GSA TODAY

VOL. 36, NO. 3–4 | March–April 2026

THE MEMBERSHIP PUBLICATION OF THE GEOLOGICAL SOCIETY OF AMERICA™

THE POWER OF RESEARCH GRANTS p. 10

Science

Tower in Motion: Resonance Mode Analysis of Devils Tower, Wyoming, USA

PAGE 4

My Stories, My Science

More Than Data: How a Travel Grant Reignited My Science and Community

p. 26

Geoheritage

Loreto, Mexico: A Natural Laboratory for Study of the Interaction Between Faulting and Sedimentation

p. 28

GSA TODAY

GSA TODAY (ISSN 1052-5173 USPS 0456-530) prints news and information for more than 19,000 GSA member readers and subscribing libraries, with 11 monthly issues (March–April is a combined issue). *GSA TODAY* is published by The Geological Society of America® Inc. (GSA) with offices at 3300 Penrose Place, Boulder, Colorado, USA, and a mailing address of P.O. Box 9140, Boulder, CO 80301-9140, USA. GSA provides this and other forums for the presentation of diverse opinions and positions by scientists worldwide, regardless of race, citizenship, gender, sexual orientation, religion, or political viewpoint. Opinions presented in this publication do not reflect official positions of the Society.

Subscriptions: GSA members: Contact GSA Member & Customer Services, +1-800-472-1988; +1-303-357-1000 option 3; gsaservice@geosociety.org for information and/or to place a claim for non-receipt or damaged copies. **Nonmembers and institutions:** *GSA TODAY* is US$117/yr; to subscribe, or for claims for non-receipt and damaged copies, contact gsaservice@geosociety.org. Claims are honored for one year; please allow sufficient delivery time for overseas copies. Periodicals postage paid at Boulder, Colorado, USA, and at additional mailing offices. Postmaster: Send address changes to GSA Member & Customer Services, P.O. Box 9140, Boulder, CO 80301-9140.

***GSA TODAY* STAFF**

Science Editors: Peter Copeland, University of Houston, Department of Earth and Atmospheric Sciences, Science & Research Building 1, 3507 Cullen Blvd., Room 314, Houston, Texas 77204-5008, USA, copeland@uh.edu; **Christian Koeberl**, Department of Lithospheric Research, University of Vienna, Althanstrasse 14, A-1090 Vienna, Austria, christian.koeberl@univie.ac.at.

Managing Editor: Katie Busser, kbusser@geosociety.org, gsatoday@geosociety.org

Graphics Production: Mia Rincón, mrincon@geosociety.org

For advertising inquiries, contact: advertising@geosociety.org

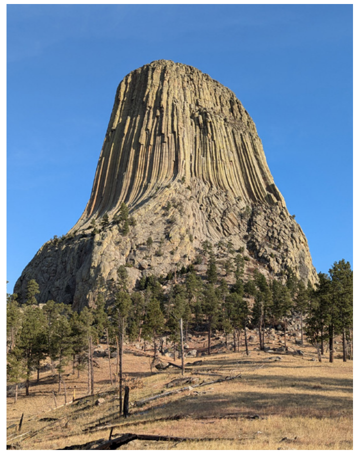
GSA Online: www.geosociety.org
GSA TODAY: www.geosociety.org/gsatoday

Printed in the USA using pure soy inks.

THE GEOLOGICAL SOCIETY OF AMERICA®

CONTENTS

MARCH–APRIL 2026



Cover: Devils Tower, Wyoming, USA
Credit: Jeffrey R. Moore, Kathryn Vollinger, and Jan Burjánek.
See related article on p. 4–9.

FEATURES

IN THIS ISSUE

PAGE 26

Vineyards and the Cordillera in Mendoza.

ERRATUM: Fault rocks: A fourth class of rocks
Robert D. Hatcher Jr.
ORIGINAL ARTICLE: 2025, GSA Today, v. 35, no. 7, p. 4–9, https://doi.org/10.1130/GSATG608A.1.
First published 1 July 2025.
Robert Hatcher Jr. apologizes to Professor Celal Sengör and his co-author Mehmet Sakinc for neglecting to cite their 2001 paper published in *Paradoxes in Geology*, and include it in the references. It should have been cited on page 5, column 1, paragraph 3.
The full reference that should have been included is as follows:
Şengör, A.M.C., and Sakinç, M., 2001, Structural rocks: Stratigraphic implications, *in* Briegel, U., and Xiao, W.-J., eds., Paradoxes in Geology: Amsterdam, Elsevier Science, p. 131–227, https://doi.org/10.1016/B978-044450560-6/50010-2.

SCIENCE

Tower in Motion:

Resonance Mode Analysis of Devils Tower, Wyoming, USA

Jeffrey R. Moore,*[1] Kathryn Vollinger,[2] and Jan Burjánek[3]

ABSTRACT

Devils Tower, Wyoming, is a 265-m-high cylindrical rock tower of phonolite porphyry with deep cultural significance and is the site of America's first national monument. We deployed a seismometer on the summit of Devils Tower for 21 h in October 2024, in addition to two identical sensors at the base, and used ambient vibration modal analysis techniques to identify resonance modes. Close axial symmetry of the tower gives rise to similar frequencies for the first two modes at 1.1 and 1.2 Hz. We then performed 3-D numerical modeling to predict modal deformation fields: the first two predicted modes are full-height swaying of the tower in orthogonal directions, matching resonance frequencies from field data, followed by a third, torsional mode. The model derived a calibrated global Young's modulus for the tower of 8 GPa, which is approximately seven times lower than that measured from intact rock testing due to the added compliance of joints. Our results contribute to a growing understanding of the structural dynamics of freestanding rock landforms with different sizes, geometry, and composition, and more generally to engaging public interest in geologic features of cultural heritage sites.

INTRODUCTION

Freestanding structures at Earth's surface are in constant motion, vibrating in response to wind, seismic energy, and anthropogenic

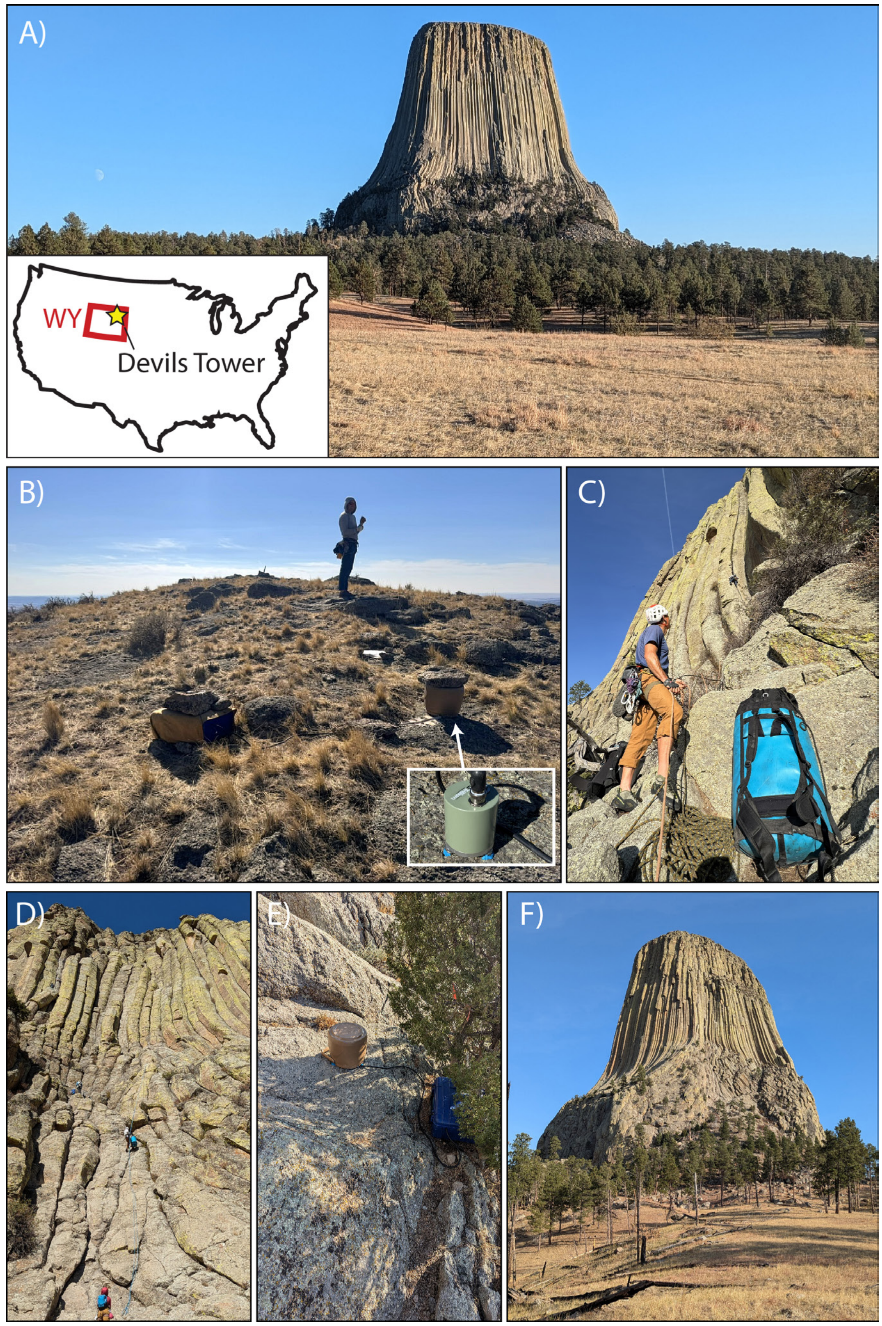


Figure 1. Photographs of Devils Tower and seismometer deployments. (A) Tower with view toward east-southeast (location inset); (B) view from the summit looking south showing seismometer under bucket (detail inset), covered data logger, and battery under tarp; climbers (C) hauling seismometer to the summit and (D) rappelling with equipment; (E) Station C at the base of the south cliff; (F) Devils Tower looking north.

