Society Division

Disciplines: Energy Geology, Engineering Geology, Geochemistry

Advocates: Justin Birdwell; Qinhong Hu; Mindy Solomon; Marc Buursink; Denise J. Hills; Eric Stautberg

We seek contributions describing research relevant to geologic energy resources, emphasizing multi-resource development (e.g., heat + Li extraction from brines), non-traditional fossil fuel use (e.g., REEs from coal), and hydrogen, compressed air, and CO₂ storage.

T12. Emerging Voices in Energy Geology Research: Contributions from Students and Early Career Professionals

Endorsers: GSA Energy Geology Division, Council on Undergraduate Research Geosciences Division, GSA Geology and Society Division

Disciplines: Energy Geology, Geoscience and Public Policy, Geoscience Education

Advocates: Justin Birdwell; Qinhong Hu; Mindy Solomon; Marc Buursink; Denise J. Hills; Eric Stautberg

This session will focus on completed research and work in progress performed by students at all levels and early career professionals relevant to geologic energy with emphasis on the expansion of nonfossil energy resources.

T13. Lacustrine Petroleum Systems around the World

Endorser: GSA Energy Geology Division

Disciplines: Energy Geology, Limnogeology, Engineering Geology

Advocates: Josh Sigler; Justin Birdwell; Qinhong Hu; Ryan Gall

This session seeks contributions describing research into understanding the geologic features of modern and ancient lakes and petroleum system elements in lacustrine basins, with emphasis on those being developed in western North America and China.

T14. Science and Technology Advancement in Responsible Mining of Critical Minerals from Primary and Secondary Resources

Endorsers: GSA Energy Geology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Geology and Society Division

Disciplines: Energy Geology, Economic Geology, Geochemistry

Advocates: Guangping Xu; Dawn Wellman; Yuanzhi Tang

Innovative technology and approaches are needed for mining of critical minerals (CMs) to meet unprecedented demand. This session invites presentations on innovative solutions in characterization, extraction, separation, in situ

recovery, and more that ensure responsible recovery while minimizing environmental impact.

 **T15. Subsurface Data Curation, Visualization, and Assessment to Support Geologic Carbon Storage**

Endorsers: GSA Energy Geology Division, GSA Geoinformatics and Data Science Division

Disciplines: Energy Geology, Geoinformatics and Data Science

Advocates: Paige Morkner; Julia Mulhern

Subsurface data are central to advancing geologic carbon storage (GCS) efforts. This session focuses on data curation and management, data visualization, and subsurface data assessments for GCS.

T16. The Role of Salt Formations in the Energy Transition

Endorser: GSA Geology and Society Division

Disciplines: Energy Geology, Economic Geology, Structural Geology

Advocate: C. Nur Schuba

This session will explore the pivotal role of salt formations in sustainable energy, delving into their application in compressed air energy storage, hydrogen storage, geological repositories, and geothermal energy. Presentations will cover geomechanics, geochemistry, and operational considerations for cleaner energy solutions.

T17. Geological Perspectives on Harnessing Hydrogen: From Formation to Storage

Endorser: GSA Geology and Society Division

Disciplines: Energy Geology, Economic Geology, Engineering Geology

Advocate: C. Nur Schuba

Presentations will explore processes leading to formation and trapping of natural hydrogen, criteria for selecting storage sites, and the role of the geosciences in ensuring safe and effective hydrogen storage solutions.

ENGINEERING GEOLOGY

T18. Current Trends in Landslide Inventories and Assessments: Innovative Techniques, Collection Methods, Modeling, and Risk

Endorsers: GSA Environmental and Engineering Geology Division, GSA Quaternary Geology and Geomorphology Division

Disciplines: Engineering Geology, Environmental Geoscience, Geoscience Information/Communication

Advocates: Matthew Crawford; Anne Witt; William Burns; Stephen Slaughter

Landslide inventories are the foundation for assessing landslide susceptibility, hazard, and risk. This session will showcase innovative landslide studies including change detection, new remote sensing techniques, automated mapping processes, susceptibility mapping, and more.

ENVIRONMENTAL GEOSCIENCE

T19. Environmental Geochemistry and Health

Endorsers: GSA Geology and Health Division, Environmental & Engineering Geophysical Society, GSA Geobiology and Geomicrobiology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Hydrogeology Division

Disciplines: Environmental Geoscience, Geology and Health, Geochemistry

Advocates: Sarah Hayes; Jean Morrison; Ann Ojeda

We invite presentations on the environmental fate of contaminants and their impact on human and environmental health. Transdisciplinary contributions, especially those examining the rock-soil-water-human nexus at all scales with strong public outreach or societal impact, are encouraged.

T20. 36th Annual Undergraduate Research Exhibition Sponsored by Sigma Gamma Epsilon

Endorsers: Sigma Gamma Epsilon, GSA Limnogeology Division, GSA Marine and Coastal Geoscience Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

Disciplines: Environmental Geoscience, Stratigraphy, Petrology, Igneous

Advocates: Richard Ford; Alexander K Stewart; C Marshall; Diane Burns; Norman Levine; Steve Bennett

All students are encouraged to submit research to this poster session. Investigations from ANY geological sub-discipline are welcome. Presenters who are SGE members are eligible to compete for monetary awards distributed at the meeting.

T21. Advances in Environmental Geochemistry: Honoring the Scientific Contributions of Charles N. Alpers

Endorsers: GSA Environmental and Engineering Geology Division, GSA Geology and Health Division, GSA Hydrogeology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

Disciplines: Environmental Geoscience, Hydrogeology, Geochemistry

Advocates: Sarah Hayes; Peggy O'Day; Jacob Fleck; Kate M. Campbell

We welcome contributions inspired by the research of Charlie Alpers on metal cycling (especially Hg, As, Pb, Cu, and Zn), environmental impacts of mining, source attribution, sediment fingerprinting, and impact of wildfires on water quality.

T22. Environmental and Engineering Geology Division: Poster Session for Graduate and Undergraduate Students

Endorsers: GSA Environmental and Engineering Geology Division

Disciplines: Environmental Geoscience, Engineering Geology

Advocates: Francis Rengers; W. Paul Burgess; Luke McGuire; Ann Youberg

We encourage graduate and undergraduate students to submit poster presentations on topics related to applied

research in environmental and engineering geology. Monetary awards will be given to the top presenters at the Division awards ceremony.

T23. Environmental and Engineering Geology Division Oral Session

Endorser: *GSA Environmental and Engineering Geology Division*

Disciplines: Environmental Geoscience, Engineering Geology

Advocates: Francis Rengers; W. Paul Burgess; Luke McGuire; Ann Youberg

The oral session for the Environmental and Engineering Geology Division (EEGD) provides an opportunity for the geoscience community to present their research, data, and work pertaining to environmental and engineering geology.

T24. Advances in Military Geoscience: Challenges Across All Environments

Endorsers: *GSA Quaternary Geology and Geomorphology Division, GSA Environmental and Engineering Geology Division, GSA Soils and Soil Processes Division, GSA Geology and Society Division*

Disciplines: Environmental Geoscience, Geomorphology, Soils and Soil Processes

Advocates: Brad Sion; Eric McDonald

This session highlights intersections between geoscience research and military operations and policies. Relevant topics include: environmental science, geoarchaeology, Quaternary geology, economic geology, terrain analysis, geochemistry, hydrology, soils, fluvial dynamics, and coastal and marine environments.

T25. Mining and Sustainability: Views from the Field to Guide Development of a Twenty-First-Century Approach that Elevates Place, People, Justice, and Legacy

Endorsers: *GSA Energy Geology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Geology and Society Division, Association of Environmental & Engineering Geologists*

Disciplines: Environmental Geoscience, Geoscience and Public Policy, Environmental Justice

Advocates: Gregory Wessel; Etzigueri Gongora Ubeda; James Heller

This session will consider steps the mining industry can take to transition from responsible mining to true sustainability, by bringing those affected together around a modern protocol that values place, people, justice, and legacy.

GEOARCHAEOLOGY

T26. The New Role of Geoscience in Archaeological Training and Demand in U.S. Cultural Resource Management (CRM)

Endorsers: *GSA Geoarchaeology Division, GSA History and Philosophy of Geology Division, GSA Geology and Society Division*

Disciplines: Geoarchaeology, Geoscience Education, Geoscience and Public Policy

Advocates: Samantha Marie Krause; Daniel Sandweiss; Heidi Luchsinger

This session will explore studies that do any of the following: (1) focus on CRM geoarchaeology, (2) integrate geoscience and archaeology using new methods, and (3) discuss developments in enhancing curriculum at the collegiate level.

T27. Geoarchaeology of Landesque Capital: Current Research on Long-Term Water and Soil Management

Endorsers: *GSA Geoarchaeology Division, GSA Soils and Soil Processes Division, GSA Hydrogeology Division, GSA Geology and Society Division*

Disciplines: Geoarchaeology, Soils and Soil Processes, Hydrogeology

Advocates: Wilhemina Colón Loder; Timothy Beach; Samantha Marie Krause

This session invites research that considers any of these landesque capital techniques such as terracing, canals, wetland fields, and reservoirs to adapt to different landscapes, climates, climate, and other environmental changes.

GEOBIOLOGY AND GEOMICROBIOLOGY

T28. New Voices in Geobiology

Endorsers: *GSA Geobiology and Geomicrobiology Division*

Disciplines: Geobiology and Geomicrobiology

Advocates: John Spear; Nagissa Mahmoudi; Dylan Wilmeth; Lucy Webb; Victoria A. Petryshyn; Trinity Hamilton

This session will bring together new research focusing on the interplay between geologic and biologic processes with a special emphasis on work by early-career scientists exploring new questions and hypotheses.

T29. New Advances in Geobiology

Endorser: *GSA Geobiology and Geomicrobiology Division*

Disciplines: Geobiology and Geomicrobiology

Advocates: John Spear; Nagissa Mahmoudi; Dylan Wilmeth; Lucy Webb; Victoria A. Petryshyn; Trinity Hamilton

This session will focus on new research at the intersection between geological and biological processes with special emphasis on novel materials and methods, new field sites, and advances at the intersections of scientific fields.

T30. Dynamic Environments across the Ediacaran–Cambrian Boundary and the Rise of Early Animals

Endorsers: *GSA Geobiology and Geomicrobiology Division, GSA Geochronology Division*

Disciplines: Geobiology and Geomicrobiology, Paleontology, Diversity, Extinction, Origination, Geochemistry

Advocates: Prescott Vayda; Amy Hagen; Watsawan Chanchai; Mary C. Lonsdale; Iona M. Baillie; Reina Harding; Tianran Zhang



This session seeks to bring together scientists who apply paleontological, geochemical, stratigraphical, geochronological, or other novel approaches to understand the timing and interplay between the environment and early animal evolution during the Ediacaran–Cambrian transition.

GEOCHEMISTRY

📍 T31. Understanding the Origin of Salt Giants

Endorsers: *International Association of Sedimentologists (IAS), GSA Sedimentary Geology Division, Geochemical Society, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division*

Disciplines: Geochemistry, Geobiology and Geomicrobiology, Paleoclimatology/Paleoceanography

Advocates: Francesco Dela Pierre; Tim Lowenstein; Luis Gibert

This session is open to researchers working on different aspects of modern and ancient evaporitic successions (sedimentology, tectonics, geochemistry, geophysics, geobiology, etc.) that can be used for the interpretation of Salt Giants.

T32. Latest Advances in the Use of Mercury to Trace Geological and Paleoenvironmental Processes through Earth History

Endorsers: *Geochemical Society, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division*

Disciplines: Geochemistry, Tectonics, Paleontology, Diversity, Extinction, Origination

Advocates: Stephen Grasby; Runsheng Yin

This session examines the wide spectrum of studies that employ mercury and its isotopes to elucidate geological and paleoenvironmental processes, including recent advances made and challenges still faced in refining its use.

T33. Advances in Nontraditional Stable Isotope Measurements and Utility as Proxies in Modern and Paleo-Settings

Endorsers: *GSA Geobiology & Geomicrobiology Division, GSA Quaternary Geology and Geomorphology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, Geochemical Society, GSA Soils and Soil Processes Division*

Disciplines: Geochemistry, Environmental Geoscience, Geobiology and Geomicrobiology

Advocates: Jiuyuan Wang; Yi Wang; Jordan Wostbrock

Nontraditional stable isotopes greatly advance our understanding of geological processes. In this session, we welcome all contributions that cover analytical methodology, proxy development, and application of non-traditional stable isotope systems.

T34. Mineralogy, Geochemistry, Petrology, and Volcanology Student Session

Endorsers: *GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, Council on Undergraduate Research Geosciences Division, Mineralogical Society of America*

Disciplines: Geochemistry, Petrology, Igneous, Volcanology

Advocates: Madeline Murchland; Charles Lewis; Emily L. Fischer

GSA's MGPV student representatives invite the Division's student population to present their research at our oral and poster session. We encourage abstracts from any subdiscipline within our respective fields with hopes of stimulating a multidisciplinary Early Career Researcher (ECR) community within MGPV.

GEOCHRONOLOGY

T35. Dating the Quaternary: Development and Application of Geochronological Tools in Geomorphology and Archaeology

Endorsers: *GSA Geoarchaeology Division, GSA Geochronology Division, GSA Limnogeology Division, GSA Quaternary Geology and Geomorphology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division*

Disciplines: Geochronology, Quaternary Geology, Geoarchaeology

Advocates: Christina Neudorf; Kathleen Rodrigues; Nathan D. Brown; Harrison Gray

This session will feature new developments in Quaternary dating techniques that provide chronologies for events that shape Earth's surface as well as insights into human migration, settlement, and land use.

T36. Application of Novel Analytical Methods to Reconstruct the Development of Orogenic Systems

Endorsers: *GSA Geochronology Division, GSA Structural Geology and Tectonics Division*

Disciplines: Geochronology, Tectonics, Petrology, Metamorphic

Advocates: John M. Cottle; Kyle P. Larson

This session will highlight the development and application of emerging analytical techniques that enable the deconvolution of the complex tectonic, metamorphic, and magmatic processes in orogenic systems.

T37. Advances and Applications of Thermochronology to Tectonic, Magmatic, Basin, and Geomorphic Problems

Endorsers: *GSA Sedimentary Geology Division, GSA Quaternary Geology and Geomorphology Division, GSA Geochronology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division*

Disciplines: Geochronology, Tectonics, Geomorphology

Advocates: Kendra Murray; Alyssa Abbey; Gilby Jepson; Scott Jess

Thermochronology is applied widely to better understand a variety of fundamental Earth system processes. This session aims to highlight work applying these methods to improve our understanding of tectonism, magmatism, basin histories, and landscape evolution.

T38. New Advances and Applications of CA-TIMS U/Pb Geochronology and CA Method in the Earth Sciences: A Session in Honor of James Mattinson

Endorsers: *GSA Geochronology Division, GSA Structural Geology and Tectonics Division, GSA Sedimentary Geology*

Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

Disciplines: Geochronology, Tectonics, Stratigraphy

Advocates: Matthew Rioux; Michael Eddy; William C. McClelland

We seek contributions from a broad range of disciplines to explore the breadth, significance, and innovations in applications of the chemical abrasion method (e.g., CA-TIMS) in U-Pb geochronology and petrochronology.

T39. What's the Cosmognosis? Recent Advances in Understanding Earth and Planetary Processes with Cosmogenic Nuclides

Endorsers: *GSA Quaternary Geology and Geomorphology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Planetary Geology Division, GSA Geochronology Division*

Disciplines: Geochronology, Geomorphology, Tectonics

Advocates: Marissa Tremblay; Marie Bergelin; Michal Ben-Israel

This session welcomes abstracts on applications of cosmogenic nuclides across a range of geoscience topics, including but not limited to geomorphology, paleoclimate, tectonics, volcanology, polar science, and planetary geology.



GEOHERITAGE

T40. Human Dimensions of Geoheritage

Endorsers: *American Geosciences Institute, GSA Geoarchaeology Division, GSA Geoinformatics and Data Science Division, GSA History and Philosophy of Geology Division, History of Earth Sciences Society, GSA Sedimentary Geology Division, GSA Quaternary Geology and Geomorphology Division, GSA Environmental and Engineering Geology Division, GSA Marine and Coastal Geoscience Division, GSA Karst Division, GSA Soils and Soil Processes Division, GSA Energy Geology Division, GSA Limnogeology Division, GSA Geochronology Division, GSA Hydrogeology Division, GSA Geobiology and Geomicrobiology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Geology and Health Division, GSA Structural Geology and Tectonics Division, GSA Geology and Society Division*

Disciplines: Geoheritage, History and Philosophy of Geology, Geoscience Information/Communication

Advocates: Christina DeVera; Tim Henderson

Presentations will explore the human dimensions of geoheritage to understand impacts of geologic phenomena on

human history, provide effective methods of science communication, and promote the importance of geoconservation through increased knowledge and public interest.

GEOINFORMATICS AND DATA SCIENCE

T41. What Is the Problem This Solves? Creating User-Centered AI Tools for the Geoscience Community

Endorser: *GSA Geoinformatics and Data Science Division*

Disciplines: Geoinformatics and Data Science, Geoscience Education

Advocate: Jessica Lawrence-Hurt

Key questions speakers will address include:

* Should we go it alone or partner with others?

* What resources should we expect to deploy?

* What sorts of problems lend themselves to AI solutions—and what sorts don't?

T42. Open Science, Open Data: Geoinformatics and Why It Should Be on Everyone's Radar

Endorsers: *GSA Geoinformatics and Data Science Division, GSA History and Philosophy of Geology Division, GSA Geology and Society Division*

Disciplines: Geoinformatics and Data Science

Advocates: Tao Wen; Andrew Zaffos; Denise J. Hills; Shweta Narkar; Jarrod Burges

Open science is the art of creating social and technical systems that make the scientific process more ethical, inclusive, and effective. It naturally dovetails with the goal of geoinformatics to make data more accessible.