*jeff.moore@utah.edu
[1] University of Utah, Department of Geology & Geophysics, Salt Lake City, Utah 84112, USA
[2] Independent researcher, Leavenworth, Washington, USA
[3] Institute of Geophysics of the Czech Academy of Science, Prague, Czech Republic
CITATION: Moore, J.R., et al., 2026, Tower in motion: Resonance mode analysis of Devils Tower, Wyoming, USA: GSA Today, v. 36, p. 4–9, https://doi.org/10.1130/GSATG635A.1.

forces (Carder, 1936; Cloud et al., 1952; Moore et al., 2019; Weber et al., 2022). These inputs excite the normal modes of the structure, resulting in resonance. While the dynamic properties of civil structures have been investigated for more than a century (e.g., Omori, 1900), similar research on geologic features is still an emerging field (Dowding et al., 1983; King, 2001; Geimer et al., 2020; Müller and Burjánek, 2023). However, past studies have shown that the dynamic properties of freestanding geologic landforms have important similarities to their civil counterparts (Finnegan et al., 2022a), and that techniques used in engineering can be applied to understand resonance of geologic features (Häusler et al., 2021).

Modal analysis is the process of determining the resonance properties of a structure from frequency-domain techniques (Fu and He, 2001). In the past it was necessary to excite vibration of structures at different frequencies and measure the resulting response; however, with advances in instrument technology it is now possible to use ambient seismic data for modal analysis (Cloud et al., 1952; Brownjohn et al., 2010). Typical approaches involve spectral analysis, identifying frequency peaks in comparison to nearby reference sites, site-to-reference spectral ratios, and polarization analysis (e.g., Geimer et al., 2020). More advanced techniques offer resolution of modes with close frequency spacing, show directional modal vectors preserving phase information, include rotational or six component tensor data, and allow processing of sensor arrays (Häusler et al., 2021; Dzubay et al., 2022; Grechi et al., 2024).

Recent studies have shown that the resonance properties of rock towers can be described using analytical expressions for a cantilever (Dowding et al., 1983; Bottelin et al., 2013; Finzi et al., 2020; Martin et al., 2020; Finnegan et al., 2022a). Tall towers in particular occupy an end member cantilever bending description utilizing Euler-Bernoulli beam theory, but towers of different aspect ratios can incorporate elements of shear deformation, as described by Timoshenko beam theory (Michel and Guéguen, 2018; García Suárez et al., 2025). Results of these studies are valuable for assessing resonance susceptibility and vibration-induced damage risks for geologic features with important cultural value (e.g., King, 2001). Similar studies have also assessed the dynamic properties of large mountain landforms, highlighting topographic amplification relevant for earthquake triggering of landslides (e.g., Weber et al., 2022).

Despite growing interest in the dynamic properties of rock landforms, most research is confined to studies of a few key rock types (often sandstone) and typical landform scales that allow in situ seismic measurement (Finnegan et al., 2022a). While such studies continue to expand and include new materials (e.g., Grechi et al., 2024), it is also important to analyze large-scale features with different geometries. Moreover, vibration analysis of cultural heritage sites, including geologic features of national parks and monuments, is important not only in developing approaches for long-term management and conservation, and in aiding vibration risk assessment (e.g., Dowding et al., 1983; Moore et al., 2016), but also can be valuable for public outreach to generate new interest in geologic features as dynamic at time scales concurrent with human perception and visitation.

Here we describe the dynamic properties of Devils Tower, a 265-m-high rock tower of intrusive igneous rock in northeastern Wyoming and the site of America's first national monument. We deployed a broadband seismometer on the summit of Devils Tower for 21 h in October 2024, and two other identical instruments at its base for comparison. Data indicate two closely spaced first resonance modes at 1.1 and 1.2 Hz. With the aid of calibrated numerical modeling, we show the predicted deformation fields for these modes and derive a global Young's modulus for the tower, which we compare with lab-measured values on core samples. Our results expand understanding of the resonance properties of rock landforms and provide a new means of visitor outreach describing Devils Tower as a dynamic landform constantly in motion, swaying in resonance with Earth's forces.

STUDY SITE AND EXPERIMENT

Devils Tower is a ~265-m-high monolith of Cenozoic phonolite porphyry rising from surrounding Jurassic sedimentary rocks in northeastern Wyoming (Fig. 1). The iconic prominence of the tower, as well as its characteristic columnar jointing, have helped make it an important cultural site for millennia. Local Indigenous people refer to the tower as Bear Lodge (or similar variants thereof), while the name change to Devils Tower arose in the early 1900s, possibly stemming from a mistranslation (Rogers, 2007). The site was designated as America's first national monument in 1906. Different theories exist as to the formation of the intrusive igneous body, whether it be a stock, laccolith remnant, volcanic plug, or lava coulee (see Závada et al., 2015). Today the site is a popular tourist attraction.

We deployed a Nanometrics Trillium Compact 20-s, three-component broadband seismometer on the summit of Devils Tower from 12–13 October 2024 (Fig. 1). The instrument was carried to the summit by a team of climbers under an approved permit from the National Park Service. The seismometer (station D) was located on the northern portion of the tower summit (Fig. 2A). It was placed on bedrock, with a dab of adhesive putty under each foot to aid coupling, leveled and oriented north, and then covered to prevent wind buffeting. The seismometer was paired with a 24-bit Nanometrics Centaur datalogger recording continuous data at 100 Hz. Two identical seismometer setups were additionally deployed (Fig. 2A): station C on bedrock at the base of the tower's south wall, and station A on a large flat boulder embedded in colluvium ~200 m south of the tower. The various instruments had different run times: station D ran the longest for 21 h from afternoon to late morning, while the overlapping duration of all three sensors was 19 h (12 Oct. 20:00–13 Oct. 15:00 UTC).

METHODS

We processed continuous seismic data for spectral information using the approach of Finnegan et al. (2022a). We removed the mean, trend, and instrument response from each trace, then band-pass filtered data between 0.1 and 40 Hz and computed power spectral density curves using fast Fourier transforms in overlapping 5-min windows. We additionally used Frequency Domain Decomposition (FDD; Brinker and Ventura, 2015), which is a modal analysis technique used to identify natural frequencies, mode shapes, and damping ratios from ambient vibration data. FDD decomposes the cross-power spectral density matrix of recorded signals via eigenvalue decomposition, with peaks in the first eigenvalues indicating dominant modes and corresponding eigenvectors describing their shapes (Poggi et al., 2014; Labuta et al., 2025).

We used the commercial finite-element software COMSOL Multiphysics to perform 3-D eigenfrequency simulations (i.e., solved in the frequency-domain, no input motion applied). Models require accurate representation of topography, which we obtained from a USGS 1-m LiDAR digital elevation model (Fig. 2), in addition to specified material properties. Following the approach of Moore et al. (2018), we set density at 2600 kg/m^3, representing unweathered phonolite porphyry (likely accurate to within ± 10%), and let Young's modulus vary until a close match was found to resonance frequencies identified from experimental data. The surrounding country rock was not independently described as this material has negligible effect on modal deformation of the tower.

Laboratory rock strength and deformation testing were performed according to ASTM D7012 standards. We obtained a fresh phonolite porphyry boulder from the scree slope at the base of Devils Tower and extracted three 3.8-cm-diameter cores with lengths between 8.4 and 8.7 cm. Core specimens were prepared for testing following ASTM D4543, with ends machined flat and parallel and an axial strain gauge affixed, then loaded in an unconfined state until failure. Young's modulus was determined as the slope of the stress-strain curve at 50% strength (ASTM D7102), and the uniaxial compressive strength was determined as the stress at sample failure.

RESULTS

Spectral analysis of ambient vibration data from the Devils Tower summit station shows a prominent peak around 1.1 Hz (Fig. 3A), which is strongest on the horizontal components of motion (HHX and HHY) and similarly seen on spectra from station C at the base of the tower (see also Fig. S1 in the Supplemental Material[4]). We interpret this peak as relating to a resonance mode of Devils Tower. Other higher frequency spectral peaks are also apparent. Additionally, we observed a strong peak at ~0.15 Hz, which is seismic energy created by the world's oceans and measured equally across all stations (Longuet-Higgins, 1950). Modal displacements at the summit station at 1.1 Hz were ~0.5 µm at maximum during a windy period, and most often one order of magnitude lower during calm periods under ambient seismic excitation.

Close inspection of the 1.1 Hz peak indicates subtle differences between the E-W horizontal component (HHX) and the N-S (HHY), with the latter appearing slightly offset to higher frequency (Fig. 3A). To clarify, we extracted the frequency with peak power in the band between 0.9 and 1.3 Hz for 5-min windows over all 21 available hours (Fig. 3B). Results show that the dominant spectral peak switches randomly between 1.1 and 1.2 Hz, which is clarified by the histogram in Figure 3C, where the two frequencies are clearly distinguished with equal count. This suggests that there are actually two spectral peaks representing two resonance modes of the tower at ~1.1 and 1.2 Hz. We identified no drifts in these frequencies over time, which can accompany temperature changes and/or freezing pore water in the near surface (e.g., Geimer et al., 2022).

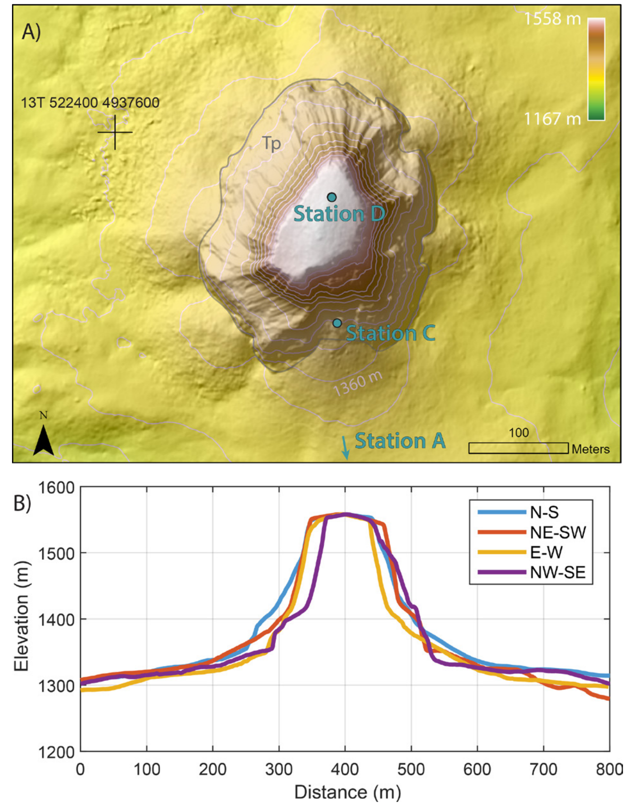


Figure 2. Topography of Devils Tower. (A) Hillshade with elevation coloring, contour interval is 20 m. UTM coordinate given for reference. Layout of three seismic stations shown. Tp: phonolite porphyry; (B) topographic profiles at 45° azimuth intervals showing radial similarity of the cross-profile. The slimmest aspect is the E-W direction while the thickest is N-S. Source: USGS 1-m LiDAR.

We applied FDD analysis in an attempt to discern properties of resonance modes with similar frequency. FDD confirmed two closely spaced peaks at 1.1 and 1.2 Hz (Fig. 3D). Particle motion associated with the 1.1 Hz mode is oriented EEN–WWS and appears elliptical rather than linear (Fig. S2), as is typically expected, while the 1.2 Hz mode shows a similar directional pattern. Based on previous observations at rock towers, the 1.2 Hz mode shape is expected to be oriented perpendicular to the 1.1 Hz mode, which is also suggested by a peak in the second eigenvalue between 1.0 and 1.3 Hz. However, properties of the perpendicular mode cannot be identified from the first eigenvalue. FDD analysis also revealed several local maxima between 1.7 and 5 Hz (Fig. 3D), including a peak at 2 Hz that appears significant as suggested by characteristic shapes observed in the third, fourth, and fifth eigenvalues.

Numerical modal analysis allowed us to test the hypothesis that experimental data resolve resonance modes of Devils Tower. We implemented a 3-D uniform, isotropic model of Devils Tower in COMSOL Multiphysics for eigenfrequency analysis. Assuming a constant density of 2600 kg/m^3, we found a Young's modulus of 8 GPa produced results closely matching field data: the model predicts the first two resonance frequencies of Devils Tower are 1.1 and 1.2 (Fig. 4), matching measurements. The model also predicts a third mode at 2.1 Hz,

[4] Supplemental Material. Figure S1. Power spectral density plots for all stations. Figure S2. Particle motion for the first two modes. Figure S3. Results of laboratory rock testing. Figure S4. Visualized second mode of vibration. Animation S1. Modal animations. Audio S1. Sonified vibration of Devils Tower. Please visit https://doi.org/10.1130/GSAT.S.31366117 to access the supplemental material; contact editing@geosociety.org with any questions.

similar to that evident in FDD analysis. Modeled mode shapes for the first two modes indicate full-height deformation in roughly orthogonal directions (approximately E-W for the first, N-S for the second), with the third torsional mode showing the tower rotating about a vertical axis.

DISCUSSION

Experimental and numerical modal analysis shows that the first two resonance modes of Devils Tower are full-height deformation likely in orthogonal directions (Fig. 4). This sequence is common for rock towers (e.g., Moore et al., 2019; Finnegan et al., 2022a; Müller and Burjánek, 2023; García Suárez et al., 2025; Jbara and Tsesarsky, 2025). However, notable at Devils Tower is the close similarity of the first two resonance frequencies, which arises due to the near-axial symmetry of the tower's form (cf. Cloud et al., 1952) and is clarified in Figure 2B. With perfect axial symmetry, the two modes would be at identical frequencies. However, the tower is slightly slimmer in the E-W direction (modeled orientation of motion for the first mode), and thicker in the N-S direction (modeled orientation of motion for the second mode).

The third resonance mode predicted for Devils Tower from numerical modeling is torsion with rotational motion about a vertical axis. This sequence of modes is also relatively common for other rock towers (e.g., Michel et al., 2010; García Suárez et al., 2025). Dzubay et al. (2022) noted similar observations for a ~30-m-high sandstone tower in Utah, where the first two modes were mutually orthogonal bending and the third was torsion, and confirmed the torsional mode using a rotational seismometer. In a study of a broad range of tower and fin landforms, Finnegan et al. (2022a) noted that geometry plays a key role in controlling the progression of mode shapes, with semi-symmetrical towers typically having two orthogonal first-order modes followed by torsion. The third mode at Devils Tower is only weakly apparent in spectral analysis, possibly due to a lack of strong excitation.

FDD analysis indicates the presence of multiple modes in the 1.1–1.3 Hz range, with a peak in the second eigenvalue suggesting an orthogonal mode. The absence of an expected perpendicular mode shape in the first eigenvalue indicates a more complex modal structure, where the fundamental mode is split into closely spaced components. This multiplet likely overlaps with the 1.2 Hz mode, complicating mode shape estimation. An alternative explanation is that the second mode is only weakly excited and the fundamental mode dominates the observed response. Careful selection of time windows reveals multiple sub-peaks in the eigenvalues; however, the limited number of time windows reduces the robustness of this approach. The peak close to 2 Hz likely corresponds to the torsional mode predicted by numerical modeling, as suggested by its characteristic signature in the higher-order eigenvalues. More reliable characterization of higher modes would require a dense array of measurements across the tower.

Results from numerical modeling closely matched experimental field data, with nearly identical resonance frequencies predicted versus measured for the first two modes, despite the simplified uniform composition. This implies the tower can generally be considered monolithic, which is not surprising given theories on its genesis (Závada et al., 2015). In a previous study of the Matterhorn, Weber et al. (2022) hypothesized that implementing a stress-dependent

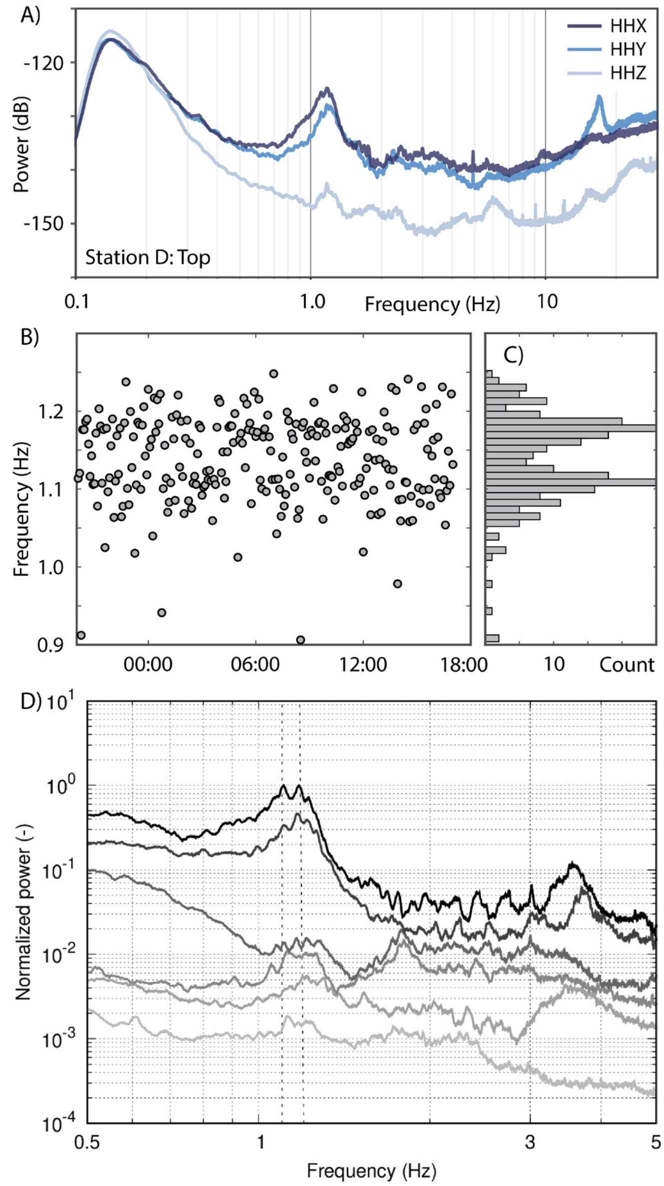


Figure 3. Spectral attributes of seismic data. (A) Power spectral density; power in decibels relative to unit acceleration; (B) frequency with peak power extracted in 5-min windows over time; (C) histogram of frequency data; (D) FDD results for joint analysis of stations A and D showing six frequency-dependent eigenvalues (in grayscale) of the cross-spectral density matrix. Dashed lines are 1.1 and 1.2 Hz.