T43. Advancing Energy Transition–Associated Minerals Exploration: Data-Driven Ideas for Present and Future Challenges

Endorsers: *GSA Geoinformatics and Data Science Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Geology and Society Division*

Disciplines: Geoinformatics and Data Science, Energy Geology, Economic Geology

Advocates: Shaunna Morrison; David Zhen Yin; Ahmed Eleish; Xiaogang Ma; Behnam Sadeghi

Exploring critical minerals: A session for geoscientists utilizing data science, machine learning, geostatistics, and geomathematics in mineral exploration studies and practices.

T44. Geologic Maps and Their Derivatives (Posters)

Endorsers: *Association of American State Geologists, GSA Geoinformatics and Data Science Division*

Disciplines: Geoinformatics and Data Science, Hydrogeology, Structural Geology

Advocates: Richard Berg; Harvey Thorleifson

This poster session will highlight new geologic maps, mapping programs, and innovations in geological mapping, including data management, web accessibility, 3D, and applications in water and land management.

T45. Innovations in Geological Mapping

Endorsers: *Association of American State Geologists, GSA Geoinformatics and Data Science Division*

Disciplines: Geoinformatics and Data Science, Hydrogeology, Structural Geology

Advocates: Richard Berg; Harvey Thorleifson

This session will highlight exciting research outcomes based on geologic mapping, new geologic maps, mapping programs, and innovations in geological mapping methods, including data management, web accessibility, 3D, and applications in water and land management.

T46. Sustainable, Equitable, and Usable Earth Science Cyberinfrastructure

Endorsers: *GSA Geoinformatics and Data Science Division, GSA Geology and Society Division*

Disciplines: Geoinformatics and Data Science

Advocates: Andrea Thomer; Natalie Raia; Simon Goring

This session brings together the developers and users of earth science data infrastructure to share plans for making earth science cyberinfrastructure more sustainable, equitable, and usable over the next 20 years.

GEOLOGY AND HEALTH

T47. Respectful Approaches in Geoscience Contexts for Supporting Indigenous Communities

Endorsers: *GSA Geology and Health Division, GSA Environmental and Engineering Geology Division, GSA Energy Geology Division, GSA Geoscience Education and Data Science Division, GSA History and Philosophy of Geology Division, GSA Geology and Society Division*

Disciplines: Geology and Health, Environmental Geoscience, Geoscience and Public Policy

Advocates: Darryl Reano; Kenneth Ridgway; Abhishek RoyChowdhury; Darlene Wilson; Wai Allen

This session will discuss successful approaches to Indigenous community-driven science. We invite abstracts on convergence research relating to water use, energy and mineral needs, climate change, and Traditional Ecological Knowledge as they pertain to Native communities.

T48. Quantifying and Addressing the Environmental and Health Impacts of Active, Orphaned, and Abandoned Oil and Gas Wells

Endorser: *GSA Geoinformatics and Data Science Division*

Disciplines: Geology and Health, Energy Geology, Geoinformatics and Data Science

Advocates: Tao Wen; Jaisree Iyer

This session invites abstracts applying field, laboratory, process-based modeling, and machine learning approaches to quantify impacts and improve management of oil/gas wells spanning all statuses (active, abandoned, orphaned) and types (unconventional, conventional).



T49. The Founding of Medical Geology: The Contributions and Legacy of Dr. Olle Selinus

Endorsers: *GSA Geology and Health Division, GSA History and Philosophy of Geology Division*

Disciplines: Geology and Health, Hydrogeology, Environmental Geoscience

Advocates: Laura Suzanne Ruhl; Robert Finkelman; Malcolm Siegel

This session is dedicated to the memory of recently departed Dr. Olle Selinus, one of the founders of the field of medical geology, and focuses on the science, impacts, and contributions to the discipline he inspired.

GEOMORPHOLOGY

T50. Advances in Arid Lands Geomorphology

Endorsers: *GSA Quaternary Geology and Geomorphology Division, GSA Soils and Soil Processes Division, GSA Hydrogeology Division*

Disciplines: Geomorphology, Quaternary Geology, Soils and Soil Processes

Advocates: Mark Sweeney; Karl W. Wegmann; Dennis Wolf

This session seeks presentations on any aspect of nonpolar deserts, including the imprint of rapid meteorological events or longer-term climate variability, fluvial-eolian-hillslope interactions and processes, geochronology, soil development, and vegetation dynamics.

T51. Earth Surface Processes in Tectonically Active and Unstable Regions

Endorsers: *GSA Quaternary Geology and Geomorphology Division, GSA Geochronology Division, GSA Geophysics and Geodynamics Division*

Disciplines: Geomorphology, Quaternary Geology, Tectonics

Advocates: Achim Beylich; Takashi Oguchi; Sunil Kumar De; Arjun M. Heimsath

This session explores the latest research on the controls, mechanisms, amplitudes, rates, and impacts of Earth surface processes that drive the dynamics and evolution of mountain landscapes and unstable regions at tectonically active margins worldwide.

T52. Impact of Contemporary Climate Change and Human Activities on Geomorphological Hazards

Endorsers: *GSA Quaternary Geology and Geomorphology Division, GSA Geology and Society Division*

Disciplines: Geomorphology, Quaternary Geology, Environmental Geoscience

Advocates: Sunil Kumar De; Takashi Oguchi; Achim Beylich; Jennifer Pierce; Lisa L. Ely

Most of the geomorphological hazards occur due to the fusion of climate change and human activities. The proposed session invites scientific contributions on the impact of contemporary climate change and human activities on geomorphological hazards.

T53. Wildland Fire in the Anthropocene: An Agent of Geomorphic, Ecologic, and Societal Change

Endorsers: *GSA Environmental and Engineering Geology Division, GSA Soils and Soil Processes Division, GSA Quaternary Geology and Geomorphology Division, GSA Geology and Society Division*

Disciplines: Geomorphology, Soils and Soil Processes, Engineering Geology

Advocates: Andrew Graber; James Guilinger; Alexander Gorr; Natalie Collar

This session will consider the impacts of wildland fire on landscapes and society, particularly through the lenses of water quality management, post-fire hazard prediction, vegetation and soil-hydraulic property recovery, and prediction of post-fire management needs before fires occur.

T54. The Cryosphere & Mountain Hydrology, Past and Present and Future

Endorsers: *GSA Quaternary Geology and Geomorphology Division, GSA Hydrogeology Division*

Disciplines: Geomorphology, Hydrogeology, Quaternary Geology

Advocates: Olivia Stanley; Glenn Thackray

This session encompasses linkages between snow, ice, and mountain stream hydrology on all timescales. We aim to explore current, former, and future cryospheric influences on surface and groundwater hydrology, stream ecology, and human endeavors.

T55. Aeolian Systems in Time and Space

Endorsers: *GSA Quaternary Geology and Geomorphology Division, GSA Soils and Soil Processes Division, GSA Planetary Geology Division, GSA Sedimentary Geology Division, SEPM (Society for Sedimentary Geology)*

Disciplines: Geomorphology, Sediments, Clastic, Stratigraphy

Advocates: Madeline Kelley; Alana Archbold

This session will explore research focused on all aspects of aeolian processes and landforms, including dunes, dust, and loess in modern and ancient aeolian systems on Earth and other planets.

GEOPHYSICS/GEODYNAMICS

T56. Geologic Carbon Storage

Endorsers: *GSA Geophysics and Geodynamics Division, GSA Geology and Society Division*

Disciplines: Geophysics/Geodynamics, Environmental Geoscience

Advocates: Lianjie Huang; Ting Chen; Erkan Ay; Bjorn Paulsson

This session solicits abstracts on site selection, geologic and geophysical site characterization, modeling and monitoring of CO₂ injection/migration, risk assessment, and case studies of large-scale geologic carbon storage projects.

T57. The Use of Geophysics to Explore and Investigate for Mineral, Hydrocarbon, and Water Resources

Endorsers: *GSA Geophysics and Geodynamics Division, GSA Energy Geology Division, GSA Hydrogeology Division*

Disciplines: Geophysics/Geodynamics, Hydrogeology, Energy Geology

Advocate: Kevin Mickus

Abstracts are requested that use all types of geophysics to explore and investigate minerals, hydrocarbons, and water.

T59. Geophysical Studies in Africa: Tectonics, Geomorphology, Groundwater, and Resource Exploration

Endorsers: *GSA Geophysics and Geodynamics Division, GSA Structural Geology and Tectonics Division, GSA Quaternary Geology and Geomorphology Division, GSA Hydrogeology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division*

Disciplines: Geophysics/Geodynamics, Tectonics, Economic Geology

Advocate: Kevin Mickus

Abstracts using geophysics to solve tectonic, geomorphological, mineral, petroleum, and groundwater problems in Africa are requested.

T60. Near-Surface Geophysics to Solve Geological Problems

Endorsers: *GSA Geophysics and Geodynamics Division, GSA Quaternary Geology and Geomorphology Division, GSA Environmental and Engineering Geology Division, GSA Hydrogeology Division, GSA Geoarchaeology Division, GSA Karst Division, GSA Limnogeology Division, GSA Energy Geology Division, GSA Soils and Soil Processes Division*

Discipline: Geophysics/Geodynamics

Advocate: Kevin Mickus

Near-surface geophysics is increasingly used to study a variety of problems, including environmental, engineering, archaeological, karst, hydrological, and geological. Abstracts that study these problems are requested.

T61. Woollard Session: Interdisciplinary Insights into Fault Zone Properties and Faulting Processes

Endorser: *GSA Geophysics and Geodynamics Division*

Discipline: Geophysics/Geodynamics

Advocates: Anjana Shah; Shannon Dulin; Amanda Hughes; Ting Chen

In the spirit of the research of 2023 Woollard Awardee Mian Liu, we invite contributions centered on the theme of interdisciplinary observational, theoretical, and numerical modeling studies of faults and fault zones. The session will also include a keynote from the 2024 Woollard Awardee.

GEOSCIENCE AND PUBLIC POLICY

T62. Shaping a Sustainable Future with Geology in the Twenty-First Century: Geology and Society Division Turns 21

Endorsers: *GSA Geology and Society Division, GSA Energy Geology Division, GSA Environmental and Engineering Geology Division, GSA Quaternary Geology and Geomorphology Division, GSA International Committee, GSA Structural Geology and Tectonics Division, GSA Marine and Coastal*

Geoscience Division, GSA Soils and Soil Processes Division, GSA Geoinformatics and Data Science Division

Disciplines: Geoscience and Public Policy, Environmental Geoscience, Energy Geology

Advocates: M. Harris; Lily Jackson; James Heller; Denise J. Hills

This broadly interdisciplinary session seeks presentations on how geology positively impacts society for a globally sustainable future through workforce training, scientific advancement, resource development, hazard mitigation, energy challenges, climate change analysis, environmental stewardship, infrastructure development, and international collaboration.

T63. Geoscience “Ambassador” Programs: Insights on Critical Issues of Power, Dignity, Agency, and Belonging

Endorsers: *GSA Geology and Society Division, GSA Geoinformatics and Data Science Division*

Disciplines: Geoscience and Public Policy, Geoscience Information/Communication, Geoscience Education

Advocates: Elizabeth Long; Julia Clarke; Adam Papendieck; Katherine Ellins; Stephen K. Boss; Lucas J. LeGendre

The session will feature presentations from a variety of past and current ambassador programs to initiate a new dialogue on what is known and what needs to be learned for effective, inclusive, and respectful ambassadorship.

GEOSCIENCE EDUCATION

T64. Teaching Media Literacy in the Geological Sciences

Endorser: *GSA Geoinformatics and Data Science Division*

Disciplines: Geoscience Education, Geoscience Information/Communication

Advocates: James Lehane; Gabriel-Philip Santos

Media literacy in the geological sciences is imperative as hyperconnectivity and mass media have intertwined within society. This session intends to share methods to augment media literacy as well as combat media disinformation.

T65. Intention Is Not Enough: Real-Life Power Imbalances in the History of Geosciences and Possible Futurities

Endorsers: *GSA Geoscience Education Division, GSA Geology and Society Division, GSA Geoarchaeology Division, GSA Geology and Health Division*

Disciplines: Geoscience Education, Environmental Justice, Geoscience and Public Policy

Advocates: Karen Pham; Darryl Reano; Thi Truong

This session will make space to unpack, from multiple perspectives, the power dynamics that are an inevitable part of collaborations within geoscience research, education, and workplace contexts.

T66. Strategies and Best Practices in the Development and Execution of Youth Outreach Programs

Disciplines: Geoscience Education, Geoscience Information/Communication

Advocates: Leah Turner; Jasmine Gulick

This session shares innovative strategies in engaging youth in earth science. Topics include curriculum, outreach, mentorship, digital engagement, and fundraising. Participants will feel inspired, informed, and empowered to develop and execute effective youth outreach programs.



T67. Whither Geoscience?

Endorsers: *GSA Hydrogeology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Geology and Society Division*

Disciplines: Geoscience Education, Hydrogeology, Economic Geology

Advocates: Peter Reiners; Paul Ferre

This session will feature open and lively discussions on topics related to the challenges and opportunities facing geosciences. Discussion leaders will present a topic and gather attendees to discuss possible paths forward. Each discussion leader will summarize the discussions and these summaries will be published openly as community calls to action.

T68. Geoscience Research Posters by 2YC and 4YCU Undergraduate Students

Endorsers: *National Association of Geoscience Teachers (NAGT), GSA Geoscience Education Division, NAGT Geo2YC Division, Council on Undergraduate Research Geosciences Division*

Discipline: Geoscience Education

Advocates: Gretchen L. Miller; Stephanie Rollins; Adrienne Leinbach; Jessica Kelley; Sara Rutzky; Ian Brown

This session is designed for two-year college (2YC) and four-year college and university (4YCU) students presenting research posters in any subdiscipline of geoscience.

T69. Making Sense of Methodologies and Theoretical Frameworks in Geoscience Education Research

Endorsers: *GSA Geoscience Education Division, National Association of Geoscience Teachers (NAGT), NAGT Geoscience Education Research (GER) Division*

Discipline: Geoscience Education

Advocates: Samuel Nyarko; Chris Mead; Emily Scribner; Kathryn Boyd; Caitlin Callahan; Chris Mead

Methods and theoretical frameworks from within and outside of GER shape our field. Presenters are encouraged to highlight their decision-making process in research studies. New approaches and applications of established methods/frameworks are welcomed.

T70. Iris Moreno Totten Research in Geoscience Education Session

Endorsers: *GSA Geoscience Education Division, National Association of Geoscience Teachers (NAGT)*

Discipline: Geoscience Education

Advocates: Meagan M. Gilbert; Larry Collins Jr.

This session will highlight empirical research being done in the field of geoscience education. Early career and student presenters will be considered for the Geoscience Education Division's Totten Award.

🇺🇸 T71. Earth Materials Next Gen: Innovative Approaches to Teaching Mineralogy and Petrology that Align with Student and Societal Demands

Endorsers: GSA Geoscience Education Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

Discipline: Geoscience Education

Advocates: Elizabeth Kenderes; Angela Van Boening; Miriam Barquero Molina

We explore cutting-edge teaching of Earth materials exceeding the basics, addressing societal concerns, and aligning with today's research and job demands. We invite abstracts showcasing innovative approaches, such as service-based projects, and those exploring how licensure exam content impacts learning.

T72. Geoscience Outreach Involving Undergraduates and High School Students Continues to Pique Interest and Build Cohort: Revelations from Longitudinal Tracking 2004–2023

Endorsers: GSA Quaternary Geology and Geomorphology Division, GSA Geoinformatics and Data Science Division, GSA Geology and Society Division, GSA Environmental and Engineering Geology Division, GSA Energy Geology Division, GSA Soils and Soil Processes Division, GSA Marine and Coastal Geoscience Division, GSA Geoscience Education Division, GSA Structural Geology and Tectonics Division, GSA Sedimentary Geology Division, GSA Hydrogeology Division

Disciplines: Geoscience Education, Geoscience Information/Communication, Environmental Geoscience

Advocates: Nazrul Khandaker; Taufique Mahmood

Undergraduate, high school, and faculty-led research outcomes on a variety of current and emerging geoscience-related topics with interdisciplinary focus are sought for this session.

T74. Current Advances in Geoscience Education Research

Endorsers: National Association of Geoscience Teachers (NAGT), GSA Geoscience Education Division, NAGT Geoscience Education Research (GER) Division

Discipline: Geoscience Education

Advocates: Larry Collins Jr.; Samuel Nyarko

This session will highlight empirical research being done in the field of geoscience education. We welcome submissions from geoscience education researchers at all career stages to showcase projects that highlight current areas of interest in the discipline.

GEOSCIENCE INFORMATION/COMMUNICATION

T75. Power and Pitfalls of Generative Artificial Intelligence in the Geosciences and Geoscience Education

Endorser: GSA Geoinformatics and Data Science Division

Disciplines: Geoscience Information/Communication, Geoscience Education, Geoinformatics and Data Science

Advocates: Callan Bentley; Jacquelyn Hams; Michael ODonnell

Generative artificial intelligence has the potential to transform science and science education. We explore attempts to harness the power of large language models and other AI to explore geological questions and to facilitate student learning.

T76. Putting the “Art” in Earth: Exploring the Intersection between Geoscience and the Creative Arts

Endorsers: GSA History and Philosophy of Geology Division, GSA Geology and Society Division

Disciplines: Geoscience Information/Communication, Geoscience Education, Geoheritage

Advocates: Kellum Tate-Jones; Jacquelyn Hams; Gui Aksit; Carmi Milagros Thompson

Many geoscientists employ creative arts for understanding, communicating, and enhancing their relationships to geoscience. We invite submissions of geoscience-related artwork in any medium and/or ways art can be used in geoscience to showcase the intersection of earth science and art.