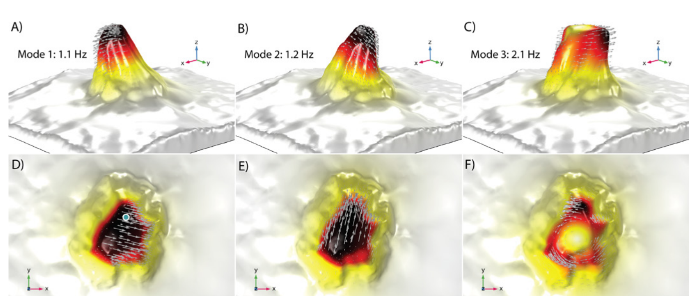


Figure 4. Numerical modal analysis. (A–C) First three predicted resonance modes of Devils Tower showing exaggerated modal deflection (view looking southwest; y = north, x = east). Color scale and arrows show relative modal displacement (black greatest, white zero); (D–F) map view of undeformed displacement vectors; green dot is seismometer location.

Young's modulus might be more appropriate for large-scale landforms where modulus increases at higher confining pressures at depth; however, their tests did not reveal substantial differences to a uniform model nor an improved fit to field data. Thus, we elected to use the simplified uniform modeling approach. We also did not treat the surrounding sedimentary rock units as independent material in the model as these areas do not affect predictions for the tower.

The model-calibrated Young's modulus of 8 GPa for Devils Tower represents a mean effective value for the rock mass. While derived from small-strain measurements, the value appears to better represent one we might expect for large strains in engineering applications, where the rock mass modulus is less than that of intact rock due to the added compliance of joints (Moore et al., 2018; Müller and Burjánek, 2023). To clarify, we measured the Young's modulus of phonolite porphyry core samples from Devils Tower using standard laboratory techniques (see Fig. S3). The mean value determined was 55 GPa (range: 48–66 GPa), which is ~7 times greater than that of our numerical model. For comparison, Moore et al. (2018) assessed similar data sets for Navajo Sandstone arches and found that resonance-based modulus estimates were 2–5 times lower than intact rock values.

The large difference between rock mass and intact moduli results from the compliance of joints, such as the vertical columnar joints that are a well-known feature of Devils Tower, which cannot be captured by laboratory measurements on small samples. Using the approach of Hoek and Diederichs (2006) and Grechi et al. (2024), we investigated use of the disturbance factor (D) to scale between intact and rock mass moduli. We found that a relatively large disturbance factor of 0.7–1 is required to match our values. While the parameter is normally applied in smaller-scale engineering studies, its use is intended to account for joint dilation and added joint compliance, which is applicable in our study. The result suggests that the bulk of the rock mass at Devils Tower contains dilated joints, even at depth. This may arise from the particular stress conditions and lack of confinement at the freestanding tower.

Past studies on rock landforms, including rock towers, cave formations, and cliff blocks, have found that the fundamental resonance modes of these features conform to that of a cantilever beam (Finnegan et al., 2022a). When validated, such comparisons mean that resonance frequencies and modal strain fields can be predicted from analytical solutions, which is valuable when field data are difficult to acquire. At Devils Tower, if we simply apply approximate geometrical properties (height: 250 m, width: 250 m) in the Euler-Bernoulli cantilever equation (Moore et al., 2019) and use the value of 8 GPa for Young's modulus determined from numerical modeling, we calculate a first resonance frequency of 1.1 Hz, close to our measured value. However, we note that a priori estimates of Young's modulus are rarely available for all materials and feature scales, which remains a key output of this analysis.

Normal mode vibration of a cantilever is not always best described by the Euler-Bernoulli model, which is appropriate for slender towers and an end member of more generalized Timoshenko beam theory (García Suárez et al., 2025). Shorter towers, on the other hand, incorporate important components of shear deformation. Boutin et al. (2005) and Michel and Guéguen (2018) developed a parameter, C, that relates the ratio of bending stiffness to shear stiffness to assess the importance of each in the deformation at various modes. C values <~0.01 indicate bending dominates while C >~1.0 indicates shear dominates. We found that the C value for Devils Tower, where the height and width are similar, is ~0.5, suggesting that modal deformation consists of a mix of bending and shear.

Results of our study are valuable in understanding the structural dynamics of freestanding rock landforms with different sizes, geometry, and composition. This information is useful for assessing risks from vibration-induced damage (e.g., Dowding et al., 1983; King, 2001; Moore et al., 2016; Finnegan et al., 2022b) or predicting co-seismic rockfalls and requires a growing number of field-based data sets. Equally valuable, and especially relevant at Devils Tower, our study helps create a new way for visitors to experience the landform—not only as a geologic structure evolving slowly over millions of years, but as a dynamic and lively landform constantly in motion at human timescales (Figure S4; Animation S1; Audio S1). While the movements are small, they are nonetheless a real part of the story of Devils Tower, and their knowledge may help visitors better appreciate the delicacy and sensitivity of geologic landforms.

CONCLUSION

Devils Tower vibrates at a set of identifiable resonance modes, excited by ambient forces such as wind and seismic energy. We deployed a seismometer overnight on the summit of Devils Tower, as well as two identical instruments at and near its base, and used frequency-domain modal analysis techniques to identify the resonance modes. We found the fundamental mode of Devils Tower occurs at 1.1 Hz, with a second mode at 1.2 Hz. The close frequency spacing arises from the relatively close axial symmetry of the cylindrical tower. We implemented the geometry of Devils Tower in a simplified numerical model in an attempt to replicate field observations. Results captured the fundamental mode and predicted a second perpendicular mode, with frequencies closely matching field data, and in addition predicted the third torsional mode that was evident from FDD analysis. Tuning material properties to match measured frequencies, we determined a calibrated global Young's modulus for the tower of 8 GPa, a value that is ~7 times lower than measured from intact rock testing, which results from the added compliance of joints at the rock mass scale. Our study contributes to better understanding of the dynamics of freestanding rock landforms with different scale and composition, and to engaging public interest in geologic features of national heritage sites.

ACKNOWLEDGMENTS

We are grateful for climbing assistance from Cameron Reade and Greg Dooley, and to the National Park Service for permitting this research. Thanks to Dan Seely at IGES Inc. for performing rock testing, Wil Mace for coring assistance, Paul Geimer for preparing topographic data, and Mauro Häusler for discussions on data analysis. This material is based on work supported by the National Science Foundation under Award No. 2150896. Data generated are available through the University of Utah HIVE repository: https://doi.org/10.7278/S5d-ajvn-wqqq.

REFERENCES CITED

Bottelin, P., Levy, C., Baillet, L., Jongmans, D., and Gueguen, P., 2013, Modal and thermal analysis of Les Arches unstable rock column (Vercors massif, French Alps): Geophysical Journal International, v. 194, no. 2, p. 849–858, https://doi.org/10.1093/gji/ggt046.

Boutin, C., Hans, S., Ibraim, E., and Roussillon, P., 2005, In situ experiments and seismic analysis of existing buildings. Part II: Seismic integrity threshold: Earthquake Engineering & Structural Dynamics, v. 34, no. 12, p. 1531–1546, https://doi.org/10.1002/eqe.503.

Brincker, R., and Ventura, C., 2015, Introduction to Operational Modal Analysis: Hoboken, New Jersey, Wiley, https://doi.org/10.1002/9781118535141.

Brownjohn, J.M.W., Magalhaes, F., Caetano, E., and Cunha, A., 2010, Ambient vibration re-testing and operational modal analysis of the Humber Bridge: Engineering Structures, v. 32, no. 8, p. 2003–2018, https://doi.org/10.1016/j.engstruct.2010.02.034.

Carder, D.S., 1936, Observed vibrations of buildings: Bulletin of the Seismological Society of America, v. 26, no. 3, p. 245–277, https://doi.org/10.1785/BSSA0260030245.

Cloud, W.K., Hershberger, J., and Warner, S.E., 1952, Vibration observations, Sather Tower, University of California, Berkeley, California: Bulletin of the Seismological Society of America, v. 42, no. 1, p. 1–7, https://doi.org/10.1785/BSSA0420010001.

Dowding, C.H., Kendorski, F.S., and Cummings, R.A., 1983, Response of rock pinnacles to blasting vibrations and airblasts: Bulletin of the Association of Engineering Geologists, v. 20, no. 3, p. 271–281, https://doi.org/10.2113/gseegeosci.xx.3.271.

Dzubay, A., Moore, J.R., Finnegan, R., Jensen, E.K., Geimer, P.R., and Koper, K.D., 2022, Rotational components of normal modes measured at a natural sandstone tower (Kane Springs Canyon, Utah, USA): The Seismic Record, v. 2, no. 4, p. 260–268, https://doi.org/10.1785/0320220035.

Finnegan, R., Moore, J.R., Geimer, P.R., Dzubay, A., Bessette-Kirton, E.K., Bodtker, J., and Vollinger, K., 2022a, Ambient vibration modal analysis of natural rock towers and fins: Seismological Research Letters, v. 93, no. 3, p. 1777–1786, https://doi.org/10.1785/0220210325.

Finnegan, R., Moore, J.R., and Geimer, P.R., 2022b, Contribution of anthropogenic vibration sources to crack growth in natural rock arches: Frontiers of Earth Science, v. 10, https://doi.org/10.3389/feart.2022.1035652.

Finzi, Y., Ganz, N., Dor, O., Davis, M., Volk, O., Langer, S., Arrowsmith R., and Tsesarsky, M., 2020, Stability analysis of fragile rock pillars and insights on fault activity in the Negev, Israel: Journal of Geophysical Research: Solid Earth, v. 125, no. 12, https://doi.org/10.1029/2019JB019269.

Fu, Z.F., and He, J., 2001, Modal Analysis: Amsterdam, Elsevier, 304 p.

García Suárez, J., McPhillips, D., and Asimaki, D., 2025, Seismic response of rock towers at the Trona Pinnacles (USA) to the 2019 Ridgecrest earthquake sequence: Theory, observations, and models: Bulletin of the Seismological Society of America, v. 115, no. 6, p. 2769–2792, https://doi.org/10.1785/0120250073.

Geimer, P.R., Finnegan, R., and Moore, J. R., 2020, Sparse ambient resonance measurements reveal dynamic properties of freestanding rock arches: Geophysical Research Letters, v. 47, no. 9, https://doi.org/10.1029/2020GL087239.

Geimer, P.R., Finnegan, R., and Moore, J. R., 2022, Meteorological controls on reversible resonance changes in natural rock arches: Journal of Geophysical Research: Earth Surface, v. 127, no. 10, https://doi.org/10.1029/2022JF006734.

Grechi, G., Moore, J.R., Jensen, E.K., McCreary, M.E., Czech, T.L., and Festin, M.M., 2024, Modal analysis of a lava tube roof complex: Tabernacle Hill, Utah, USA: Rock Mechanics and Rock Engineering, v. 57, p. 1–10, https://doi.org/10.1007/s00603-024-03868-9.

Häusler, M., Geimer, P.R., Finnegan, R., Fäh, D., and Moore, J.R., 2021, An update on techniques to assess normal-mode behavior of rock arches by ambient vibrations: Earth Surface Dynamics, v. 9, no. 6, p. 1441–1457, https://doi.org/10.5194/esurf-9-1441-2021.

Hoek, E., and Diederichs, M.S., 2006, Empirical estimation of rock mass modulus: International Journal of Rock Mechanics and Mining Sciences, v. 43, no. 2, p. 203–215, https://doi.org/10.1016/j.ijrmms.2005.06.005.

Jbara, A., and Tsesarsky, M., 2025, Dynamic fragility of a slender rock pillar in a carbonate rock mass: Natural Hazards and Earth System Sciences, v. 25, no. 7, p. 2197–2213, https://doi.org/10.5194/nhess-25-2197-2025.

King, K.W., 2001, Chiricahua pinnacle vibration investigation: Preliminary report for Chiricahua National Monument, Lakewood, Colorado, EGU.

Labuta, M., Oprsal, I., Landa, D.A., and Burjánek, J., 2025, Ambient vibrations of a deep maar resonator: Soil Dynamics and Earthquake Engineering, v. 188, p. 109072, https://doi.org/10.1016/j.soildyn.2024.109072.

Longuet-Higgins, M.S., 1950, A theory of the origin of microseisms: Philosophical Transactions of the Royal Society of London, Series A, Mathematical and Physical Sciences, v. 243, no. 857, p. 1–35, https://doi.org/10.1098/rsta.1950.0012.

Martin, A., Lecocq, T., Hinzen, K.G., Camelbeeck, T., Quinif, Y., and Fagel, N., 2020, Characterizing stalagmites' eigenfrequencies by combining in situ vibration measurements and finite element modeling based on 3D scans: Geosciences, v. 10, no. 10, p. 418, https://doi.org/10.3390/geosciences10100418.

Michel, C., and Guéguen, P., 2018, Interpretation of the velocity measured in buildings by seismic interferometry based on Timoshenko beam theory under weak and moderate motion: Soil Dynamics and Earthquake Engineering, v. 104, p. 131–142, https://doi.org/10.1016/j.soildyn.2017.09.031.

Michel, C., Guéguen, P., El Arem, S., Mazars, J., and Kotronis, P., 2010, Full-scale dynamic response of an RC building under weak seismic motions using earthquake recordings, ambient vibrations and modelling: Earthquake Engineering & Structural Dynamics, v. 39, no. 4, p. 419–441, https://doi.org/10.1002/eqe.948.

Moore, J.R., Thorne, M.S., Koper, K.D., Wood, J.R., Goddard, K., Burlacu, R., Doyle, S., Stanfield, E., and White, B., 2016, Anthropogenic sources stimulate resonance of a natural rock bridge: Geophysical Research Letters, v. 43, no. 18, https://doi.org/10.1002/2016GL070088.

Moore, J.R., Geimer, P.R., Finnegan, R., and Thorne, M.S., 2018, Use of seismic resonance measurements to determine the elastic modulus of freestanding rock masses: Rock Mechanics and Rock Engineering, v. 51, p. 3937–3944, https://doi.org/10.1007/s00603-018-1554-6.

Moore, J.R., Geimer, P.R., Finnegan, R., and Michel, C., 2019, Dynamic analysis of a large freestanding rock tower (Castleton Tower, Utah): Bulletin of the Seismological Society of America, v. 109, no. 5, https://doi.org/10.1785/0120190118.

Müller, J., and Burjánek, J., 2023, In situ estimation of effective rock elastic moduli by seismic ambient vibrations: International Journal of Rock Mechanics and Mining Sciences, v. 170, https://doi.org/10.1016/j.ijrmms.2023.105459.

Omori, F., 1900, Earthquake measurement in a brick building: Public Earthquake Investigation Committee in Foreign Languages, v. 4, p. 7–11.

Poggi, V., Ermert, L., Burjanek, J., Michel, C., and Fäh, D., 2014, Modal analysis of 2-D sedimentary basin from frequency domain 382 decomposition of ambient vibration array recordings: Geophysical Journal International, v. 200, no. 1, p. 615–626, https://doi.org/10.1093/gji/ggu420.

Rogers, J., 2007, Standing Witness: Devils Tower National Monument: National Park Service, 289 p.

Weber, S., Beutel, J., Häusler, M., Geimer, P.R., Fäh, D., and Moore, J.R., 2022, Spectral amplification of ground motion linked to resonance of large-scale mountain landforms: Earth and Planetary Science Letters, v. 578, https://doi.org/10.1016/j.epsl.2021.117295.

Závada, P., Dědeček, P., Lexa, J., and Keller, G.R., 2015, Devils Tower (Wyoming, USA): A lava coulée emplaced into a maar-diatreme volcano?: Geosphere, v. 11, no. 2, p. 354–375, https://doi.org/10.1130/GES01166.1.

MANUSCRIPT RECEIVED 27 AUGUST 2025
REVISED MANUSCRIPT RECEIVED 10 DECEMBER 2025
MANUSCRIPT ACCEPTED 16 FEBRUARY 2025

The Power of Undergraduate Research Grants in the Geosciences

How GSA's Geographic Sections Lead the Way in Supporting Undergraduate Research

Each year, GSA's geographic Sections award undergraduate research grants to student members, helping fund projects that range from field-based investigations to laboratory and data-driven studies. While the financial support is critical, the impact often reaches far beyond a single project. For many recipients, these grants represent their first experience leading research, working closely with mentors, presenting findings, or seeing themselves as future geoscientists.

Section undergraduate research grants can often be the difference between a limited project and a fully realized study. As Antonio B. Rodriguez (University of North Carolina at Chapel Hill) describes, GSA funding allowed his undergraduate student to spend months at a coastal research site collecting cores and processing samples—work that would not have been possible without dedicated support. "Her honors thesis would not have been publishable without the support of GSA," he notes.

For students, these grants often represent a first experience leading research, working closely with a mentor, and contributing to a project with real scientific outcomes. For advisors, they provide a pathway to advance research while mentoring emerging scientists, strengthening the geosciences at multiple levels. We invite you to immerse yourself in these students' experiences and consider how undergraduate research can be a transformative step in your geoscience journey. With applications for the 2026 Section Undergraduate Research Grants due 10 April, undergraduate students are encouraged to review their Section's eligibility criteria and apply.

Find Your Section: https://www.geosociety.org/GSA/GSA/Sections/Home.aspx

Apply for a 2026 Section Undergraduate Research Grant
https://geosociety.co/GSASectionResearchGrants

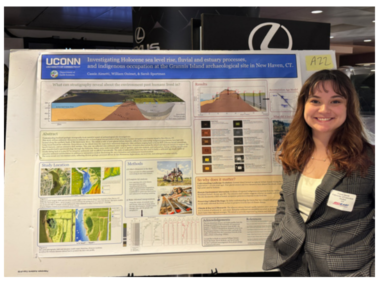
Undergraduate Research Week

GSA Celebrates Undergraduate Research Grant recipients

On 16 November 2010, the U.S. House of Representatives declared the week of 11 April 2011 “Undergraduate Research Week.” Since that time, the Council on Undergraduate Research (CUR) has designated a week in April each year as “Undergraduate Research Week.” This is a national celebration in which CUR showcases what other campuses are doing to celebrate UR, congratulates students on their research, and thanks those faculty and mentors who have helped guide the way for UR.

Learn more about CUR and Undergraduate Research Week:
https://www.cur.org/events-services/undergraduate-research-week/

Cassie Aimetti, 2024 Northeastern Section Grant Recipient



Cassie Aimetti presenting her undergraduate research project at the BIG EAST Fourth Annual Undergraduate Research Poster Symposium at Madison Square Garden on 15 March 2025.