T77. Reaching New Audiences through Data-Rich Art and Geoscience Collaborations

Endorsers: Association of American State Geologists, GSA Geoinformatics and Data Science Division, GSA Geology and Society Division

Disciplines: Geoscience Information/Communication, Geoscience Education, Hydrogeology

Advocates: Maria Leria; Susan Eriksson; William Andrews

The intersection of art and earth sciences reaches new audiences at a critical time for public engagement in science through new, data-rich initiatives, e.g., online exhibits, digital and print publications, and story maps.



NPS Photo

T78. Geoscience and Hydrology of Your Public Lands: STEM Internships, Research, Science, Mapping, Resource Management, and Education

Endorsers: GSA Karst Division, GSA Hydrogeology Division, GSA Geology and Society Division

Disciplines: Geoscience Information/Communication, Geoheritage, Geoscience and Public Policy

Advocates: Jason Kenworthy; Matthew Dawson; Limaris Soto; Chelsea Bitting; Lesley Petrie; Brent H. Breithaupt; F. Edwin Harvey

An interdisciplinary forum for geoscientists, land managers, educators, Scientists in Parks, and GeoCorps™ America participants or sponsors to present their work and describe its relevance to the public and land managers.

HISTORY AND PHILOSOPHY OF GEOLOGY

T79. Found in the Collection: Hidden Histories Revealed

Endorsers: *GSA History and Philosophy of Geology Division, GSA Geology and Society Division*

Disciplines: History and Philosophy of Geology, Geoheritage, Geoscience Information/Communication

Advocates: Renee M. Clary; Paul Mayer; Patricia Coorough Burke

Research using geological collections encompasses more than object name and location. Studying these collections leads the researcher to associated historical documents and publications in order to reconstruct their stories. This session will highlight these histories and the development of geoscience.

T80. Geociencias en las Américas / Geosciences in the Americas

Endorsers: *GSA Karst Division, GSA International Committee, GSA Soils and Soil Processes Division, Board on Earth Sciences and Resources, National Academies of Sciences, Engineering, and Medicine, U.S. National Committee for Geodesy and Geophysics, National Academies of Sciences, Engineering, and Medicine, GSA Geology and Society Division, GSA Diversity in the Geosciences Committee*

Disciplines: History and Philosophy of Geology, Geoheritage, Geology and Society

Advocates: Ángel García Jr.; Ester Sztejn; Elizabeth Long; Aaron Velasco

Esta sesión tiene como propósito promover la comunicación de la investigación geocientífica en las Américas en español dentro de GSA. This session aims to promote communication of geoscientific research in the Americas in Spanish within GSA.

HYDROGEOLOGY

T81. Advances in Groundwater Recharge and Unsaturated-Zone Hydrology: A Reflection on Rick Healy's Legacy

Endorsers: *GSA Hydrogeology Division, GSA Soils and Soil Processes Division*

Disciplines: Hydrogeology, Soils and Soil Processes

Advocates: Donald Rosenberry; Kim Perkins; Bridgett Scanlon; Richard Webb

Recent advances in understanding and quantification of groundwater recharge and associated unsaturated-zone processes are presented, including examples that demonstrate better management and/or decision-making related to water-resource-related issues.

T82. A Showcase of Undergraduate Research in Hydrogeology

Endorsers: *GSA Hydrogeology Division, Council on Undergraduate Research Geosciences Division*

Discipline: Hydrogeology

Advocates: Megan Jones; Miguel Valencia; Desire Piphus

This session is designed for undergraduates presenting research and senior theses in the field of hydrogeology. Prizes will be awarded for top presentations. Employers and graduate advisers are encouraged to attend.

T83. Groundwater Pollution with Arsenic and Other Geogenic Legacy Contaminants, Related Health Risks and Management: Advancing Learning through Geospatial Tools, Machine Learning, Data Science, and Artificial Intelligence

Endorsers: *GSA Hydrogeology Division, GSA International, International Medical Geology Association, International Water Association (IWA), Specialist Group Metals and Related Substances in Drinking Water (METRELS), GSA Geoinformatics and Data Science Division, GSA Geology and Health Division, GSA Geology and Society Division*

Disciplines: Hydrogeology, Environmental Geoscience, Geology and Health

Advocates: Prosun Bhattacharya; Abhijit Mukherjee; Mohammad Ayaz Alam; Madhumita Chakraborty; Joseline Tapia; Julian Ijumulana; Rakesh Kumar

The growing trend of data aggregation and analysis with machine learning and artificial intelligence enables us to improve understanding of the specificities of groundwater basins in terms of water qualitative perspective for direct consumption and/or treatment for groundwater supplies.

T84. Fight or Flight? Mitigation Versus Adaptation in a Hotter, Drier Landscape

Endorsers: *GSA Geology and Society Division, GSA Quaternary Geology and Geomorphology Division, GSA Hydrogeology Division*

Disciplines: Hydrogeology, Quaternary Geology, Environmental Geoscience

Advocates: Jessica Driscoll; Jeanne Godaire; Anne C. Tillery

This session will highlight science designed for natural resource managers to make informed decisions on whether to mitigate or adapt to drought conditions.



T85. Status of the Headwaters in Our Changing World: Springs and Base Flow

Endorser: *GSA Hydrogeology Division*

Disciplines: Hydrogeology, Environmental Geoscience, Geoscience and Public Policy

Advocates: Abraham Springer; Alan E. Fryar

Springs and base flow are significant contributors to streams and the ecosystems, cultures, and values they support. Presentations examining the influences of our

changing world on the hydrogeology and associated values of springs and base flow are encouraged.

T86. Coastal Hydrogeology in an Age of Rising Seas

Endorsers: *GSA Hydrogeology Division, International Society of Groundwater for Sustainable Development (ISGSD), GSA Karst Division, GSA Environmental and Engineering Geology Division, National Ground Water Association, GSA Marine and Coastal Geoscience Division, Soil Science Society of America, American Institute of Professional Geologists, GSA Geology and Society Division, GSA Soils and Soil Processes Division*

Disciplines: Hydrogeology, Marine/Coastal Geoscience, Engineering Geology

Advocates: Tara Root; Michael C. Sukop; Shellie Habel; Alicia M. Wilson; Holly Michael; Barret L. Kurylyk; Christopher Russoniello; Miguel Valencia

Understanding hydrogeology in coastal areas is crucial, particularly as sea levels rise. Seawater intrusion can lead to loss of potable or agricultural water supplies. Water table rise from sea-level rise can increase flooding and affect infrastructure.

T87. Surface Water–Groundwater Exchange Responses to Climate, Land Use, and Other Changes

Endorsers: *GSA Quaternary Geology and Geomorphology Division, GSA Hydrogeology Division, GSA Geology and Society Division*

Disciplines: Hydrogeology, Limnogeology, Geomorphology

Advocates: Michael Gooseff; Martin A. Briggs

Exchanges between surface water bodies and groundwater are dependent upon many state variables, and a myriad of changes may influence these exchanges, thereby reducing watershed functions such as solute retention and transformation.

T88. Use of Oil and Gas Production Waste Outside the Oil Field: Lab, Field, and Modeling Studies of Potential Impacts

Endorsers: *GSA Hydrogeology Division, GSA Energy Geology Division, GSA Geology and Health Division, GSA Geology and Society Division*

Disciplines: Hydrogeology, Energy Geology, Geology and Health

Advocates: Isabelle Cozzarelli; Bonnie McDevitt; Treasure Bailey; James E. Saiers

Use of oil and gas wastewaters and solids are increasingly viewed as potential solutions to waste disposal and water scarcity issues. This session addresses knowledge gaps bridged by lab, field, and modeling studies examining (re) use potential.

T89. Groundwater Recharge Processes in Regional Aquifers: Tracer, Geophysical, and Modeling Approaches for Sustainable Groundwater Management

Endorser: *GSA Hydrogeology Division*

Disciplines: Hydrogeology, Geochemistry, Geoinformatics and Data Science

Advocates: Jennifer McIntosh; Hoori Ajami; Grant Ferguson

This session highlights efforts to constrain natural and enhanced groundwater recharge to regional aquifers through environmental tracers, remote sensing observations, and hydrologic modeling approaches.

T90. Groundwater Monitoring by State Geological Surveys: The Backbone for Monitoring the Nation's Groundwater

Endorsers: *Association of American State Geologists, American Geosciences Institute, GSA Hydrogeology Division, GSA Geology and Society Division*

Disciplines: Hydrogeology, Karst, Geoscience Information/Communication

Advocates: David R. Wunsch; Keith E. Schilling

Collectively, state geological surveys play a critical role in monitoring the nation's groundwater. This session will highlight groundwater monitoring, monitoring network design, and data sharing by state geological surveys with the USGS National Groundwater Monitoring Network and other entities.

T91. Groundwater Sustainability in Times of Climate and Human Uncertainties

Endorsers: *GSA Hydrogeology Division, GSA International, GSA Environmental and Engineering Geology Division, GSA Geoinformatics and Data Science Division, GSA Geology and Health Division, GSA Geology and Society Division, International Society of Groundwater for Sustainable Development (ISGSD), International Association of Hydrogeologists*

Disciplines: Hydrogeology, Geoscience and Public Policy, Geology and Health

Advocates: Abhijit Mukherjee; Prosun Bhattacharya; Karen Villholth; Roger Sathre; Srimanti Duttagupta

This session will include topical interdisciplinary studies that bridge groundwater quantification and pollution to solutions and sustainability, from science to policy, from technology to clean water and food with impending climate changes and human-induced stresses.

T92. Advances in Managed Aquifer Recharge

Endorsers: *GSA Environmental and Engineering Geology Division, GSA Geology and Society Division, GSA Geophysics and Geodynamics Division, GSA Hydrogeology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, International Association of Hydrogeologists*

Disciplines: Hydrogeology, Environmental Geoscience, Geochemistry

Advocates: Gordon Osterman; Scott Bradford; Deborah Leslie

This session will present an interdisciplinary overview of the hydrological, geochemical, and geobiological processes and interactions associated with the practical implementation and operation of managed aquifer recharge strategies.

T93. Groundwater–Surface Water Interaction: From Sediment–Water Interface to Watersheds

Endorsers: *GSA Hydrogeology Division, GSA Quaternary Geology and Geomorphology Division*

Discipline: Hydrogeology

Advocates: Masaki Hayashi; J. Frederik Devlin; Andrew Wiebe

This session will showcase recent advances in ground-water–surface water interaction and its hydrological, geochemical, and ecological implications at all scales, encompassing ground-based measurements, remote sensing, and numerical modeling studies.

T94. The Use of Managed Aquifer Recharge to Enhance Groundwater Supplies

Endorsers: GSA Hydrogeology Division, GSA Environmental and Engineering Geology Division, International Association of Hydrogeologists, GSA Geology and Society Division

Disciplines: Hydrogeology, Environmental Geoscience, Engineering Geology

Advocates: Madeline E. Schreiber; Tingying Xu; Yipeng Zhang; Todd Halihan

In this session, we invite presentations on field, laboratory, and modeling studies that address scientific and engineering aspects of managed aquifer recharge (MAR). Presentations can also include regulations, economics, risk assessment, and public acceptance of MAR projects.

T95. Using Geologic Context to Improve Hydrogeologic Characterizations

Endorsers: GSA Hydrogeology Division, GSA Geoinformatics and Data Science Division, GSA Karst Division

Disciplines: Hydrogeology, Karst

Advocates: Maureen Muldoon; Susan Swanson

This session highlights the integration of geologic data into hydrogeologic characterization efforts.



T96. Hydrogeology in Support of Integrated Water Management

Endorsers: GSA Hydrogeology Division, GSA Quaternary Geology and Geomorphology Division

Discipline: Hydrogeology

Advocates: Geoffrey Cromwell; Claudia Faunt; Joseph Fackrell; Christina Stamos

This session will discuss hydrogeologic studies that help inform water management decisions at basin- and regional-scale. Technical topics may be wide ranging and should emphasize how the technical work has been, or will be, incorporated into water management decision-making.

KARST

T97. New Frontiers in Cave and Karst Science

Endorsers: GSA Karst Division, National Cave and Karst Research Institute, Karst Waters Institute, Geochemical Society, GSA Hydrogeology Division, GSA Geobiology and Geomicrobiology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Quaternary Geology and Geomorphology Division, GSA Environmental and Engineering Geology Division, GSA Geophysics and Geodynamics Division, GSA Sedimentary Geology Division, GSA Geochronology Division, GSA Geology and Society Division

Disciplines: Karst, Hydrogeology, Geobiology and Geomicrobiology

Advocates: Patricia N. Kambesis; Jeanne Lambert Sumrall; Rachel Bosch; Natasha Sekhon; Lewis Land; Daniel S. Jones

We encourage submissions in any field of cave and karst science, with special emphasis on novel techniques, interdisciplinary approaches, and contributions from diverse early career researchers (students, postdocs, and faculty).

T98. Karst Ecosystems and Biogeochemistry

Endorsers: Geochemical Society, GSA Environmental and Engineering Geology Division, GSA Geobiology & Geomicrobiology Division, National Cave and Karst Research Institute, GSA Karst Division, GSA Geobiology and Geomicrobiology Division, Karst Waters Institute, GSA Hydrogeology Division, GSA Geology and Society Division

Disciplines: Karst, Geobiology and Geomicrobiology, Geochemistry

Advocates: Daniel S. Jones; Jeanne Lambert Sumrall

This session seeks abstracts that deal with the study of cave and karst ecosystems, including the identification, quantification, and/or discussion of biota, flora, microbial, and related biogeochemical processes associated with cave and karst features.

T99. Karst Hazards and Monitoring

Endorsers: GSA Karst Division, GSA Environmental and Engineering Geology Division, GSA Geophysics and Geodynamics Division, National Cave and Karst Research Institute, Karst Waters Institute, GSA Hydrogeology Division, GSA Geology and Society Division

Disciplines: Karst, Engineering Geology

Advocates: Lewis Land; Jeanne Lambert Sumrall; Rachel Bosch; Daniel S. Jones

Hazards (e.g., sinkholes, pollution, radon, development) and monitoring approaches (e.g., GIS applications, historical data analyses) in karst landscapes will be addressed in this session, including technical applications (e.g., lidar, 3D scanning, geodatabase development) and management implications (resource management, education, policy, regulation).

T100. Karst Hydrology and Hydrogeology

Endorsers: GSA Karst Division, GSA Hydrogeology Division, GSA Environmental and Engineering Geology Division, National Cave and Karst Research Institute, Geochemical Society, Karst Waters Institute, GSA Geology and Society Division

Disciplines: Karst, Hydrogeology

Advocates: Jeanne Lambert Sumrall; Lewis Land; Natasha Sekhon; Daniel S. Jones

This session covers fundamental aspects of fluid-rock interactions within karst landscapes, including geologic, hydrogeologic, and hydrologic investigations. Appropriate topics range from dye tracing and aquifer processes to surface–subsurface hydrologic interactions and quantitative modeling.

T101. Karst Sedimentary, Paleoclimate, and Historical Records

Endorsers: GSA Karst Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Quaternary Geology and Geomorphology Division, GSA Sedimentary Geology Division, National Cave and Karst Research Institute, Karst

Waters Institute, Geochemical Society, GSA Geochronology Division, SEPM (Society for Sedimentary Geology), GSA Hydrogeology Division, GSA Geology and Society Division, GSA Soils and Soil Processes Division

Disciplines: Karst, Paleoclimatology/Paleoceanography, Geoarchaeology

Advocates: Natasha Sekhon; Kathleen Wendt; Annabel Wolf; Daniel S. Jones

We are seeking abstracts on cave deposits (sediments, speleothems, tufa, etc.), karst environmental records (sedimentary, carbonate stratigraphy, etc.), and geoarchaeological and historical investigations to interpret past climates, landscapes, extreme events, and land-use histories, and to model or predict future changes.

LIMNOGEOLOGY

T102. Alkaline Lakes on Earth and Beyond: Mineralogy, Geochemistry, and Habitability

Endorsers: *Mineralogical Society of America, GSA Planetary Geology Division, GSA Geochronology Division, GSA Geobiology and Geomicrobiology Division*

Disciplines: Limnogeology, Planetary Geology, Geobiology and Geomicrobiology

Advocates: Lindsay McHenry; Daniel Gebregiorgis

This session will cover the unique hydrochemical, mineralogical, and biological processes and deposits of modern and ancient alkaline lakes on Earth and Mars, and how these preserve evidence for changing environments.

T103. Lakes of the World through Time and Space: Archives of Climate, Paleoenvironments, Ecosystems, Geohazards, and Economic Resources

Endorsers: *GSA Continental Scientific Drilling Division, GSA Marine and Coastal Geoscience Division, GSA Quaternary Geology and Geomorphology Division, GSA Sedimentary Geology Division, GSA Energy Geology Division, GSA Environmental and Engineering Geology Division, GSA Geoarchaeology Division, GSA Geobiology and Geomicrobiology Division, GSA Geology and Society Division, GSA Geophysics and Geodynamics Division, GSA Hydrogeology Division, GSA Limnogeology Division, GSA Geoinformatics and Data Science Division, GSA Geochronology Division, Paleontological Society, SEPM (Society for Sedimentary Geology), AASP-The Palynological Society*

Disciplines: Limnogeology, Paleoclimatology/Paleoceanography, Stratigraphy

Advocates: Christopher Schiller; Scott W. Starratt

This session celebrates lacustrine research across the globe. Lake sediments are excellent archives of changing climate, paleoenvironments, human impacts, and economic resources. This session explores limnogeological research on all time and spatial scales.

T104. Cenozoic Lakes across Western North America: From the Varved Beds of the Green River Formation to the Ice-Covered Alpine Lakes of the Sierra Nevada

Endorsers: *GSA Continental Scientific Drilling Division, GSA Marine and Coastal Geoscience Division, GSA Quaternary*

Geology and Geomorphology Division, GSA Sedimentary Geology Division, GSA Energy Geology Division, GSA Environmental and Engineering Geology Division, GSA Geoarchaeology Division, GSA Geobiology and Geomicrobiology Division, GSA Geology and Society Division, GSA Geophysics and Geodynamics Division, GSA Hydrogeology Division, GSA Limnogeology Division, GSA Geoinformatics and Data Science Division, GSA Geochronology Division, Paleontological Society, SEPM (Society for Sedimentary Geology), AASP-The Palynological Society

Disciplines: Limnogeology, Paleoclimatology/Paleoceanography, Stratigraphy

Advocates: Matthew Kirby; Scott W. Starratt

Lakes have played an important role in the economic and cultural history of western North America. This session brings together geological, biological, and modeling research on modern lakes and lacustrine deposits across the region.



MARINE/COASTAL GEOSCIENCE

T105. Understanding Temporal Dynamics in Hydrogeochemistry and Sedimentary Processes in Estuarine Environments

Endorsers: *GSA Marine and Coastal Geoscience Division, GSA Sedimentary Geology Division, GSA Geochronology Division, International Association for Geoscience Diversity, GSA Environmental and Engineering Geology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division*

Disciplines: Marine/Coastal Geoscience, Geochronology, Sediments, Clastic

Advocates: Henry Agbogun; Onema Adojoh

This session explores temporal changes in estuarine environments with respect to water chemistry and sediment inputs. Effects of evolving physiochemical properties and isotopic composition of water, as well as the geochemical attributes of sediments on the environment, will be presented.

T106. Recent Advances and New Voices in Marine and Coastal Geoscience

Endorsers: *GSA Energy Geology Division, GSA Sedimentary Geology Division, AASP-The Palynological Society, the Paleontological Society, GSA Environmental and Engineering Geology Division, GSA Geoarchaeology Division, GSA Geobiology and Geomicrobiology Division, GSA Geology and Society Division, GSA Geophysics and Geodynamics Division, GSA Limnogeology Division, GSA Marine and Coastal*

Geoscience Division, GSA Quaternary Geology and Geomorphology Division, GSA Geoinformatics and Data Science Division, GSA Geochronology Division, SEPM (Society for Sedimentary Geology)

Disciplines: Marine/Coastal Geoscience, Paleoclimatology/Paleoceanography, Quaternary Geology

Advocates: Lauren Toth; Andrea Hawkes; Kelly Best Lazar; Nicole Khan; Ashley Long; Katya Beener; Emma Bouie; Scott W. Starratt

We seek abstracts on physical oceanography, marine geology, geomorphology, sediment transport, geophysics, tectonic processes, climate change, paleobiology, or any aspect of oceans and coasts, past and present. We encourage students to participate in this session.

T107. Got Sand? Science Supporting Regional Sediment Management (RSM) for Coastal Resilience

Endorsers: *GSA Marine and Coastal Geoscience Division, GSA Sedimentary Geology Division, GSA Quaternary Geology and Geomorphology Division, GSA Geology and Society Division*

Disciplines: Marine/Coastal Geoscience, Environmental Geoscience, Engineering Geology

Advocates: Ashley Long; Katherine Luciano

We seek abstracts encompassing research, tools, and application advancements needed for Regional Sediment Management (RSM), a systems-based approach for managing sediments in coastal, marine, and inland environments. Participation by coastal managers, scientists, engineers, and students is encouraged.

T108. Coastal and Shallow Marine Sediments as Archives of Extreme Events

Endorsers: *GSA Quaternary Geology and Geomorphology Division, GSA Marine and Coastal Geoscience Division, GSA Sedimentary Geology Division, SEPM (Society for Sedimentary Geology), GSA Geology and Society Division*

Disciplines: Marine/Coastal Geoscience, Stratigraphy, Quaternary Geology

Advocates: Claire Divola; Joseph Carlin

This session explores the study and use of coastal and shallow marine sediments to identify, understand, and evaluate past extreme events such as tsunamis, earthquakes, storms, and other geological phenomena.

MINERALOGY/CRYSTALLOGRAPHY

T109. Advances in Mineral Sciences from Atomistic to Macro Perspectives: Recognition of Dr. Nancy L. Ross, 2024 Roebling Medalist of the Mineralogical Society of America

Endorsers: *Mineralogical Society of America, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division*

Disciplines: Mineralogy/Crystallography, Petrology, Igneous, Geophysics/Geodynamics

Advocates: Steven Jacobsen; Alexandra Navrotsky; Robert J. Bodnar

The 2024 Roebling Medal of the Mineralogical Society of America is being awarded to Dr. Nancy L. Ross of Virginia

Tech for her instrumental role in the development of the field of mineral physics.

T110. LGBTQ+ Experiences and Initiatives in Mineralogy and Crystallography

Endorsers: *GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, Mineralogical Society of America, GSA Geology and Society Division*

Disciplines: Mineralogy/Crystallography, Geochemistry, Petrology, Igneous

Advocates: Tyler L. Spano; Si Athena Chen; Nicole Childs; C Marshall

This session opens a dialogue on LGBTQ+ experiences within the earth sciences. The format will be presentations followed by a panel session. Talks discussing history, challenges faced by LGBTQ+ mineralogists, and initiatives for LGBTQ+ individuals in science are encouraged.

T111. Early Career Investigators in Mineralogy and Crystallography

Endorsers: *Mineralogical Society of America, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division*

Discipline: Mineralogy/Crystallography

Advocates: Tyler L. Spano; Si Athena Chen; Nicole Childs

This session provides a platform for early career mineralogists and crystallographers to share their research. Talks related to professional development and strategies for increasing diversity, equity, and inclusion in mineral sciences are also welcome.



T112. Crystal Clarity: Unraveling Mineralogical Mysteries with Spectroscopy

Endorsers: *Mineralogical Society of America, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division*

Discipline: Mineralogy/Crystallography

Advocates: Tyler L. Spano; C Marshall

This session highlights spectroscopic techniques as applied to mineral sciences. Talks that explore Raman, infrared, X-ray fluorescence, laser-induced breakdown, Mössbauer, neutron, and other forms of spectroscopy are welcome, as are papers describing underlying crystallographic and physiochemical effects on spectral observations.

T113. Synchrotron X-ray and Neutron Applications in Earth and Environmental Science

Endorsers: *Mineralogical Society of America, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Sedimentary Geology Division*

Disciplines: Mineralogy/Crystallography, Geochemistry, Environmental Geoscience

Advocates: Joanne Stubbs; Cara Santelli; Si Athena Chen

X-ray and neutron techniques are complementary in studying earth and environmental science. This session aims to establish a platform for information exchange,

explore diverse applications, and facilitate the use of synchrotron X-ray and neutron facilities.

T114. Gem Minerals, Localities, and Geological Significance

Endorsers: *Mineralogical Society of America, GSA Geochronology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division*

Disciplines: Mineralogy/Crystallography, Economic Geology, Geoscience Information/Communication

Advocates: James Shigley; Barbara Dutrow

Gemstones are among the most recognized of all minerals. This session focuses on diverse aspects of gem minerals including their formation conditions, exploration and mining, properties, compositions, treatments, inclusions, and identification, along with their geological implications.

PALEOCLIMATOLOGY/PALEOCEANOGRAPHY

T115. Proxy and Model Records of Cenozoic Climates in South America

Endorsers: *GSA Sedimentary Geology Division, SEPM (Society for Sedimentary Geology), GSA Soils and Soil Processes Division*

Disciplines: Paleoclimatology/Paleoceanography, Sediments, Clastic, Paleontology, Biogeography/Biostratigraphy

Advocates: Ethan Hyland; Jennifer Cotton

This session brings together proxy and model research into the complex development of Andean topography and impacts on changing hydroclimate and environments, to evaluate current knowledge on the evolution of South American climate across the Cenozoic.

T116. Insights from Microfossils and Their Modern Analogues: From Traditional and Emerging Approaches to Critical Reevaluations (Posters)

Endorsers: *AASP-The Palynological Society, SEPM (Society for Sedimentary Geology), Paleontological Society, GSA Marine and Coastal Geoscience Division, Paleontological Research Institution, Cushman Foundation, Geochemical Society*

Disciplines: Paleoclimatology/Paleoceanography, Paleontology, Biogeography/Biostratigraphy, Marine/Coastal Geoscience

Advocates: Robert K. Poirier; Andressa Alves; Chiara Borrelli

Assemblage- and proxy-based (i.e., geochemical) records derived from microfossils make up two foundational pillars of paleoclimate research. We encourage studies applying traditional and novel microfossil-based reconstructions, including those seeking to revisit old assumptions that may bias paleo-reconstructions.

T117. New Advances in the Analysis of Biogenic Hard Parts (Sclerochronology): Novel Applications, Proxies, and Insights

Endorsers: *GSA Geoarchaeology Division, GSA Marine and Coastal Geoscience Division, Paleontological Society, GSA Quaternary Geology and Geomorphology Division*

Disciplines: Paleoclimatology/Paleoceanography, Geoarchaeology, Marine/Coastal Geoscience

Advocates: Bernd R. Schoene; C. Fred T. Andrus; Donna M. Surge

Sclerochronology is increasingly utilized in diverse disciplines (e.g., paleontology, paleoclimatology, geoarchaeology). We invite scientists who study growth patterns and chemical and structural properties of biogenic hard parts to share their research, be it on fundamental processes, methods development, or any application.

T118. Understanding the Links between Life, Biogeochemical Cycles, and Environmental Feedbacks throughout the Mesozoic

Disciplines: Paleoclimatology/Paleoceanography, Geobiology and Geomicrobiology, Geochemistry

Advocates: Benjamin Gill; Jeremy Owens; João Trabucho Alexandre; Andrew H. Caruthers; Selva Marroquin

This session highlights integrative research to understand Mesozoic biotic, environmental, and climatic change. The goal is to foster interactions between specialists to provide a holistic understanding of outstanding questions about Earth's system.

T119. Oceans and Climates through Earth History: Modeling, Proxy, and Proxy Development Studies (Posters)

Endorsers: *AASP-The Palynological Society, Cushman Foundation, SEPM (Society for Sedimentary Geology), Paleontological Society, GSA Marine and Coastal Geoscience Division, Paleontological Research Institution, GSA Geochronology Division*

Disciplines: Paleoclimatology/Paleoceanography, Geochemistry, Paleontology, Diversity, Extinction, Origination

Advocates: Megan Fung; Miriam E. Katz

This poster session brings together modeling, proxy, and proxy development studies to improve our understanding of rapid ocean and climate events, and shifts between long-term climate/ocean states, within the context of normal variability throughout Earth history.

T120. Cushman Foundation Symposium: Biostratigraphy of Planktonic Foraminifera and the Geological Time Scale: Honoring the Career of William A. Berggren

Endorsers: *Cushman Foundation, Paleontological Society, SEPM (Society for Sedimentary Geology), Paleontological Research Institution, AASP-The Palynological Society, GSA Geochronology Division, GSA Sedimentary Geology Division, GSA Marine and Coastal Geoscience Division*

Disciplines: Paleoclimatology/Paleoceanography, Paleontology, Biogeography/Biostratigraphy, Stratigraphy

Advocates: Richard Fluegeman; Lizette Leon-Rodriguez; Maria Rose Petrizzo

This session will focus on the integration of biostratigraphic records of planktonic foraminifera with other types of stratigraphic data (chemostratigraphy, magnetostratigraphy, cyclostratigraphy, etc.) toward the refinement of the geologic time scale.

PALEONTOLOGY

T121. Piecing Together the Extinction Puzzle: Integrated Approaches to Quantifying Organism-Environment Interactions

Endorsers: GSA Geobiology & Geomicrobiology Division, Paleontological Society

Disciplines: Paleontology, Diversity, Extinction, Origination, Geochemistry, Geobiology and Geomicrobiology

Advocates: John Huntley; Trinity Hamilton; Ashley Prow

This session will highlight recent work reconstructing animal-habitat co-evolution, extinction patterns, and/or spatio-temporal distribution of environmental stressors during major biotic events over the Phanerozoic, using paleobiology, ecophysiology, geochemistry, and Earth-system modeling.

T122. The Cretaceous-Paleogene (K-Pg) Boundary Interval: From Large-Scale Geological Events to Mass Extinction Mechanisms

Endorsers: Paleontological Society, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Planetary Geology Division, GSA Geobiology and Geomicrobiology Division, GSA Sedimentary Geology Division, GSA Geochronology Division

Disciplines: Paleontology, Diversity, Extinction, Origination, Planetary Geology, Volcanology

Advocates: Pim Kaskes; Isabel Fendley; James Witts

The Cretaceous-Paleogene boundary interval witnessed extreme geological events: the Chicxulub impact event, Deccan Traps volcanism, and a biological catastrophe. New proxy-records, coupled with numerical modeling, can unravel the mechanisms driving the environmental change and the mass extinction.

T123. Future Leaders in Paleontology

Endorser: The Paleontological Society

Disciplines: Paleontology, Biogeography/Biostratigraphy, Paleontology, Diversity, Extinction, Origination, Paleontology, Paleoecology/Taphonomy

Advocates: Jim Schiffbauer; Sarah Jacquet; John Huntley

The Paleontological Society is pleased to offer the sixth annual “Future Leaders in Paleontology” topical session. This session will showcase the outstanding work of our student members in a high-profile setting.

T124. Life on the Boundary: Cretaceous/Paleogene Environments, Ecology, and Extinction Dynamics in Antarctica

Disciplines: Paleontology, Diversity, Extinction, Origination, Paleontology, Paleoecology/Taphonomy, Paleoclimatology/Paleoceanography

Advocates: Kerin Claeson; Julia Clarke; Matthew Lamanna; Patrick O'Connor; Thomas Tobin

This session will convene U.S. and international researchers studying the Cretaceous/Paleogene (K/Pg) paleontology, stratigraphy, sedimentology, and paleoenvironment of Antarctica, with particular emphasis on K/Pg boundary events in the James Ross Basin of the Antarctic Peninsula.

T125. Conservation Paleobiology and Species Invasions: Impacts of Biogeographic Shifts and Changing Community Structure in the Past and Present

Endorsers: Paleontological Society, SEPM (Society for Sedimentary Geology), Paleontological Research Institution, GSA Geobiology & Geomicrobiology Division, GSA Geology and Society Division

Disciplines: Paleontology, Paleoecology/Taphonomy, Paleontology, Biogeography/Biostratigraphy, Geobiology and Geomicrobiology

Advocates: Priyanka Soni; Samuel Little; David Bottjer; Austin Hendy

This session showcases advancements from integrating paleoecology, invasion ecology, niche modeling, and biogeography with conservation paleobiology. These studies of past and present environmental conditions are aimed to tackle challenges posed by future climate change.

T126. Evolution of Marine Life in the Cambrian: Biotic, Biogeochemical, and Stratigraphic Contexts

Endorsers: GSA Geobiology & Geomicrobiology Division, SEPM (Society for Sedimentary Geology), Paleontological Society

Disciplines: Paleontology,

Paleoecology/Taphonomy, Geochemistry, Stratigraphy
Advocates: Rudy Lerosey-Aubril; Robert R. Gaines; Sara Pruss; Javier Ortega-Hernandez

This session is dedicated to studies of the Cambrian System that illuminate the biotic, geobiological, stratigraphic, and geochemical contexts of the evolution of marine life during this period.



T128. Development in Deep Time: Ontogeny in the Fossil Record

Endorsers: Paleontological Society, Paleontological Research Institution

Disciplines: Paleontology, Phylogenetic/Morphological Patterns, Paleontology, Paleoecology/Taphonomy, Geobiology and Geomicrobiology

Advocates: Samantha B. Ocon; James C. Lamsdell

The developmental progression of organisms—ontogeny—can impact our understanding of the fossil record. This session centers on paleobiological research with an ontogenetic framework and its implications for our interpretation of the history of life.

T129. Phylogenetic and Computational Approaches in Paleobiology

Endorsers: GSA Geobiology and Geomicrobiology Division, Paleontological Research Institution, Paleontological Society, GSA Geoinformatics and Data Science Division

Disciplines: Paleontology, Phylogenetic/Morphological Patterns, Paleontology, Paleoecology/Taphonomy, Paleontology, Diversity, Extinction, Origination

Advocates: Katherine Jordan; Mark Nikolic

This session highlights recent advances integrating phylogenetics, modeling, and computational methods with fossil data to address evolutionary and ecological questions through deep time. Topics include macroevolutionary trends, diversification dynamics, trait evolution, macroecology, and paleobiogeography.

PETROLOGY, IGNEOUS

T130. GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division Awards Session

Endorser: *GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division*

Disciplines: Petrology, Igneous, Petrology, Metamorphic, Mineralogy/Crystallography

Advocates: Alan Whittington; Elisabeth Widom

The GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division honors their 2023 student research, Distinguished Geological Career (DGCA), and Early Geological Career (EGCA) awardees.

T131. Petrology and Volcanology of Earth and Other Planets

Endorsers: *GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Planetary Geology Division*

Disciplines: Petrology, Igneous, Planetary Geology, Volcanology

Advocates: Amanda B. Clarke; Jade Star Lackey; Claire McLeod; Alan Whittington; Elisabeth Widom

This session will bring together scientists studying petrologic processes on Earth and other planets, moons and asteroids, using field observations, experiments, geochemical analysis, and theoretical exploration.

T132. Magmatism and Accreted Terranes from the North American Cordillera to the Norwegian Caledonides: A Session in Honor of the Scientific Contributions of Calvin G. Barnes

Endorsers: *GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Structural Geology and Tectonics Division, Geochemical Society, GSA Geochronology Division*

Disciplines: Petrology, Igneous, Geochemistry, Tectonics

Advocates: Valbone Memeti; Gregory Dumond; Nolwenn Coint

Cal Barnes pioneered field-based to mineral-scale petrology to advance granitoid petrogenesis and emplacement in the context of terrane accretion and other settings. We invite contributions from petrology, geochemistry, geochronology, and tectonics to celebrate Cal's career.