My lifelong fascination with history and the natural world has led me to pursue a PhD in anthropology with a research focus in geoarchaeology. During my undergraduate experience at the University of Connecticut, I wove earth science and anthropology into a dual major that culminated in the completion of a grant-funded senior thesis supported by three awards, including the Stephen G. Pollock Undergraduate Student Research Grant through GSA, which transformed my education into hands-on experience. My project examined Holocene sea-level rise at the Grannis Island archaeological site in New Haven, Connecticut, where I used sediment vibracoring to build a paleoenvironmental reconstruction of the intertidal landscape during active Indigenous occupation over the last 8,000 years. While completion of an undergraduate thesis was optional, my decision to pursue this project inspired me to continue my education in graduate school and significantly increased my preparedness to one day enter the workforce. From initial project design and fieldwork to extensive laboratory analysis and final thesis writing, I gained proficiency in real-world skills that coursework alone could not provide.

Cassie Aimetti and her team opening a soil core at the UConn Ucore Lab. Photo Credit: Sydney Herdle/UConn Photo.

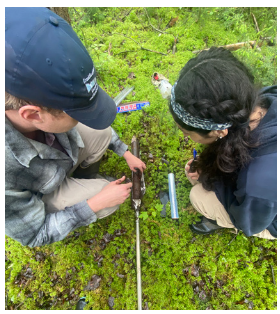
William Ouimet, associate professor of earth sciences at UConn, Cassie Aimetti, and Preston Senderoff working to extract a soil core collected on Grannis Island in New Haven, Connecticut, on 30 May 2024. Photo Credit: Sydney Herdle/UConn Photo.

My undergraduate research also provided opportunities to network and share my work, including poster presentations at conferences, an oral presentation at the 2025 GSA Joint Northeastern and North-Central Section Meeting, and a talk at the 2025 Archaeological Society of Connecticut Meeting. Additionally, my project was shaped by a commitment to the public. I not only contributed to academia but also supported the protection of the vulnerable coastal archaeological site I was studying to ensure its continued stewardship. I am currently in the process of nominating Grannis Island to Connecticut’s State Register of Historic Places and have met with the land trust that stewards the property to discuss the development of educational signage to engage visiting students with local Indigenous history.

Ultimately, I am fascinated by the evolving natural landscape and believe that to prepare for the future of our planet, we need to refine our understanding of the past. My future career paths include faculty positions, work in cultural resource management, or museum and collections-based roles. Regardless of which path I take, engaging in geoarchaeological undergraduate research with the support of GSA grant funding did not simply complement my education; it fostered confidence, clarified my academic trajectory, and laid the foundation for my graduate training and future career.

Maria Fernanda Araoz Pozo, 2025 Northeastern Section Grant Recipient

Receiving a GSA Undergraduate Research Grant has shaped my honors thesis work in environmental science in very tangible ways. The grant is currently supporting five accelerator mass spectrometry radiocarbon dates for peat cores from Bear Meadows, a high-elevation peatland in central Pennsylvania, and these dates have become the backbone of my project. With them, I am building a Bayesian age depth model that allows me to place charcoal, macrofossil, and geochemical records into time, rather than treating the core as a purely stratigraphic sequence.



Maria Fernanda Araoz Pozo and Dr. Adam Benfield collecting a 120-cm peat core at Bear Meadows using a Russian peat corer.

My work has involved every step of the research process. I collected peat cores in the field, subsampled them at high resolution, processed sediments for charcoal analysis, and spent long hours at the microscope identifying charcoal fragments and botanical macrofossils. I completed loss on ignition analyses to track changes in organic matter accumulation and selected key stratigraphic levels for radiocarbon dating based on shifts in charcoal and macrofossil abundance. I am currently continuing charcoal and macrofossil analyses and preparing samples for C:N ratios and stable carbon and nitrogen isotope work, which will help further characterize peatland development and environmental change through time. The radiocarbon dates funded by GSA are what allow this project to move forward as a true paleoenvironmental reconstruction. They make it possible to ask how fire activity changed through the Holocene and how those changes relate to peatland formation and later landscape dynamics.

This experience has been fundamental preparation for graduate school. It has taught me how to design a project around real constraints, how to make careful decisions about sampling and analysis, and how to connect field observations with laboratory data and broader environmental questions. I plan to continue this kind of paleoenvironmental research in graduate school, and this project has given me both the skills and the confidence to do so.

Marina Ashurkoff using Virginia Tech's JEOL JXA-iHP200F Microprobe to research the presence of quartz zoning in their samples. Connor McCloud, another undergraduate researcher who used the microprobe, is featured alongside Professor Clementine Hamelin during examination of mineral assemblages in thin sections representative of metamorphic grades.

Marina Ashurkoff, 2025 Southeastern Section Grant Recipient

The most valuable part of my undergraduate research was being able to conduct original research in a community of geologists who helped build my confidence as a scholar. Whether I was venturing out into the field to collect samples, learning the basics of how to operate a microprobe, picking and preparing sample aliquots, or presenting at GSA Connects, I worked in a supportive community with people who were motivated by the research process. Working with my peers led me to understand that whether your research is on urban heat islands or quartz crystal ecofacts, there is a rich geologic community who will connect with what you're going through. My formative research community and conference experiences being ones of support means that even in the most difficult times of any future research, I know there will be people who believe in my ability to find the answer.

Marina Ashurkoff, Alicia June, and Annika Wolle enjoying the sunshine outside of the geology building after a day of researching.

The William & Mary undergraduate contingent at GSA Connects in San Antonio. From left to right: Sage Khurana, Kirsten Smith, Marina Ashurkoff, and Kaila Bertha.

Matthew Centofanti, 2025 Southeastern Section Grant Recipient

Matthew Centofanti installing background dye receptacles preparing for upcoming injections.

Matthew Centofanti retrieving a temperature logger from a karst spring.

My experiences in undergraduate research have been extremely formative to my academic career. During my first semester at Virginia Tech, I became involved with the university's caving club. On my first caving trip with the club, we passed by the remnants of a research project measuring stalactite drip rates. I was immediately intrigued by the idea of studying complex karst systems. I decided to email the professor who was involved in the project to inquire about research opportunities. Unfortunately, my professor had no current karst projects. Nevertheless, I applied for a summer research position in her lab, focusing on water-quality monitoring at a drinking water reservoir. Over the summer, I conducted field work and prepared water samples for analysis. Through this experience, I gained both technical and soft skills. I learned how to communicate with large lab groups, visualize data, and work as a team in the field to collect data.

The following semester, my professor offered an independent project to another undergraduate student and me. The project I was working on used dye tracing to delineate the groundwater sources supplying a state fish hatchery, supporting informed water-resource management. I was responsible for coordinating field visits, communicating with scientists at state and federal agencies, and collecting and analyzing data. For the first time in my academic career, I felt that the material I was learning in the classroom was directly related to the project I was working on. Additionally, I had far greater accountability for the work that I was doing. The study had real-world applications that directly made an impact.

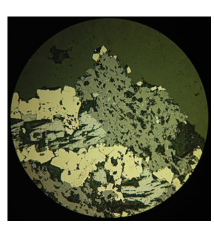
In 2025, I received a GSA Undergraduate Research Grant to help continue the groundwater delineation work that I had started in 2024. To this day, we continue to perform dye injections, collect spring-water quality data, and delineate the aquifer that is crucial to the health of the fish hatchery. Undergraduate research has supported my academic growth and deepened my passion for both my coursework and my research. My research has motivated me to work harder in the classroom and has helped me develop new technical skills, thereby increasing my competence as a scientist.

Alexis Cervantes Felipe, 2025 Cordilleran Section Grant Recipient

Receiving the GSA Undergraduate Research Grant to me represents a vital recognition for those of us venturing into the world of research early in our careers. My project is focused on the mineralogical analysis of a segment from the San Carlos vein in Fresnillo, Zacatecas, México, and this grant helped me take my research a step further, allowing me the use of specialized techniques to analyze the samples and giving me the chance to spend my days uncovering the identity of the minerals that Fresnillo offers to the world.

The discoveries I made, combined with the motivation that programs like this provide, served as a catalyst to drive my passion for ore deposits. Exploring this mineral system in detail not only defined my undergraduate experience but also solidified my commitment to understanding this incredible part of geology. I'm honored to share some of the beauty I encountered during the analysis, which represents the starting point of my professional trajectory focused on the understanding of this type of deposit.

Stereomicroscope image of a euhedral crystal of a silver sulfosalt solid solution (Prs-Pyg) within a vug. The crystal is approximately 2 mm in length and shows polysynthetic twinning. Observed during thin-section preparation.



Reflected light photomicrograph (20x magnification, 1 mm field of view) displaying the predominant sulfides of the vein. Shown are pale yellow pyrite (Py) and bluish-gray galena (Gn) with characteristic triangular cleavage pits. These are associated with sphalerite (Sp) containing acanthite (Aca) inclusions, all surrounded by siliceous gangue matrix.