PETROLOGY, METAMORPHIC

T133. State-of-the-Art and Future Directions in Petrology and Petrochronology: A Session in Honor of Chris Yakymchuk, University of Waterloo, GSA MGPV Early Geological Career Awardee for 2024

Endorsers: *GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Geochronology Division*

Disciplines: Petrology, Metamorphic, Geochronology, Petrology, Igneous

Advocates: Michael Brown; Robert Holder; Jillian Kendrick; David Pattison

This session honors Chris for outstanding transformational research in petrology and petrochronology, involving field and laboratory work, and using theory and modeling; we welcome forward-looking contributions from the community at large to advance these disciplines.

PLANETARY GEOLOGY

T134. Best Practices and Exciting Discoveries in Identifying, Mapping, and Analyzing Planetary Landforms and Terrestrial Analogues

Endorsers: *GSA Planetary Geology Division, GSA Quaternary Geology and Geomorphology Division, GSA Limnogeology Division*

Disciplines: Planetary Geology, Geoinformatics and Data Science, Quaternary Geology

Advocates: Kelsey Crane; Kirby Runyon; Leta McCullough; Michael Ortigoza

We invite abstracts that investigate the methodology of planetary and terrestrial landform analysis or that explore methodologies as a means of achieving insight into the evolution of those landforms, with emphasis on Earth analogue analysis.

T135. Big Science from Small Worlds

Endorser: *GSA Planetary Geology Division*

Discipline: Planetary Geology

Advocates: Jennifer Scully; Debra Buczkowski; Kynan H.G. Hughson

We encourage geologic, geochemical, and geophysical analyses of small bodies: dwarf planets, asteroids, comets, and more! Remote sensing, laboratory-based, and other studies can be comparative of more than one body, or in-depth studies of one body.

T136. Impact Cratering: A Dominant Process in the Solar System

Endorsers: *GSA Planetary Geology Division, GSA Structural Geology and Tectonics Division, GSA Marine and Coastal Geoscience Division, GSA Continental Scientific Drilling Division, GSA Geophysics and Geodynamics Division, GSA Quaternary Geology and Geomorphology Division*

Disciplines: Planetary Geology, Continental Scientific Drilling, Geomorphology

Advocates: Jeffrey Plescia; Christian Koeberl

This session focuses on the nature of impact craters and their influence on planetary geologic evolution. We solicit contributions on aspects of impact crater formation, ejecta, shock processes, geochemical and mineralogical signatures, modeling, and geologic implications—particularly comparison among bodies.

T137. Sulfates on Earth, Mars, and Beyond

Endorsers: *GSA Geobiology and Geomicrobiology Division, GSA Limnogeology Division, GSA Planetary Geology Division, GSA Sedimentary Geology Division, SEPM (Society for*

Sedimentary Geology), *GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division*

Disciplines: Planetary Geology, Mineralogy/Crystallography, Geobiology and Geomicrobiology

Advocates: Kathleen Benison; Maya Bradford

Sulfate minerals are important as both chemical sediments and diagenetic phases in elucidating environments, climates, and life. We welcome presentations about the sedimentology, petrography, geochemistry, and/or geobiology of terrestrial and extraterrestrial sulfate minerals.

T138. **The G.K. Gilbert Award Session: TBD**

Endorser: *GSA Planetary Geology Division*

Discipline: Planetary Geology

Advocates: Marisa Palucis; Samuel Birch

This session highlights the work of the G.K. Gilbert Award winner. The award is given by the Planetary Geology Division for outstanding contributions to the solution of fundamental problems within planetary geology, in the broadest sense.

T139. **Planetary Exploration and Education: How We Learn about Our Solar System and Beyond**

Endorsers: *GSA Planetary Geology Division, GSA Geoscience Education Division*

Disciplines: Planetary Geology, Geoscience Education, Geoheritage

Advocate: Nicholas Patrick Lang

This session links how we teach and learn about outer space to how we gained that information (e.g., space missions). Descriptions of outreach, teaching activities/courses, strategies for working with students, and planetary missions are encouraged.

T140. **Myths and Misrepresentations Surrounding Cosmic Impact Claims in Paleoclimatology, Paleontology, Paleoeology, Geoarchaeology, and Quaternary Research**

Endorsers: *GSA Planetary Geology Division, GSA Geoarchaeology Division, GSA History and Philosophy of Geology Division, GSA Quaternary Geology and Geomorphology Division*

Disciplines: Planetary Geology, Geoarchaeology, History and Philosophy of Geology

Advocates: Christian Koeberl; Mark Boslough; Vance Holliday

Sensationalized but unfounded claims about cosmic impacts and environmental catastrophes receive extensive media coverage, contributing to public misunderstanding. Speakers will share their experiences in responding to such myths and misrepresentations in their areas of expertise.

T141. **Active and Anticipated Science from Planetary Science Research, Programs, and Future Flight Projects**

Endorsers: *GSA Planetary Geology Division, GSA Quaternary Geology and Geomorphology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division*

Disciplines: Planetary Geology, Geomorphology, Volcanology

Advocates: Samuel Birch; Michael Kelley

This session welcomes presentations of scientific results from planetary science investigations, including both fundamental research and data analysis from spacecraft missions to other solid bodies throughout the solar system.

T142. **Shake and Bake: Volcanism and Tectonism across the Solar System**

Endorsers: *GSA Planetary Geology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division*

Disciplines: Planetary Geology, Structural Geology, Volcanology

Advocates: Debra Buczkowski; Kelsey Crane

We welcome submissions that compare landforms and processes on multiple bodies, including Earth, as well as how lessons from specific studies can be applied more generally to understanding volcanism and tectonism across the solar system.

T143. **Planetary Geologic Mapping: Discoveries through the Solar System**

Endorsers: *GSA Planetary Geology Division, GSA Quaternary Geology and Geomorphology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division*

Disciplines: Planetary Geology, Geomorphology, Volcanology

Advocates: Debra Buczkowski; Tracy K.P. Gregg

We encourage abstract submissions related to geologic mapping of solid solar system bodies, including the terrestrial planets, moons, and asteroids, and subsequent analyses, results, and discoveries.

T144. **Friends of Hoth, Episode VIII: The Last Moons**

Endorser: *GSA Planetary Geology Division*

Disciplines: Planetary Geology, Structural Geology, Tectonics

Advocates: Alex Patthoff; Emily S. Martin; Erin Leonard

We invite abstracts relating to surface, structural, and tectonic processes; interior and thermal evolution; and planetary analogues as they pertain to icy satellites in the outer solar system. This includes experimental, observational, and theoretical approaches.

T145. **Geomorphology and Landscape Evolution of Mars**

Endorsers: *GSA Planetary Geology Division, SEPM (Society for Sedimentary Geology), GSA Quaternary Geology and Geomorphology Division*

Disciplines: Planetary Geology, Geomorphology, Stratigraphy

Advocates: Sharon Wilson; Rebecca Williams; Matthew Chojnacki; Elena Favaro; Nicholas Warner

This session focuses on aeolian, fluvial, glacial, lacustrine, and crater degradation processes to investigate the geomorphology and landscape evolution of Mars. We welcome research using Martian orbital, rover, and lander data, as well as terrestrial analogues.

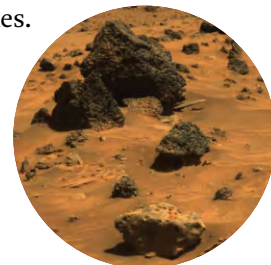


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NASA/JPL/Cornell

PRECAMBRIAN GEOLOGY

T146. Dynamics of Earliest Earth Systems

Endorsers: *GSA Geophysics and Geodynamics Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division*

Disciplines: Precambrian Geology, Structural Geology, Petrology, Metamorphic

Advocates: A. Alexander Webb; Peter J. Haproff

We discuss recent advancements in understanding the development of the earliest Earth systems spanning the Hadean magma ocean(s) to the Paleoproterozoic rock record, prior to the Great Oxidation Event.

QUATERNARY GEOLOGY

T147. Surf and Turf: Quaternary Landscapes Session in Honor of Dan Muhs

Endorsers: *GSA Quaternary Geology and Geomorphology Division, GSA Soils and Soil Processes Division, GSA Marine and Coastal Geoscience Division, GSA Geoarchaeology Division*

Disciplines: Quaternary Geology, Stratigraphy, Soils and Soil Processes

Advocates: Stephen Wolfe; Lindsey T. Groves; Jeff Pigati

This session will include topics of loess, dunes, paleosols, sea-level history, and Quaternary paleoenvironments that complement Dan Muhs' diverse research. Presentations welcomed from past and present colleagues and those who have benefited from his research insights.

T148. Evolving Understanding of the Mechanics, Sedimentology, and Landscapes of Glaciers and Glaciation: A Tribute to Dr. Ed Evenson

Endorser: *GSA Quaternary Geology and Geomorphology Division*

Disciplines: Quaternary Geology, Geomorphology, Environmental Geoscience

Advocates: Patrick Burkhart; Gregory S. Baker; Paul Baldauf

Ed Evenson made substantial contributions to demonstrating the synchronicity of glaciation between the northern and southern hemisphere, mechanisms of debris entrainment into ice, deposition of till, and refinements in understanding of glacial landforms. Abstracts describing such phenomena are welcomed.

T149. Back to the Old School? Integrating Soil Relative Dating with Geochronology to Establish Absolute Age of Quaternary Deposits in Southwestern North America

Endorsers: *GSA Quaternary Geology and Geomorphology Division, GSA Soils and Soil Processes Division, GSA Structural Geology and Tectonics Division, GSA Geochronology Division*

Disciplines: Quaternary Geology, Soils and Soil Processes, Geomorphology

Advocates: Eric McDonald; Eric Kirby; J.B.J. Harrison; Alan Hidy

This session highlights the utility of integrating classic and new relative dating techniques (e.g., soils, surface morphology, DEM analysis) with advances in numerical dating

for deciphering climate, alluvial, and tectonic histories from Quaternary deposits and landforms.

T150. Critical Zone Science: Intersection of Processes Linked to Geomorphology, Ecology, and Climate

Endorsers: *GSA Quaternary Geology and Geomorphology Division, GSA Hydrogeology Division, GSA Soils and Soil Processes Division, GSA Geochronology Division, GSA Geophysics and Geodynamics Division, GSA Geology and Society Division*

Disciplines: Quaternary Geology, Geomorphology, Soils and Soil Processes

Advocates: Tammy M. Rittenour; Jessica Hartman; Dave P. Huber; Nora Vaughan; Jennifer Pierce; Martha Cary (Missy) Eppes

This session welcomes interdisciplinary studies that investigate the rates and processes of soil production, regolith formation, carbon storage, and the role of ecological and/or hydrologic feedbacks in shaping the landscape (both past and present).

T151. Geologic Research in the Cascades: Understanding Glacier Change, Geologic Hazards, and Mountain Hydrology along an Active Margin in a Changing Climate

Endorsers: *GSA Quaternary Geology and Geomorphology Division, GSA Hydrogeology Division*

Disciplines: Quaternary Geology, Environmental Geoscience, Geomorphology

Advocates: Claire Todd; Scott Beason; Taylor Kenyon

We invite researchers studying the Cascades or similar environments to share work related to glacier change, geologic hazards, hydrology, or other topics central to geologic understanding of this dynamic region.

T152. Toward Understanding the Spatial, Structural, and Temporal Characteristics of Surface Deformation in Tectonically Active Multi-Fault Systems in the American Cordillera and Other Plate Margins

Endorsers: *GSA Quaternary Geology and Geomorphology Division, GSA Structural Geology and Tectonics Division, GSA Environmental and Engineering Geology Division, GSA Geochronology Division, GSA Geophysics and Geodynamics Division*

Disciplines: Quaternary Geology, Structural Geology, Tectonics

Advocates: Christopher Menges; Stephanie Dudash; Andrew Cyr; Max Garvue; James A. Spotila; Scott Bennett

This session welcomes studies integrating geologic mapping of landforms, surficial deposits, and structures with geochronology and geophysics to characterize the spatial distribution, geomorphology, structure, and timing of surface deformation among complex fault systems in the Cordillera and other plate margins.

T153. Faults and Floods in Western North America: In Memory of the Outstanding Contributions of Dr. Ralph E. Klinger

Endorsers: GSA Quaternary Geology and Geomorphology Division, GSA Soils and Soil Processes Division

Disciplines: Quaternary Geology, Geomorphology, Soils and Soil Processes

Advocates: Jeanne E. Godaire; Sylvia R Nicovich; Joanna L. Redwine; Tessa M. Harden; Jim E. O'Connor; P. Kyle House

We invite works that span the field of geomorphology and soils with an emphasis on societal impact. Studies that focus on flood hydrology, fluvial geomorphology, soil geomorphology, and seismic hazard are especially welcome.



SEDIMENTS, CARBONATES

T154. Sedimentary Geology Division/SEPM Student Research Poster Competition: Dynamics of Stratigraphy and Sedimentation

Endorsers: GSA Sedimentary Geology Division, SEPM (Society for Sedimentary Geology), Council on Undergraduate Research Geosciences Division

Disciplines: Sediments, Carbonates, Sediments, Clastic, Stratigraphy

Advocates: Andrew Leier; Jason Flaum; Joel E. Saylor

Students (at any level) may present posters of original research on any topics within sedimentary geology: carbonates, clastics, chemical sediments, ancient and/or modern systems. Posters are judged for monetary awards.

SOILS AND SOIL PROCESSES

T155. Recent Advances in Soil and Paleosol Science

Endorsers: GSA Soils and Soil Processes Division, GSA Hydrogeology Division, GSA Karst Division, GSA Environmental and Engineering Geology Division, GSA Sedimentary Geology Division, SEPM (Society for Sedimentary Geology), GSA Quaternary Geology and Geomorphology Division

Discipline: Soils and Soil Processes

Advocates: Arnaud Temme; Dennis Terry Jr.

This session gathers recent research in soil and paleosol science. We invite submissions from field, laboratory, and modeling studies that leverage or examine pedogenic processes and archives, from deep-time through modern systems.

T156. Emerging Voices in Soil and Paleosol Science

Endorsers: GSA Soils and Soil Processes Division, GSA Quaternary Geology and Geomorphology Division, GSA Hydrogeology Division, GSA Karst Division, GSA Environmental and Engineering Geology Division, GSA Sedimentary Geology Division, SEPM (Society for Sedimentary Geology)

Discipline: Soils and Soil Processes

Advocates: Rebecca Taormina; Jessica Prince

This session will gather undergraduate and graduate students to highlight their research in soils and/or paleosols. We invite submissions from field, laboratory, and modeling studies that leverage or examine pedogenic processes and archives, from deep-time through modern systems.

T157. Forecasting Soil Geochemical Futures: Observation and Modeling Approaches to Hydroclimate-Driven Soil Biogeochemical Processes

Disciplines: Soils and Soil Processes, Geobiology and Geomicrobiology, Hydrogeology

Advocates: Yang Song; Jennifer McIntosh

This session focuses on impacts of a changing hydroclimate on soil biogeochemical processes, including nutrient cycling, carbon sequestration, mineral weathering, and broader ecosystem services, through observation, experimental, and modeling approaches.

STRATIGRAPHY



T158. Using 3-D Geological Models to Explore Geologic Processes, Assess Natural Resources and Hazards, and Meet Societal Needs

Endorsers: GSA Hydrogeology Division, GSA Structural Geology and Tectonics Division, Association of American State Geologists, GSA Geophysics and Geodynamics Division, GSA Geoinformatics and Data Science Division, SEPM (Society for Sedimentary Geology), GSA Geology and Society Division

Disciplines: Stratigraphy, Structural Geology, Geoscience Information/Communication

Advocates: Claudia Faunt; Geoffrey Cromwell; Donald Sweetkind

Three-dimensional geological models are used to explore geologic processes, assess natural resources and hazards, and meet societal needs. This oral session will cover 3-D geologic model development, case studies, and uses of 3-D models.

T159. Making Sense of Subsidence: New Voices and Recent Advances in Basin Analysis

Endorsers: SEPM (Society for Sedimentary Geology), GSA Geochronology Division

Disciplines: Stratigraphy, Tectonics, Geochronology

Advocates: Ryan Eden; Eliel Anttila

This session features research into the formation and evolution of sedimentary basins in active-margin environments, with an emphasis on novel analytical or statistical techniques relevant to the advancement of the field of basin analysis.

T160. North American Cordilleran Margin Tectonic Framework: Paleozoic and Precambrian

Endorsers: GSA Structural Geology and Tectonics Division, GSA Geochronology Division, GSA Geophysics and Geodynamics Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

Disciplines: Stratigraphy, Tectonics, Petrology, Metamorphic
Advocates: Elizabeth Balgord; Arturo Barron; Karissa B. Vermillion

An overview of the Precambrian–Paleozoic basement and terrane evolution and stratigraphic architecture of western North America. We invite talks from a wide range of specialties including metamorphic petrology, geochronology, stratigraphy, deep-time thermochronology, structural geology, and tectonics.

T161. 130 Years of Research in the Turkana Basin, Kenya: Insights into Earth, Climate, and Life in Eastern Africa

Endorsers: GSA Geoarchaeology Division, GSA Continental Scientific Drilling Division, GSA Limnogeology Division, GSA Quaternary Geology and Geomorphology Division, GSA Sedimentary Geology Division, GSA Structural Geology and Tectonics Division, SEPM (Society for Sedimentary Geology)
Disciplines: Stratigraphy, Paleontology, Paleoecology/Taphonomy, Tectonics

Advocates: Christian Rowan; Catherine Beck; Craig Feibel
Commemorating the 130th anniversary of the first scientific publication on the Turkana Basin, Kenya, our goal is to showcase diverse research in archaeology, geology, paleoclimate, paleontology, seismology, and tectonics.

STRUCTURAL GEOLOGY

T162. Innovative Ideas in Tectonics of Earth and Other Planetary Bodies: A Session in Memory of An Yin

Endorsers: GSA Structural Geology and Tectonics Division, GSA Geophysics and Geodynamics Division, GSA Planetary Geology Division

Disciplines: Structural Geology, Tectonics, Planetary Geology
Advocates: Hanzhang Chen; Erin Leonard; Andrew V. Zuza; Chen Wu; Valeria Jaramillo

In celebration of the late professor An Yin, we explore pioneering ideas in tectonics touched by his storied career, from terrestrial tectonics to outer solar system icy worlds.

T163. Integrated Geologic and Chronometric Insights into Tectonic Processes at Plate Boundaries

Endorsers: GSA Structural Geology and Tectonics Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Geochronology Division

Disciplines: Structural Geology, Tectonics, Geochronology
Advocates: Emma Armstrong; Alexia Rojas; Ethan Conrad; Julie Fosdick

Fault zones record deformation that provide insight into plate boundary evolution. This session aims to inform timing and mechanisms of fault zone processes using tools ranging from thermochronology and geochronology to rock deformation experiments.

T164. Thermal and Rheological Controls on the Development of Orogenic Belts

Endorsers: GSA Structural Geology and Tectonics Division, GSA Geochronology Division, GSA Geophysics and Geodynamics Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

Disciplines: Structural Geology, Tectonics, Petrology, Metamorphic

Advocates: Peter J. Haproff; Ryan B. Anderson; Dominik Vlaha

This session welcomes research examining thermal and rheological controls on the style, distribution, and extent of deformation in global orogens through a combination of field observations and wide-ranging analytical techniques.

T165. The Sky's the Limit: Perspectives, Uses, and Opportunities for Multidisciplinary sUAS (Drone) Data in the Geosciences

Endorsers: GSA Geoinformatics and Data Science Division, GSA Geophysics and Geodynamics Division, GSA Geology and Society Division

Disciplines: Structural Geology, Geophysics/Geodynamics
Advocates: Peter J. Berquist; Gregory S. Baker

Small uncrewed aerial systems (sUAS or “drones”) provide unique opportunities for gathering diverse data at previously unattainable temporal and spatial scales. This multidisciplinary session will showcase the breadth of geoscience sUAS applications, best practices, and lessons learned.

T166. Spatial and Temporal Evolution of Fault Zones

Endorsers: GSA Structural Geology and Tectonics Division

Disciplines: Structural Geology, Geophysics/Geodynamics, Tectonics

Advocates: Zachary Smith; W. Ashley Griffith; Alba Mar Rodriguez Padilla; Thomas K. Rockwell

Fault zones evolve over variable spatiotemporal scales, which impact slip and seismicity at all crustal depths. This session seeks interdisciplinary contributions on fault zone evolution from geologic, laboratory, geodetic, geophysical, and theoretical studies.

T167. Best Student Geologic Map Competition

Endorsers: Association of American State Geologists, American Geosciences Institute, American Institute of Professional Geologists, GSA Quaternary Geology and Geomorphology Division

Disciplines: Structural Geology, Geomorphology, Stratigraphy
Advocates: Kate Ritzel; Jenna Shelton; Michael Marketti

Students will present their research through geologic mapping projects that have a significant field component that addresses scientific or societal issues. The top three geologic maps will be awarded.

T168. Structurally Controlled Systems: Using Field, Analytical, and Modeling Approaches to Unravel Upper Crustal and Surface Processes in Contractional, Extensional, and Strike-Slip Orogens

Endorsers: GSA Geoinformatics and Data Science Division, GSA Geochronology Division, GSA Structural Geology and Tectonics Division

Disciplines: Structural Geology, Tectonics, Geochronology
Advocates: Susana Henriquez; Tandis S. Bidgoli; Daniel Sturmer

This session explores upper crustal and surface processes in ancient and modern orogenic systems using structural, sedimentary, and geomorphologic records and geochronology and thermochronology techniques. We welcome contributions from students and early career researchers.

T169. Fluids and Deformation: Does Water Really Mean Weaker?

Endorsers: GSA Structural Geology and Tectonics Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

Disciplines: Structural Geology, Geochemistry, Petrology, Metamorphic

Advocates: Sarah Trevino; Catherine Ross; Michelle Gevedon

This session welcomes interdisciplinary investigations of the effect fluids have on strain rates, chemistry, and rheology from the surface to mantle, from the nano- to macro-scale, and from experiments to regional scale studies.

TECTONICS

T170. Linking Continental Geologic Records to Geodynamic Models for the Cretaceous–Paleogene Development of the Mojave Region

Endorsers: GSA Structural Geology and Tectonics Division, GSA Geophysics and Geodynamics Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

Disciplines: Tectonics, Geophysics/Geodynamics, Petrology, Igneous

Advocates: Nikki M. Seymour; Michael L. Wells; Nicholas Van Buer

We welcome contributions that span the sedimentological, magmatic/volcanic, structural, geophysical, and model perspectives to address the enigmatic Cretaceous–Paleogene development of the Mojave Desert region and identify opportunities for future collaboration and study.

T171. Oblique Motion on the North American Cordilleran Margin: Jurassic

Endorsers: GSA Structural Geology and Tectonics Division, GSA Geochronology Division, GSA Geophysics and Geodynamics Division

Disciplines: Tectonics, Geochronology, Petrology, Igneous
Advocates: Rebecca Morris; Matthew Brueseke

An overview of the tectonic deformation on the western margin of North America during the Jurassic, emphasizing constraints on oblique motion. Data on syntectonic sedimentation and magmatism, geochronology, or thermochronology of deformation are also welcome.

T172. Oblique Motion on the North American Cordilleran Margin: Cretaceous

Endorsers: GSA Structural Geology and Tectonics Division, GSA Geochronology Division, GSA Geophysics and Geodynamics Division

Disciplines: Tectonics, Geochronology, Structural Geology

Advocates: Elisa Fitz-Diaz; Basil Tikoff

An overview of the tectonic deformation on the western margin of North America during the Cretaceous, emphasizing constraints on oblique motion. Data on syntectonic sedimentation and magmatism, geochronology, or thermochronology of deformation are also welcome.

T173. Oblique Motion on the North American Cordilleran Margin: Paleogene

Endorsers: GSA Structural Geology and Tectonics Division, GSA Geochronology Division, GSA Geophysics and Geodynamics Division

Disciplines: Tectonics, Stratigraphy, Geochronology

Advocates: Trevor Waldien; Michael Darin; Scott Bennett

An overview of tectonic deformation on the western margin of North America during the Paleogene, emphasizing constraints on oblique plate motion and deformation. Studies highlighting space-time patterns of magmatism, deformation, basin development, paleogeography, paleotopography, and plate kinematics are strongly encouraged.

T174. Unraveling the Lithotectonic Evolution of the Paleo-Gondwana Margins within the Indo-Pacific Region

Endorser: GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

Disciplines: Tectonics, Geophysics/Geodynamics, Geochemistry

Advocates: Chin-Hua Lo; John Shellnutt; Meng wan Yeh

The highly populated Indo-Pacific region is a dynamic area with significant geological activity. This session aims to explore recent advances in understanding the evolution of these plate margins from the dispersal of Gondwanan cratons.

T175. Fluids and Deformation during Subduction from the Trench to the Subarc

Endorsers: GSA Structural Geology and Tectonics Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Geophysics and Geodynamics Division, GSA Geochronology Division

Disciplines: Tectonics, Geochemistry, Geophysics/Geodynamics

Advocates: Anna Ledeczi; Justine G. Grabiec; Jason Ott; Cailey Condit

Subduction margins host a diversity of deformational and fluid-related processes across temporal and spatial scales, influencing metamorphic reactions, rock rheology, and seismic and aseismic activity. We invite contributions studying fluids and deformation in subduction zones from the trench to the subarc.

T176. Subduction Zones and Their Volcanic Arcs: Initiation and Evolution, Structure, Metamorphism, Magmatism

Endorsers: GSA Geochronology Division, GSA Geophysics and Geodynamics Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

Disciplines: Tectonics, Petrology, Metamorphic, Petrology, Igneous

Advocates: David Hernández Uribe; Jordan Wang; Paul Kapp; Robert Holder

We welcome diverse submissions on the petrology, structure, geochemistry, and geophysics of subduction zones from field, laboratory, experimental, and theoretical approaches. Example topics include initiation, evolution, volatile cycling, ophiolites, arc tempos, high-P metamorphism, mélanges, seismicity, and accretionary wedges.

T177. The Rio Grande Rift: Exploring Connections between Deformation, Magmatism, Metamorphism, Sedimentation, Mineralization, and Mantle-to-Surface Processes during Continental Extension

Endorsers: *GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Sedimentary Geology Division, GSA Structural Geology and Tectonics Division, GSA Geochronology Division*

Disciplines: Tectonics, Structural Geology, Volcanology

Advocates: Alyssa Abbey; Alex Tye; Jason Ricketts; Joshua Rosera

This session will focus on the tectonic, magmatic, metamorphic, and surface processes associated with rifting. The session will highlight the Rio Grande Rift; we also invite contributions related to continental extension broadly defined.

T178. Presentaciones de Geociencias en Español: Una Nueva Experiencia en una Reunión de la Sociedad Geológica Americana (GSA)

Endorsers: *GSA Geochronology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Geology and Society Division*

Disciplines: Tectonics, Geochronology, Geochemistry

Advocates: Alexander Iriondo; Jay Chapman; Gabriela Mora-Klepeis; Scott Bennett

Esta sesión experimental invita a presentaciones varias de geociencias en Español en todos los niveles de conocimiento del idioma. This experimental open topic session invites geoscience presentations in Spanish at all proficiency levels. Abstract submission can be in English or Spanish. Pruéballo!



T179. New Mapping and Interpretation of the Geology of the Sierra Nevada, California and Nevada, United States

Endorsers: *GSA Structural Geology and Tectonics Division, GSA Geochronology Division*

Disciplines: Tectonics, Structural Geology, Geophysics/Geodynamics

Advocates: Russell W. Graymer; Matt O'Neal; Victoria Langenheim

This session presents new geologic, geophysical, geochronologic, and other earth science maps and interpretations of the complex geologic history, mineral resources, and hazards of an iconic province, the Sierra Nevada.

T180. Geologic History of the Northern Sierra Nevada, a Persistent and Evolving Active Margin Along Western North America

Endorsers: *GSA Geochronology Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division*

Disciplines: Tectonics, Geochronology, Structural Geology

Advocate: Michelle Roberts

This session will discuss the evolution of the northern Sierra as an active margin, from a Paleozoic island arc to Mesozoic accretion and plutonism, and ultimately Cenozoic volcanism and transtensional tectonics.

T181. Composition, Structure, and Rheology of the Mantle Lithosphere

Endorsers: *GSA Structural Geology and Tectonics Division, GSA Geophysics and Geodynamics Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division*

Disciplines: Tectonics, Petrology, Igneous, Geophysics/Geodynamics

Advocates: Alexander D. Lusk; Emily J. Chin; James Kirkpatrick

We welcome petrologic, microstructural, laboratory, and geophysical contributions that seek to define the grain-to-plate-scale structure, properties, and processes of Earth's mantle lithosphere and hence impart important controls on plate tectonics.

T182. Tectonic Inheritance in Orogenic Systems

Endorsers: *GSA Structural Geology and Tectonics Division, GSA Geochronology Division, GSA Geophysics and Geodynamics Division*

Disciplines: Tectonics, Structural Geology

Advocates: John Singleton; Martin Wong; Samantha Malavarca

Preexisting structures commonly play fundamental roles in guiding the tectonic evolution of extensional and contractional orogenic systems. This session focuses on structural reactivation and the relation between extensional and contractional structures in superposed orogens.

T183. Climate and Tectonic Interactions from Bedrock to Basins

Endorsers: *GSA Limnogeology Division, SEPM (Society for Sedimentary Geology), GSA Structural Geology and Tectonics Division, GSA Geochronology Division*

Disciplines: Tectonics, Stratigraphy, Paleoclimatology/Paleoceanography

Advocates: Kurt E. Sundell; Sarah George; Alexandra Pye

Complex feedbacks exist between climatic and tectonic processes. This session welcomes field, analytical, and numerical studies on bedrock, basins, or both that document, or attempt to deconvolve, climate-tectonic feedbacks.

T184. The Changing Cordilleran Margin: Permian through Eocene Tectonism, Magmatism, and General Geology from Western Mexico through Northern California and Eastward

Endorsers: *GSA Structural Geology and Tectonics Division, GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Geochronology Division*

Disciplines: Tectonics, Structural Geology, Volcanology
Advocates: Nancy Riggs; Andrew P. Barth; Robinson Cecil; Diane Clemens-Knott; Kathleen D. Surpless

Subduction along the southwestern margin of North America that began by ca. 280 Ma was responsible for an ever-changing landscape through Eocene time. We invite submissions that address any aspect of Cordilleran tectonics over this period.

T185. Life on an Active Convergent Margin: Lessons from the Himalaya and South Asia

Endorsers: *GSA International, GSA Structural Geology and Tectonics Division, GSA Quaternary Geology and Geomorphology Division*

Disciplines: Tectonics, Engineering Geology, Quaternary Geology

Advocates: Christopher Bailey; G.M. Bhat

The Himalayas form the grandest mountain range on Earth. This interdisciplinary session will focus on the geology and tectonics of the region through the lens of active processes and their impact on human communities.

T186. Harmony and Discord: Exploring the Interplay of Climate and Tectonics in Central Asia

Endorsers: *GSA Sedimentary Geology Division, GSA Structural Geology and Tectonics Division*

Disciplines: Tectonics, Paleoclimatology/Paleoceanography

Advocates: Andrew V. Zuza; Junsheng Nie; Feng Cheng

The session provides a platform for presenting recent findings and fostering a comprehensive understanding of the complex interaction between climate and tectonics in Central Asia.

T187. Tectonics and Sedimentation of the Central Gulf of California, Mexico, and Surrounding Regions

Endorsers: *GSA Marine and Coastal Geoscience Division, GSA Structural Geology and Tectonics Division, GSA Structural Geology and Tectonics Division*

Disciplines: Tectonics, Sediments, Carbonates, Geobiology and Geomicrobiology

Advocates: Joann Miriam Stock; Kathleen Marsaglia; Ligia Perez-Cruz; Lillian Pina

This session will focus on tectonics and sedimentation of the central Gulf of California, including new drilling results from the Guaymas Basin, and geological, geobiological, and geophysical studies here and in surrounding regions.

T188. Structural Analysis, Digital Mapping Advances, Tectonics, and Tectonic-Climatic Processes from California to Alaska and Elsewhere: A Celebration of Terry Pavlis's Diverse Contributions and Career

Endorser: *GSA Structural Geology and Tectonics Division*

Disciplines: Tectonics, Structural Geology

Advocates: Jay Chapman; Sean Gulick; Lindsay Lowe Worthington; Kenneth Ridgway; Virginia Sisson; Jeff Benowitz

Terry Pavlis's continuing >40-year career has advanced our understanding of fundamental structural, tectonic, and tectonic-climate processes. This session honors Terry's impactful mentorship, leadership, and tectonic career with contributions from California to Alaska and elsewhere.

VOLCANOLOGY

T189. How Wide Is the Transform? Magmatism and Tectonics of the North American-Pacific Plate Transform

Endorsers: *GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, GSA Structural Geology and Tectonics Division, GSA Geochronology Division, Geochemical Society*

Disciplines: Volcanology, Tectonics, Geochronology

Advocates: David C. Buesch; David M. Miller; Skyler Mavor

This session addresses the North American plate transform boundary since its inception ~28 Ma and changes in transform-influenced magmatism, faulting, deformation, and basin formation across a broad swath of the plate boundary.



T190. Continental Flood Basalts: Classifying, Correlating, and Constraining Eruptive Products through Space and Time

Endorsers: *GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division, Geochemical Society, GSA Geochronology Division*

Disciplines: Volcanology, Petrology, Igneous, Geochemistry
Advocates: Nicole Moore; Emily Cahoon

We invite contributions on global studies of continental flood basalt lavas and dikes that elucidate the magmatic evolution of these provinces via geochemistry, stratigraphy, geochronology, physical volcanology, magnetostratigraphy, and computational/mathematical modeling.

Special and Late-Breaking Sessions

Adieu to the Anthropocene? Debating the Formality of Geologic Time in the Face of Accelerating Changes in Earth Processes

Endorser: GSA Geochronology Division

Disciplines: Geomicrobiology, Geochronology

Advocates: Brad E. Rosenheim; Tiffany Rivera; Elizabeth Neispolo; Robin Trayler

Over the last few decades, the term “Anthropocene” has become entrenched in scientific literature, popular publications, and even conversational vernacular. This session seeks presentations that assess the role of the term “Anthropocene” in our field after a formal decision to not include it as an official division of geologic time.

Beyond the Degree: Making an Impact with Geology

Endorser: GSA Geoscience Education Division

Discipline: Geoscience Education

Advocates: Kathryn Murdock; Scott Burns; Jennifer Nocerino

This session presents students and geologists with information on what is required for a career outside of academia, how academic departments can assist students, and personal stories from a diverse group of industry and consulting geologists.

Exploring Earth: Integrating Geosciences Across the K–12 Curriculum

Endorsers: National Association of Geoscience Teachers (NAGT), National Association of Geoscience Teachers (NAGT) K-12 Committee

Discipline: Geoscience Education

Advocate: Nancy M. Chen

This session aims to empower K–12 educators by showcasing existing curriculum resources and fostering partnerships with scientists to seamlessly integrate cutting-edge research into lesson plans, either by adapting existing materials or creating new ones.

Twenty-Five Years of GSA Section Mentoring Programs: The Successes, the Challenges, and the Future

Endorsers: GSA Geoscience Education Division, GSA Soils and Soil Processes Division

Discipline: Geoscience Education

Advocates: Roy Shlemon; Robert Sydnor

Celebrating 25 years of GSA Section Mentoring Program success, we welcome and encourage those Mentors and Mentees who have participated in these programs to submit abstracts about their experiences and recommendations, and briefly relate their mentoring experiences.