Alicia Felker, 2024 North-Central Section Grant Recipient

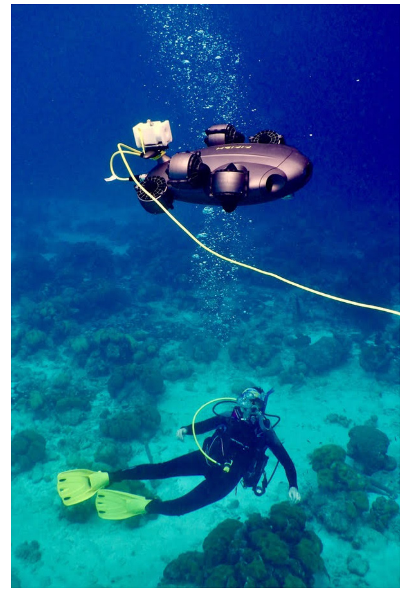
With GSA's help, I was able to accomplish a life-changing experience. I attended Augustana College in Rock Island, Illinois, with interests intertwined between geology, geography, and GIS. GSA helped me to travel to the island of Bonaire in the Lesser Antilles of the Caribbean Sea. Once at Bonaire, a pilot program was conducted through underwater research of reef documentation for orthophotomosaics, or many different pictures of a large area being sewn together into one high resolution image.

Alicia Felker holding the controller for the underwater drone while Dr. Michael Wolf is spooling the drone line.

Reef Renewal ReeFiesta 2024 event with Augustana College attendees Alicia Felker, Zoe Heiar, Sophie Arceneaux, Audrey Zettler, Dr. Jenny Arkle, and Dr. Michael Wolf.

My specific interest in drones as well as being able to obtain my Part 107 through this grant allowed me to conduct this research project. There was a team of six people for this project: the pilot in command (POC), the visual observer and line manager on the boat, two buoy controllers, and two SCUBA divers. We used a Qysea Fifish with an attachment of a GoPro Hero 5 for better resolution and a SeaStar Oddi DSM Magnetic Declination for tracking where the drone went due to no GPS signals underwater.

It was exhilarating to be at the forefront of brand-new knowledge of the underwater world of reef documentation. The reefs need help due to ocean acidification. The goal of this project was to first see how to make the "underwater maps" as well as starting an annual trip to Bonaire to take documentation of the same reefs to document Stony Coral Tissue Loss Disease (SCTLD) and track the health of the reef for years to come.



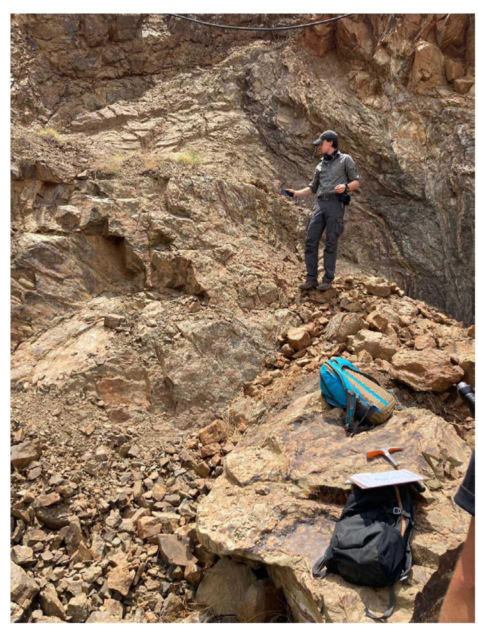
Dr. Jenny Arkle in SCUBA gear guiding the remotely operated vehicle (ROV).

The meeting helped to wrap up the whole process. I explained the pilot program to people interested in drones as well as the new environment of underwater drones. Other hard skills included learning how to use 3-D softwares like Pix4d, coral identification softwares, and better use of ESRI products like ArcGIS Pro in map creation and deep learning exercises. Communication skills were enhanced by connecting with researchers to conduct the skeleton of the project, such as Rosanne Bartholemous, a researcher that previously worked in Bonaire through Wageningen University. This opportunity granted by GSA allowed me to follow a passion for both drone research and reef health documentation, which was a life-changing experience. I plan to continue using drones in the future.

Daniel González Peón, 2025 Cordilleran Section Grant Recipient

My fascination with Earth began at an early age. I was driven by the curiosity of how landscapes form and how geologic processes shape the planet over time. This curiosity was encouraged by my parents and eventually guided me toward studying earth sciences and seeking experiences that would allow me to learn geology not only in the classroom, but directly in the field.

I am currently a final-semester undergraduate student in earth sciences at the National Autonomous University of Mexico (UNAM), campus Querétaro. As part of my thesis research, I am working on a project in the village of San Salvador Patlanoaya, located in the state of Puebla, southern Mexico. The study area is a small rural community set within a rugged, mountainous landscape characterized by open terrain, sparse vegetation, and strong seasonal contrasts. Although these conditions make fieldwork physically demanding, the landscape is remarkable for its natural beauty.



San Salvador Patlanoaya preserves a long, well-exposed Paleozoic to Mesozoic stratigraphic record, providing an ideal natural laboratory for sedimentological and tectonic studies. My thesis project focuses on reconstructing the depositional environments of the Jurassic clastic succession exposed in this area by integrating sedimentological, paleontological, and petrological data to understand its tectono-sedimentary evolution during the breakup of Pangea.

Receiving the 2025 GSA Undergraduate Research Grant was a key component of my research training, as it allowed me to conduct an essential part of my fieldwork in San Salvador Patlanoaya. Although UNAM is also supporting my project, this grant allowed me to spend significant time in the field, carefully examining outcrops, documenting lithologic variations, contributing to detailed geological mapping, and analyzing the depositional environments of the Jurassic clastic succession exposed in the area. In the coming months, I will integrate my field observations with laboratory results derived from petrographic analyses of the samples collected during field campaigns. This work will allow me to refine my interpretations of the sedimentary and tectonic processes recorded in the Jurassic clastic succession and to complete my undergraduate thesis.

Conducting field-based research and presenting my work at a national undergraduate geoscience conference allowed me to share ideas, engage in scientific discussion, and build confidence in communicating research results to both peers and senior scientists. These experiences have been fundamental in shaping how I approach scientific questions and envision my future training in the Earth sciences.

For undergraduate students in Mexico, opportunities to participate in sustained, field-based research are often limited by financial constraints. Support from GSA was crucial to my fieldwork and represents meaningful recognition of the scientific potential of students from public universities such as UNAM. Programs like the GSA Undergraduate Research Grant play a critical role in expanding access to research training and connecting students from Mexico to the global geoscience community, thereby strengthening scientific development and international collaboration.

Left to right: Kevin Talbott, Ella Stewart, and Peyton Hoyt near Beverly Beach, Oregon.

Peyton Hoyt, 2025 Cordilleran Section Grant Recipient

In January 2026, my team and I, with Dr. John D. Orcutt's research lab at Gonzaga University, traveled to the Oregon Coast to analyze Miocene stratigraphy of the Astoria Formation. Our goal was to recreate stratigraphic columns of notable pinnipedimorph localities to help determine their environment and primary form of locomotion. With the support of an Undergraduate Research Grant from the GSA Cordilleran Section, my lab and I spent four days in Newport, Oregon. In preparation for fieldwork, I was a poster presenter at GSA Connects 2025, where I had the opportunity to showcase preliminary results connecting lithology to the primary mode of locomotion for early pinnipedimorphs from published works and databases. My team and I also had the opportunity to visit the University of Oregon collections to get a closer look at some notable pinnipedimorph specimens from the Astoria Formation.

Left to right: Kevin Talbott, Ella Stewart, and Peyton Hoyt at the University of Oregon fossil collections.

I am incredibly grateful for the opportunity to pursue fieldwork as an undergraduate student. I gained many valuable skills, such as grant writing, trip budgeting, supplies organization, note-taking in the field, scheduling for fieldwork, and creating stratigraphic columns. My team and I were able to compile detailed information on the stratigraphy of the Astoria Formation along a 2+ mile stretch of beach known for yielding pinnipedimorph specimens. We identified ash layers, siltstone and sandstone deposits, faults, synclines and anticlines, and many layers of fossiliferous strata, including Dentalium, Pecten, and many other invertebrates!

This grant and field experience had a meaningful impact on both my academic path and future goals. Spending extended time in the field helped me better understand what a research career in geology looks like day to day. My research project helped me solidify my desire to pursue a field- and research-focused career in geology and environmental science. This incredible experience has strengthened my confidence as a scientist, clarified my long-term goals, and reinforced the importance of integrative research!

Macy Lym,
2025 Rocky Mountain Section Grant Recipient

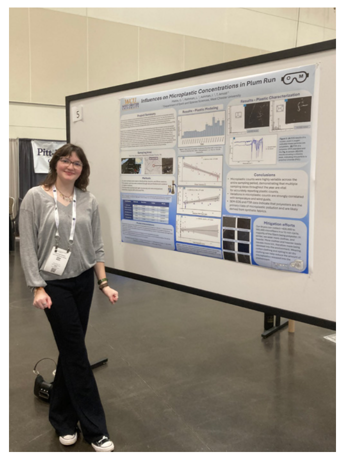
In 2004, a 9.2 magnitude earthquake hit northeastern Indonesia, and the resulting tsunami claimed over 280,000 lives throughout the region. Though an earthquake like this had been forecasted in the area, it was not communicated to the general population, so they didn't know the simple things they could have done to be safe. Since then, Professor Ron Harris has worked to forecast likely locations for natural disasters in Indonesia and communicate safety protocol to the people who live in high-risk areas. Over the past 20 years, tens of thousands of lives have been saved because of work done by the In Harms' Way nonprofit organization and its many collaborators.

Last summer, Dr. Harris and three undergraduate students, including me, went to the island of Timor in Indonesia to continue work on this vital initiative. While there, we presented our research at various colleges and to government workers to increase awareness. We taught safety principles using sayings designed by our Indonesian collaborators. We also worked with many of these people to continue our research and determine which areas are most at risk of natural disasters in the future. Participating in this project as an undergraduate has helped me develop vital skills in project planning and execution. It has prepared me to take ownership of my own project as a graduate student next year. I've also learned how to effectively collaborate with locals whose knowledge complements my own.