Discipline Sessions

In addition to topical sessions, GSA offers vibrant discipline sessions. Discipline sessions are an essential addition to the meeting and will relate to recent advances in:

Continental Scientific Drilling
Economic Geology
Energy Geology
Engineering Geology
Environmental Geoscience
Geoarchaeology
Geobiology and Geomicrobiology
Geochemistry
Geochronology
Geoheritage
Geoinformatics and Data Science
Geology and Health
Geomorphology
Geophysics/Geodynamics
Geoscience Education
Geoscience Information/Communication
Geoscience and Public Policy
History and Philosophy of Geology
Hydrogeology
Karst
Limnogeology

Marine and Coastal Geoscience
Mineralogy/Crystallography
Paleoclimatology/Paleoceanography
Paleontology, Biogeography/Biostratigraphy
Paleontology, Diversity, Extinction, Origination
Paleontology, Paleoecology/Taphonomy
Paleontology, Phylogenetic/Morphological Patterns
Petrology, Igneous
Petrology, Metamorphic
Planetary Geology
Precambrian Geology
Quaternary Geology
Sediments, Carbonates
Sediments, Clastic
Soils and Soil Processes
Stratigraphy
Structural Geology
Tectonics
Traditional Ecological Knowledge
Volcanology

Submit your abstract to discipline sessions by 18 June!

Thank You to the 2024 Joint Technical Program Committee (JTPC)

We appreciate their invaluable expertise and dedication to reviewing abstract submissions. The committee's commitment to maintaining the highest standards will contribute to the quality and diversity of the technical meeting program.

Technical Program Chair: Kevin Mickus, kevinmickus@missouristate.edu

Technical Program Vice-Chair: David Bush, dbush@westga.edu

JTPC Contact(s)	Discipline	Review Group
GSA Divisions		
Michael M. McGlue	Continental Scientific Drilling	Continental Scientific Drilling Division
Justin Edward Birdwell, Marc L. Buursink	Energy Geology	Energy Geology Division
Francis Kevin Rengers, Anne C. Witt, Ann M. Youberg	Environmental Geoscience, Engineering Geology	Environmental & Engineering Geology Division
Fred Andrus, Samantha Krause, Scott Pike	Geoarchaeology	Geoarchaeology Division
Brandt M. Gibson, Lydia Schiavo Tackett	Geobiology and Geomicrobiology	Geobiology & Geomicrobiology Division
Andrea Dutton, Tiffany Rivera, Brad E. Rosenheim	Geochronology	Geochronology Division
Denise J. Hills, Andrew Alexander Zaffos	Geoinformatics and Data Science	Geoinformatics & Data Science Division
Harshad Vijay Kulkarni, Sabrina L. Lanker, Laura Suzanne Ruhl	Geology and Health	Geology & Health Division
M. Scott Harris, James A. Heller	Geoscience and Public Policy	Geology & Society Division
Shannon A. Dulin, Amanda N. Hughes, Anjana K. Shah	Geophysics/Geodynamics	Geophysics & Geodynamics Division
Nicholas Andrew Soltis, Vic Ricchezza	Geoscience Education	Geoscience Education Division
Patricia Coorough Burke, Renee M. Clary	History and Philosophy of Geology	History & Philosophy of Geology Division
Marty Dale Frisbee, Katherine J. Knierim	Hydrogeology	Hydrogeology Division
Daniel Jones	Karst	Karst Division
Kirsten M. Menking, Scott W. Starratt	Limnogeology	Limnogeology Division
Scott W. Starratt	Marine and Coastal Geoscience	Marine & Coastal Geoscience Division
Jade Star Lackey, J. Alex Speer, Alan Whittington, Elisabeth Widom	Mineralogy/Crystallography, Geochemistry, Petrology, Volcanology	Mineralogy, Geochemistry, Petrology & Volcanology Division
Samuel Birch, Debra Buczkowski, Alexander Michael Morgan, Jennifer L. Piatek	Planetary Geology	Planetary Geology Division
Bradley G. Johnson, Jennifer L. Pierce, Mark R. Sweeney	Quaternary Geology, Geomorphology	Quaternary Geology & Geomorphology Division
William Thomas Jackson Jr., Edward Matheson	Sediments, Carbonates; Sediments, Clastic; Stratigraphy	Sedimentary Geology Division
Lauren A. Michel, Arnaud J. Temme	Soils and Soil Processes	Soils & Soil Processes Division
John Singleton, Ben Surpluss	Structural Geology, Tectonics	Structural Geology & Tectonics Division
GSA Representatives At Large		
Mary S. Hubbard		GSA International
Miriam E. Katz	Paleoclimatology/Paleoceanography	Paleoclimatology/Paleoceanography
Gregory Dumond	Precambrian Geology	Precambrian Geology
Kenneth Ridgway	Traditional Ecological Knowledge	Traditional Ecological Knowledge

(continued)

JTPC Contact(s)	Discipline	Organization Represented
Associated Societies		
Monica Gaiswinkler Easton	Geoscience Information/Communication	Association of Earth Science Editors
Elizabeth Heise, Claire McLeod		Council on Undergraduate Research Geosciences Division
Frank Ramos	Geochemistry	Geochemical Society
Robert Tolliver	Geoscience Information/Communication	Geoscience Information Society
Philip Brown	Mineralogy/Crystallography; Petrology, Igneous; Petrology, Metamorphic; Volcanology	Mineralogical Society of America
Sarah M. Jacquet, James D. Schiffbauer, René A. Shroat-Lewis, John Huntley	Paleontology, Biogeography/Biostratigraphy; Paleontology, Diversity, Extinction, Origination; Paleontology, Paleoecology/Taphonomy; Paleontology, Phylogenetic/Morphological Patterns	Paleontological Society
Lauren Terry	Economic Geology	Society of Economic Geologists
Howard Harper	Sediments, Carbonates; Sediments, Clastic; Stratigraphy	Society of Sedimentary Geology

GSA Partners with Our Associated Societies for the Annual Meeting

Building a dynamic technical program and organizing other stimulating events draws GSA together with its 78+ Associated Societies. Many of GSA's Associated Societies will present their representative science, hold tailored events, and run exhibit booths during Connects 2024. GSA is looking forward to hosting these valued partners and organizations. Members of Associated Societies also receive the GSA member registration rate to attend the meeting. GSA has a long tradition of collaborating with like-minded organizations in pursuit of mutual goals to advance the geosciences. As the Society looks to the future, it aims to build more strong, meaningful partnerships with other societies and organizations across the country and around the world in service to members and the global geoscience community. National and international societies with consistent aims and missions of advancing the geosciences and/or science in general are invited to affiliate with GSA as an Associated Society. For a full list of GSA's Associated Societies, go to <https://bit.ly/3xitvGP>.



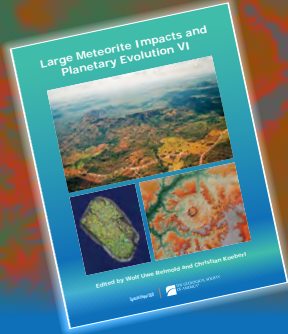
Photo Credit: Jennifer Stalcup.

Uba Saidu Malami, President of the Geological Society of Nigeria, one of GSA's newer Associated Societies, meets with GSA President Chuck Bailey and Melanie Brandt, GSA's Executive Director and CEO, at GSA Connects 2023.

The Topographic Map Mystery *Geology's Unrecognized Paradigm Problem*

A new book by Eric Clausen illustrates dozens of examples of the vast amounts of United States large-scale and well-mapped topographic map drainage system and erosional landform evidence which the Cenozoic geology and glacial history paradigm has yet to satisfactorily explain. What is the unexplained topographic map drainage system and erosional landform evidence waiting to say?

Available in e-book and hard copy formats at on-line booksellers



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Help Shape the Future of Geoscience— Serve on a GSA Committee!

Looking for an opportunity to work toward a common goal, give back to GSA, network, or make a difference? We invite you to volunteer (or nominate a fellow GSA member) to serve on a Society committee or as a GSA representative to another organization.

Learn more and access the nomination form at www.geosociety.org/Committees. Use the online form to make a self-nomination or nominate a colleague.

View Open Positions: rock.geosociety.org/forms/viewopenpositions.asp.

Terms begin 1 July 2025 (unless otherwise indicated).

GSA COUNCIL

(3) Councilor (4-year term; E, M); President-Elect (3-year term; E, M)

The management of the affairs and the property of the Society shall be the responsibility of the Board, which shall also be known as the Council. The Council shall have the authority, power, and responsibility for the general management, control, and general supervision of the affairs, business, activities, property, and assets of the Society so that the corporate activities are consistent with the stated purposes of the Society and that no act is committed by the Society in contravention of its Articles of Incorporation or Bylaws. Primary duties are to attend and participate actively in all Council meetings, serve as an active member on an average of two GSA committees per year, and support the GSA Foundation. Further information can be found at www.geosociety.org/WhoWeAre.

ACADEMIC AND APPLIED GEOSCIENCE RELATIONS COMMITTEE

Member-at-Large, Student (3-year term; E, M)

This committee is charged with strengthening and expanding relations between GSA members in applied and academic geosciences. As such, it proactively coordinates the Society's effort to facilitate greater cooperation between academia, industry, and government geoscientists.

Qualifications: Committee members must work in academia, industry, or government and be committed to developing a better integration of applied and academic science in GSA meetings, publications, short courses, field trips, and education and outreach programs. Members must also be active in one or more GSA Divisions.

Professional Interest: Environmental & Engineering Geology, Hydrogeology, Karst, Quaternary Geology &



Photo Credit: pixelfit/E+ via Getty Images.

Geomorphology, Structural Geology
& Tectonics, Sedimentary Geology.

**Nomination
deadline:
15 June**

ANNUAL PROGRAM COMMITTEE

(2) Member-at-Large (4-year term; B, E, M); Member-at-Large, Student (2-year term; B, E, M)

This committee is charged with developing a plan for increasing the quality of the annual and other society-sponsored meetings in terms of science, education, and outreach; evaluating the technical and scientific programs annually to identify modifications necessary for accomplishing the Society's long-range goals; conducting short- and long-range planning for the Society meetings as a whole; and developing a long-term logistical plan/strategy for the technical programs of all GSA meetings and other society-sponsored meetings. One member-at-large should have previous meeting experience.

ARTHUR L. DAY MEDAL AWARD

(2) Member-at-Large (3-year term; E, T)

This committee selects candidates for the Arthur L. Day Medal.

Qualifications: Members should have knowledge of those who have made "distinct contributions to geologic knowledge

B—Meets in Boulder or elsewhere; E—Communicates by phone or electronically; M—Meets at Connects; T—Extensive time commitment required during application review period

through the application of physics and chemistry to the solution of geologic problems.” All the committee’s work will be accomplished during the months of February and March. All committee decisions must be made by 1 April.

DIVERSITY IN THE GEOSCIENCES COMMITTEE

(2) Member-at-Large (3-year term; E, M)

This committee provides advice and support to GSA Council, raises awareness, and initiates activities and programs that will increase opportunities for diverse groups in the geosciences, particularly in the dimensions of race, ethnicity, gender, and physical abilities. The committee is also charged with stimulating recruitment and promoting positive career development.

Qualifications: Members of this committee must have professional or experiential knowledge of issues relevant to the goals of the committee. GSA strongly encourages nominations of members who are from the communities for which this committee is expected to serve.

DORIS M. CURTIS OUTSTANDING WOMAN IN SCIENCE AWARD COMMITTEE

(2) Member-at-Large (2-year term; E, T)

The purpose of this committee is to generate, receive, and evaluate candidates for the Outstanding Woman in Science Award. The award was established as a means to encourage women in the geosciences. Women are eligible for the first five years following their degree.

Qualifications: Members should have the ability to assess the contributions of those women who have made a major impact in the geosciences based on their PhD work.

EDUCATION COMMITTEE

Pre-College Educator (K–12) Representative (4-year term; B, E, M); Two-Year College Faculty Representative (4-year term; B, E, M); Member-at-Large (4-year term; B, E, M); Member-at-Large, Student (2-year term; B, E, M)

This committee works with GSA members representing a wide range of education sectors to develop informal, pre-college (K–12), undergraduate, and graduate earth science education and outreach objectives and initiatives.

Qualifications: Members of this committee must have the ability to work with other interested scientific organizations and science teachers’ groups.

FLORENCE BASCOM GEOLOGIC MAPPING AWARD COMMITTEE

Member-at-Large, Student (3-year term; E, T)

This committee selects candidates for the Florence Bascom Geologic Mapping Award. This award acknowledges contributions in published high-quality geologic mapping that led the recipient to publish significant new scientific or economic-resource discoveries, and to

contribute greater understanding of fundamental geologic processes and concepts.

Qualifications: Members should be knowledgeable in the field of mapping.

GEOLOGY AND PUBLIC POLICY COMMITTEE

(3) Member-at-Large (3-year term; E, M)

This committee provides advice on public policy matters to Council and GSA leadership by monitoring and assessing international, national, and regional science policy; formulating and recommending position statements; and sponsoring topical white papers. This committee also encourages active engagement in geoscience policy by GSA members.

Qualifications: Members should have experience with public policy issues involving the geosciences; ability to develop, disseminate, and translate information from the geologic sciences into useful forms for the public and GSA members; and familiarity with appropriate techniques for the dissemination of information.

GSA INTERNATIONAL COMMITTEE

Member-at-Large, North America (4-year term; E, M);

Member-at-Large, Outside of North America (4-year term; E, M)

This committee serves as GSA’s coordination and communication resource seeking to promote, create, and enhance opportunities for international cooperation related to the scientific, educational, and outreach missions shared by GSA and like-minded professional societies, educational institutions, and government agencies. This committee also builds collaborative relationships with Divisions and Associated Societies in international issues and serves as a channel for member-generated proposals on international themes.

MEMBERSHIP AND FELLOWSHIP COMMITTEE

Member-at-Large, Academia (3-year term; E, T)

This committee contributes to the growth of the GSA membership, enhances the member experience, and serves a vital role in the selection of Fellows, with the goal of fostering a membership community as pertinent and global as our science. Committee members should understand what various segments of members want from GSA and should be familiar with outstanding achievers in the geosciences worthy of fellowship.

Qualifications: Committee members should have experience in benefit, recruitment, and retention programs.

NOMINATIONS COMMITTEE

Member-at-Large (3-year term; B, E)

This committee recommends nominees to GSA Council for the positions of GSA Officers and Councilors, committee members, and Society representatives to other permanent groups.

Qualifications: Members must be familiar with a broad range of well-known and highly respected geoscientists.

NORTH AMERICAN COMMISSION ON STRATIGRAPHIC NOMENCLATURE

GSA Representative (3-year term; E, M)

This committee develops statements on stratigraphic principles; recommends procedures applicable to classification and nomenclature of stratigraphic and related units; reviews problems in classifying and naming stratigraphic and related units; and formulates expressions of judgment on these matters.

Qualifications: Members must be familiar with the fields of paleontology, biostratigraphy, and stratigraphy. Term commences 1 December 2025.

PENROSE CONFERENCES AND FIELD FORUMS COMMITTEE

(2) Member-at-Large (3-year term; E); Member-at-Large, Early Career Professional (3-year term; E)

This committee reviews and approves Penrose Conference and Field Forum proposals and recommends and implements guidelines for the success of these meetings.

Qualifications: Committee members must be past conveners of a Penrose Conference or Field Forum.

PENROSE MEDAL AWARD COMMITTEE

Member-at-Large (3-year term; E, T)

Members of this committee select candidates for the Penrose Medal Award. Emphasis is placed on “eminent research in pure geology, which marks a major advance in the science of geology.”

Qualifications: Members should be familiar with outstanding achievers in the geosciences worthy of consideration for the honor. All of the committee’s work will be accomplished during the months of February and March. All committee decisions must be made by 1 April.

PROFESSIONAL DEVELOPMENT COMMITTEE

Member-at-Large, Student (3-year term; E)

This committee directs, advises, and monitors GSA’s professional development program; reviews and approves proposals; recommends and implements guideline changes; and monitors the scientific quality of courses offered.

Qualifications: Members must be familiar with professional development programs or have adult education teaching experience.

PUBLICATIONS COMMITTEE

Member-at-Large (4-year term; E, M, T)

This committee’s primary responsibilities are: nomination of candidates for editors when positions become vacant;

Committee, Section, and Division Volunteers: Council Thanks You!

GSA Council acknowledges the many member-volunteers who, over the years, have contributed to the Society and to our science through involvement in the affairs of GSA. Your time, talent, and expertise help build a solid and lasting Society.

reviewing the quality and health of each Society publication, and reporting to Council recommendations for changes in page charges, subsidies, and any other publishing matters.

Qualifications: Members should have an interest in or experience with GSA or other Society publications.

RESEARCH GRANTS COMMITTEE

(11) Member-at-Large, Various Specialties (3-year term; B, E, T)

The primary function of this committee is to evaluate approximately 800 graduate student research grant applications and award-specific grants to chosen recipients, including some named grants supported by funds within the GSA Foundation.

Qualifications: Members may come from any sector (academia, government, industry, etc.) and should have experience in directing research projects and in evaluating research grant applications. GSA strongly encourages nominations of geoscientists from diverse backgrounds and institutions, particularly from minority-serving institutions. Extensive time commitment required 15 Feb.–15 April; each member reviews approximately 40 applications.

More information: www.geosociety.org/gradgrants

YOUNG SCIENTIST AWARD (DONATH MEDAL) COMMITTEE

Member-at-Large (3-year term; E, T)

Committee members investigate the achievements of young scientists who should be considered for this award and make recommendations to GSA Council.

Qualifications: Members should have knowledge of young scientists with “outstanding achievement(s) in contributing to geologic knowledge through original research which marks a major advance in the earth sciences.” All the committee’s work will be accomplished during the months of February and March. All committee decisions must be made by 1 April.

Nominate for GSA Scientific Division Awards

ENERGY GEOLOGY DIVISION

CURTIS-HEDBERG AWARD

Nominations due **31 July**

Submit nominations to the Curtis-Hedberg Award chair: Denise J Hills, denise.j.hills@gmail.com

The Curtis-Hedberg Award will be considered annually in accordance with the bylaws of the Society. The award will be made for outstanding contributions in the field of petroleum geology. community.geosociety.org/energydivision/awards/curtishedberg

GEOARCHAEOLOGY DIVISION

RICHARD HAY STUDENT PAPER/POSTER AWARD

Nominations due **31 August**

Submit nominations to gsa.agd@gmail.com.

At the 2006 Annual Meeting in Philadelphia, Pennsylvania, USA, the Division's management board elected to rename the student travel award for a distinguished scientist in archaeological geology. After consulting with his family, the award was officially named the Richard Hay Student Paper/Poster Award. Hay was a long-standing member of the Division and had a long and distinguished career in sedimentary geology, mineralogy, and archaeological geology. He is particularly well known for his work on the Olduvai Gorge and Laetoli hominid-bearing sites and was awarded the Division's Rip Rapp Award in 2000. The Division is proud to have our student travel award bear his name.

The award is a travel grant for a student (undergraduate or graduate) presenting a paper or poster at GSA Connects. The grant is competitive and will be awarded based on evaluation of the scientific merit of the research topic and the clarity of an expanded abstract for the paper or poster prepared by a student for presentation in the Division's technical session at the meeting. community.geosociety.org/geoarchdivision/awards/student/hay

GEOLOGY AND SOCIETY DIVISION

E-AN ZEN FUND FOR GEOSCIENCE OUTREACH GRANT

Nominations due **30 June**

Submit nominations to the Division past chair: Lily Jackson, Lily.Jackson@uwoyo.edu

This is a grant opportunity for Geology and Society Division members interested in developing innovative methods to bring geoscience knowledge to public audiences. Two grants of US\$1,500 each will be awarded to fund projects designed by the applicants to communicate geoscience information to a lay audience with the goal of increasing the understanding of geoscience and its impact on society among non-geoscientists and decision-makers. Applicants may apply as individuals or as groups, depending on the best fit for their project design. While the grant

application requirements are intentionally broad to encourage creative thinking and innovation, review of applications will emphasize the potential for impacting communities that traditionally have not had significant exposure to the geosciences. community.geosociety.org/gsocdivision/news/zenfund

HISTORY AND PHILOSOPHY OF GEOLOGY DIVISION

HISTORY AND PHILOSOPHY OF GEOLOGY STUDENT AWARD

Nominations due **15 June**

Submit nominations to the Division secretary/treasurer: Christopher Hill, chill2@boisestate.edu

The History and Philosophy of Geology Division provides a student award in the amount of US\$1,000 for a paper to be given at GSA Connects. Awards may also be given for second place. Oral presentations are preferred. Faculty advisors may be listed as second author, but not as the lead author of the paper. The proposed paper may be (1) a paper in the history or philosophy of geology; (2) a literature review of ideas for a technical work or thesis/dissertation; or (3) some imaginative aspect of the history or philosophy of geology we have not thought of before. Students should submit an abstract of their proposed talk and a 1,500–2,000-word prospectus for consideration. Currently enrolled undergraduates and graduate students are eligible, as are students who received their degrees at the end of the fall or spring term immediately preceding GSA Connects. The award is open to all students regardless of discipline, provided the proposed paper is related to the history or philosophy of a geological idea/person. The award is made possible by a bequest from the estate of Mary C. Rabbitt. Monies for the award are administered by the GSA Foundation. community.geosociety.org/histphildiv/awards/student

PLANETARY GEOLOGY DIVISION

EUGENE M. SHOEMAKER IMPACT CRATERING AWARD

Nominations due **15 August**

Submit nominations here: <https://www.lpi.usra.edu/Awards/shoemaker/>

The Eugene M. Shoemaker Impact Cratering Award is for undergraduate or graduate students, of any nationality, working in any country, in the disciplines of geology, geophysics, geochemistry, astronomy, or biology. The award, which will include US\$2500, is to be applied to the study of impact craters, either on Earth or on the other solid bodies in the solar system. Areas of study may include but shall not necessarily be limited to impact cratering processes; the bodies (asteroidal or cometary) that make the impacts; or the geological, chemical, or biological results of impact

cratering. community.geosociety.org/pgd/awards/shoemaker

RONALD GREELEY AWARD FOR DISTINGUISHED SERVICE

Nominations due **1 August**

Submit nominations to the Division chair: Sam Birch, sbirch@mit.edu

In 2011, the Planetary Geology Division established the Ronald Greeley Award for Distinguished Service. This award may be given to those members of the PGD, and those outside of the Division and GSA, who have rendered exceptional service to the PGD for a multi-year period. The award is not open to currently serving members of the management board but may be awarded to past members of the management board who have provided exceptional service to the PGD after their term on the management board has ended. Nominations for the award, which should include a description of what the nominee has given to the PGD community, may be made by any PGD member to the management board. community.geosociety.org/pgd/awards/greeley

SOILS AND SOIL PROCESSES DIVISION

STUDENT RESEARCH AWARDS

Nominations due **1 June**

Submit nominations to the Division awards committee chair: Steven Driese, Steven_Driese@baylor.edu

The Soils and Soil Processes Division of GSA is pleased to announce the availability of three student awards: two for graduate research (US\$1,000) and one for undergraduate research (US\$500). The proposed research must emphasize soil or paleosol research for it to be considered for an award. Awards will be announced by 15 June 2024. Funds may be used for field or laboratory research. Applicants are encouraged to become members of the Division, but it is not a requirement for proposal consideration.

Proposal materials should include the following, in a single file (PDF or Word only):

1. Student's full legal name, affiliation, contact information, current degree program, and expected graduation date.
2. Proposal narrative (1–2 pages): this will include the purpose and significance of the proposal research and the methods employed to complete the research.
3. Itemized budget. Please include information on all additional sources of funding for the project, including previous and pending sources of funding.
4. Project supervisor's name and contact information. Your supervisor may be contacted for a recommendation if your proposal is considered for funding.

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SIP Intern Lauren Parry conducts site monitoring at a paleontological locality at Tule Springs Fossil Beds National Monument, Nevada (NPS Photo).

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Prioritizing Mental Health During Finals: Tips for Students and Faculty

by Elisheva Sherman and Jennifer Nocerino

As students approach finals, they often feel increased tension and anxiety. At Connects 2023, GSA's annual meeting, GSA offered a Pardee Keynote Symposia titled "Encouraging Positive Mental Health in the Geosciences." Visit <https://bit.ly/4aq9BYC> for instructions on accessing the on-demand recording. The speakers in this session were from the fields of geology, anthropology, sociology, and psychology. The session was followed by a day-long NSF-funded workshop where faculty and students came together to brainstorm ways to encourage positive mental health. Here are some key takeaways:

FOR STUDENTS

- Maintain personal care
- Sleep
- Exercise
- Study with friends
- Eat (ideally a well-rounded, satisfying meal or a protein-heavy snack)
- Visit a tutoring center if your university offers one
- Meditate (start with this 10-minute meditation for stress: <https://bit.ly/3TY5SMD>)
- Self-advocate—go talk to your professors if you are having a rough time
- If your university is offering free food, massages, or puppy play events, take advantage of the opportunity
- Minimize social media—it takes time away from sleep and studying while potentially increasing feelings of isolation and/or imposter syndrome
- Remember that no matter what your grades are, you are enough
- Talk to a professional—Better Help offers students a discount on therapy sessions (~\$50/ session; www.betterhelp.com)

FOR FACULTY

Make an announcement in class encouraging students to either come talk to you or seek help if they are struggling. Provide students with the location of your campus counseling center and the following contact information:

- Campus crisis line
- National Suicide & Crisis Lifeline: 1-800-273-8255 or 988 (call or text)
- State Crisis Center (<https://988lifeline.org/crisis-centers-by-state-and-u-s-territory/>)

Announce this information with empathy and be prepared to listen when students come to you with concerns. Your support and compassion can make a difference.

May is Mental Health Month!
Find additional resources at www.mhanational.org/mental-health-month.



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WHEN YOU'RE FEELING OVERWHELMED, IT MAY FEEL DIFFICULT TO TAKE CARE OF YOURSELF, BUT SMALL STEPS WILL HELP TO EASE THE STRESS. HELP IS AVAILABLE, AND YOU ARE NOT ALONE.

Facilitating the Critical Mineral Future: Valorization of Kaolin Mining Waste through Partnerships

Paul A. Schroeder^{1,*}, W. Crawford Elliott², Yuanzhi Tang³, and Lee Lemke⁴

In order to address the growing demand for critical minerals to supply the energy transition, industry-academic-government circles must engage in discussions about the state-of-the-art procedures for extant mining operations and the potential to coproduce critical minerals such as rare earth elements (REE), which are indispensable in many key components for the automotive, battery, and communications industries. One important reason to further establish critical mineral production is the desire to reduce U.S. dependence on international supplies and increase the economic potential in rural regions. This article highlights the outcomes of a recent Georgia Essential Minerals Workshop and recommends pathways for academic-government-industry partnerships to advance the exploration and production of critical mineral resources. These recommendations reflect the consensus of 45 technical attendees from academia, government, and industry, with a focus on evaluation of the kaolin mining industry in Georgia, USA, and the potential to extract REE from production streams, overburden, and mine tailings. This partnership model may serve other regions looking to meet critical mineral needs.

The first three authors were brought together by all being faculty in earth science departments at public R1 universities and having records of engaging research on rare earth elements (REE) and mining. Their expertise includes characterizing critical mineral speciation in complex heterogeneous matrices and waste valorization, such as REE extraction from coal fly ash (Wen et al., 2024). Additionally, Elliott and Schroeder each have 30+ years of working with kaolin-producing industries in Georgia, USA. Research foci of these geoscientists include REE occurrences in Georgia kaolins (Boxleiter and Elliott, 2023; Elliott et al., 2018), volcanic systems (Karpov et al., 2018), and weathered rocks of the southeast U.S. Piedmont (Schroeder et al., 2022). Perspectives included views from 20 workshop participants from the Georgia Mining Association (GMA). The GMA supports 40 industrial corporations in its mission to “provide information on legislative matters to the membership and to create a better understanding among the people about the importance of the mining industry.”

Unifying this effort were university vision statements. The University System of Georgia’s mission is to “provide an affordable, accessible, and high-quality education; promote lifelong success of students; and create, disseminate, and apply knowledge for the advancement of our state,

and world.” The study of critical minerals presents a novel opportunity for universities to collaborate with industry and government on this societally pressing issue. The geoscientists involved in this workshop wanted to answer key questions related to the Georgia kaolin industry, including:

- What is the potential for coproducing REE from kaolin ore, mine tailings, overburden, or other kaolin production streams?
- What is needed to move from inferred resources to indicated resources?
- What technologies can be transferred from kaolin and other mining operations?
- What permitting variations are anticipated to maintain environmental compliance and stewardship?
- What outreach is needed to keep stakeholders involved during each stage of development?
- How can leaders ensure workforce training is inclusive and part of industry-academic-government partnerships?


Workshop outcomes consisted of several take-home points. Workshop participants emphasized that there is a long history and discovery of REE. A rich body of peer-reviewed REE literature exists, and we do not need to have recursive revelations. REE studies in volcanic systems and weathered rocks of

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the southeast U.S. Piedmont show near-surface mobility of REE. Biogeochemical processes (both natural and engineered lanthanophores) may concentrate abundances of REE, thus making it easier to mine. Two general pools are being mined globally: REE hosted in primary minerals (e.g., Mountain Pass, California, and Mission Mine, Georgia) and REE adsorbed on clay mineral surfaces (e.g., southeast China).

It has been demonstrated that the coarse grit fraction from kaolin feedstock contains a range of REE-bearing minerals (Boxleiter and Elliott, 2023). These host light and heavy REE in varied proportions. A rough valuation of grit from one Georgia kaolin deposit was made using a production rate of 10 tons per day, assuming literature-reported concentrations of REE and current market prices of REE. Not considering mining, processing, and transport costs, this inferred resource can be valued at nearly US\$1 million.

A multi-scale approach is required for REE extraction strategies that span from molecular to field scales of understanding. Experience with extracting REE from coal fly ash points to the numerous steps and energy required to bring REE metals to market (Liu et al., 2023; Wen et al., 2024). It is likely that kaolin streams that include overburden, grits, mine tailings, and other complex REE-mineral associations will require multifaceted characterization using analytical resources at universities and government laboratories. There are numerous opportunities to route feedstock, specific REE yields, and byproducts to other profitable uses that maintain cradle-to-grave material fates and ensure environmental soundness.

There is a long and esteemed history of mining throughout the U.S., especially in Georgia, where practices have been exemplary regarding reclamation and safety compliance. A key advantage to considering the future of REE extraction from operations like kaolin mining is existing and mature infrastructure. Georgia ranks seventh in the nation in the production of industrial minerals, meaning that the technical knowledge, workforce, mineral processing infrastructure, and transportation needs are regionally in place. This positions Georgia for a full-scale exploitation scenario of REE on time scales much shorter than starting from scratch.

During the workshop, subgroups of personnel from academic, industry, and government entities were randomly assembled into breakout sessions to discuss the questions listed above and comments made during plenary sessions. The following consensus points were reached:

- REE production may be difficult to scale because a single operation may be unable to produce sufficient feedstock.
- REE production should be viewed as a multi-mineral resource extraction endeavor, with each feedstock supplying different REE and mineral components.
- Small-scale producers participate in co-operative scenarios to build “banks,” similar to co-ops in agricultural markets.
- In addition to REE banks from kaolin mining ore streams and similar sources, enrichments may also come from coprocessing of waste from REE-bearing end products.
- Regulatory oversight needs to be evaluated at state and federal levels to identify barriers that may lead to intolerable economic and/or environmental thresholds.

- Valorization of waste streams contributes to economic national security, which enables the U.S. to establish supply chain demands.

These insights led to the following recommendations, which are intended to be guide posts for stakeholders, not only in the southeast U.S. but also in other regions around the world:

- Political will needs to bend and allow more direct partnering of industry-academic initiatives with government (e.g., U.S. Geological Survey).
- Enable basic research via industry-academic-government partnerships to characterize REE contents and occurrences in inferred resources. Consider kaolin mine tailing, grits, and overburden to be a fast track in this model.
- Establish regional consortia. This is promoted by the U.S. State Department’s concept of Minerals Security Partnership, the goal of which is to “accelerate the development of diverse and sustainable critical energy minerals supply chains through working with host governments and industry to facilitate targeted financial and diplomatic support for strategic projects along the value chain.”
- Establish consortia to organize workshops to bring stakeholders together, prioritize research and economic topics, provide continuing education for existing workforce, and train the next generation needed for sustainable growth.

ACKNOWLEDGMENTS

Georgia Essential Minerals Workshop organizers acknowledge the financial support of their universities.

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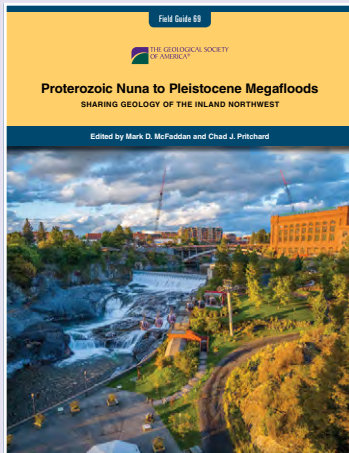
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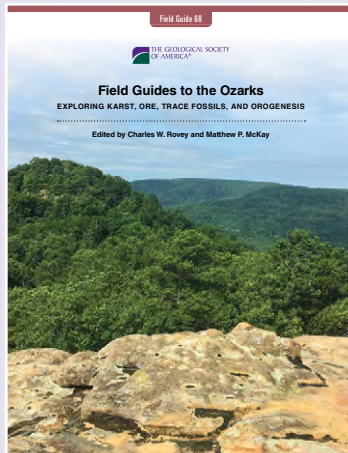
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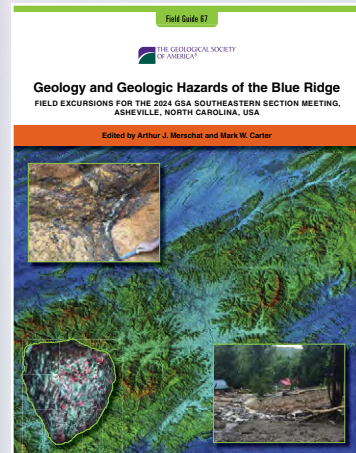
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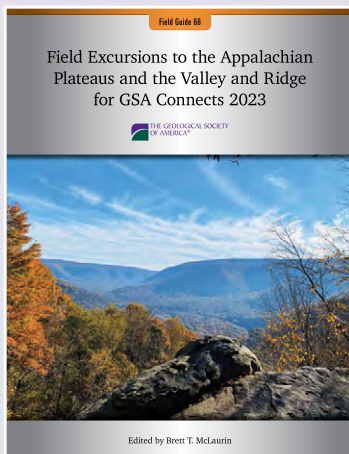
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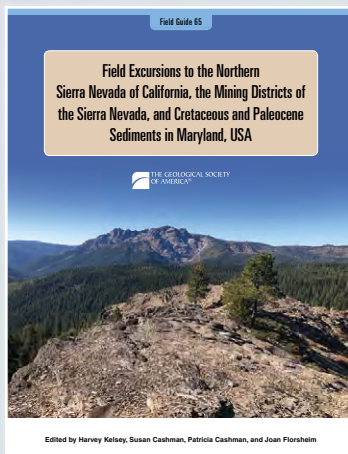
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