This project has also shown me how much of a difference one person can make. As a geologist, I can make a difference in the world. Whether by protecting people from natural disasters, providing energy resources, ensuring safe building, or any number of things, I can make a difference.

Chloe Mattie,
2025 Northeastern Section Grant Recipient

I have been involved in undergraduate research since my sophomore year, and it has been nothing short of an incredibly beneficial experience. Although learning different methods, techniques, instrumentation, and scientific writing was difficult and constantly shifting, I was able to become a better student and scientist as a result. Throughout my experience, I found the most difficult part of research, however, was funding. The more time you spend on research, the more you realize how important finding funding opportunities is. In 2025, I applied and was fortunate to receive an Undergraduate Research Grant from GSA. This grant not only helped ease equipment costs for our project, but also allowed us to successfully finish. My undergraduate research experiences both with my university and GSA have further motivated me to continue to do research and apply all the skills I have learned to my future academic and professional careers.



Poster presentation at GSA Northeastern/North-Central Section Meeting in Erie, Pennsylvania, March 2025.

Acoustic doppler set up at site for stream discharge measurements.

Andrew Moore,
2025 Southeastern Section Grant Recipient

It was during my study abroad term in Norway collecting samples that I realized that my GSA-funded undergraduate fieldwork was more than just some end-of-term project or assignment. It was going to be my path to follow. It wasn't the most glamorous work collecting samples in the rain and cold, but it felt purposeful and rewarding. Over the hundreds of miles driven, one moment still stands out. I was walking beside a very narrow road in a fjord along a road cut, hammer in hand, with cars flying past me. I wasn't in a classroom or a lab—just a guy with a map, a plan, and a rock hammer. That's when it hit me that this wasn't academic busy work to me anymore. It was real and it mattered. The idea of pursuing research became tangible and achievable in that moment, like one of those V8 commercials where someone is enlightened after a bonk to the head.

Andrew Moore collecting Alum Shale samples from a spot exposed in downtown Oslo.

About 45 mins and a few thousand ft of elevation later, conditions went from sunny and 65 °F to 12 ft of high snow on each side of the road.

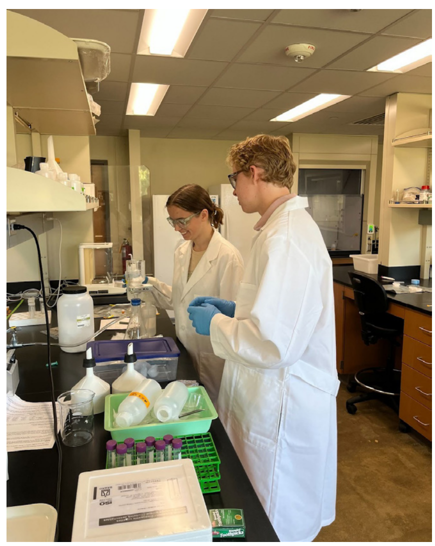
Sienna Silvest, 2025 Cordilleran Section Grant Recipient

I could not be more thankful to have the experience I did in the Brooks Range, Alaska, last July. A special thank you to my professor Dr. Jim Vogl for leading this. It was truly a life-changing experience and strongly influenced how I see my professional career taking shape 5, 10, even 20 years down the line. Being from Florida, opportunities to work and study mountainous terrain and structural features are limited, so this field experience was especially impactful. It exposed me to structural relationships and a variety of scale deformation features I never thought I would see outside of pictures in a textbook. I also discovered how much I love being in the field and want to continue this into my graduate education and career. Working in a remote environment also taught me how to make observations and interpretations in real time, adapt to challenges, and work as part of a field team. Overall, this research experience gave me clarity in the professional steps I want to take in the future, and sparked a passion for hands-on work in the geosciences.

Taking measurements of lineations and foliations to further understand the Brooks Range's structural history and relationships.

Kendall Wiggins, 2025 North-Central Section Grant Recipient

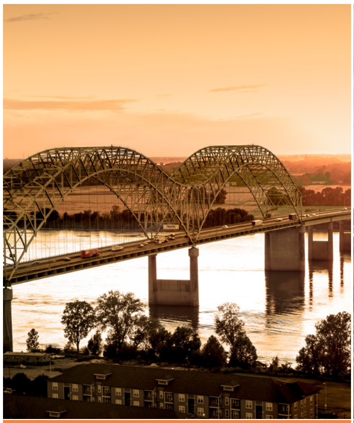
My undergraduate research experience has both informed my plans post-graduation and shaped my worldview as a scientist more widely. For the past two years, I have worked with Dr. Erik Gulbranson and other undergraduate students studying the impact of war on landscapes. During this time, I found an interest in isotope geochemistry and education as complementary ways to understand and communicate scientific problems. The mentorship I received has honed that interest further and given me the confidence to pursue graduate studies as a first-generation student. Participating in this experience at such a fraught time for science has taught me, too. I have strengthened my understanding of the value in having a diverse, supportive working team. Now, as science faces attacks from many angles, supporting and learning from diverse participation in undergraduate research is more important than ever. These experiences not only prepare future researchers for a changing scientific landscape, but also show us we belong there.



Kendall Wiggins and fellow undergraduate student Bradyn Nordeen acid washing lab material for column chromatography.

Kendall Wiggins and fellow student Kaisa Whittaker excavating a soil profile during summer fieldwork in Germany.

Three student researchers sitting on a bridge crossing during summer fieldwork in France and Germany. Photo Credit: Kendall Wiggins.



2026 Section Meetings

Early registration and travel grant submissions are open!

Student travel grants are still available for the Cordilleran and Rocky Mountain Section Meetings! These travel grants provide students with the opportunity to network, present their research, and gain invaluable experience.

Cordilleran Application
Deadline: 19 March
www.geosociety.org/cd-mtg

Rocky Mountain Application
Deadline: 16 April
www.geosociety.org/rm-mtg

Registration

Category	2026 Early Registration	2026 Standard Registration	2026 Late and Onsite Registration
Default: Professional Non-Member	$265	$465	$490
Professional Member	$225	$425	$450
Professional Senior Member	$150	$245	$270
Early Career Professional Member	$195	$295	$320
Early Career Professional Non-Member	$235	$335	$360
Lifetime Member	$225	$425	$450
Student Member	$95	$110	$130
Student Non-Member	$150	$165	$190
K–12 (Member and Non-Member)	$115	$145	$170
Guest	$75	$95	$120

**$50 less each category for One Day Registrations

Lower and middle-income countries (according to the World Bank) will receive 50% off their registration fee, which is automatically applied during the registration process.

Exhibit or Sponsor at GSA Section Meetings!

Join us as an exhibitor or sponsor at GSA's upcoming Section Meetings! These events bring together geoscientists, students, educators, and industry professionals for networking, collaboration, and discovery. Exhibiting or sponsoring is a great way to showcase your organization, connect directly with attendees, and support geoscience in your region. Opportunities include exhibit booths, program ads, student support, and custom sponsorships. Visit each Section Meeting website for details and to reserve your space.

Faulty Science Movie Night is premiering at the 2026 GSA Section Meetings—a chance to unwind, laugh at famously questionable geology, and connect with fellow attendees in a fun, low-key setting. Think science, snacks, and a shared love of spotting what Hollywood gets very wrong.

Registered attendees get to help choose the movie by voting in advance on GSA's Instagram stories—so follow us on Instagram to make your voice heard before the credits roll.

Event Dates by Section Meeting:

- **Triple Joint Southeastern / North-Central / South-Central:** 9 March
- **Northeastern:** 22 March
- **Rocky Mountain:** 19 May

Movie starts at 8:30 p.m.

Snacks included
Pajamas encouraged

$5 members
$10 non-members

Add this event when you register for your Section Meeting

https://lnkd.in/g7wm43eK

Volunteer as a Student Driver for Complimentary Field Trip and Meeting Registration

Students aged 25+ with a valid driver's license can volunteer as field trip drivers to receive complimentary registration for both the trip and the meeting. Email Rebecca Taormina, fieldtrip@geosociety.org, for more information.

Career Development and Networking Opportunities for Students

GSA Section Meetings offer a variety of ways for students to connect, learn, and build their careers in the geosciences. Whether you're looking to network with professionals, explore career pathways, or strengthen your application materials, there's something for everyone!

Career Mentoring Luncheons: Connect with mentors from industry, government, and academia while learning about nonacademic and applied geoscience career paths. Lunch is $5 for student members, $10 for student non-members, and advance registration is required. Sign up when you register for the meeting.

> **Roy J. Shlemon Mentor Program in Applied Geoscience:** Discuss career prospects and challenges with applied geoscientists from a variety of sectors.
>
> **John Mann Mentors in Applied Hydrogeology Program:** Meet professionals in hydrogeology and hydrology to learn about career options and industry insights.

Geology Club Meetups: Connect with other geology club members from across your region, share ideas, and learn how to start or grow your campus club.

Career Workshop Series: Join interactive sessions covering career planning, geoscience job sectors, résumé/CV and cover letter tips, and networking strategies.

Don't miss these opportunities to take the next step in your geoscience journey! Email gsastudents@geosociety.org with any questions.

Attending a Section Meeting? Consider Mentoring

Share your experiences and career insights as a mentor at GSA Section Meetings! Whether you are an early career or established professional, your wisdom will help students and emerging geoscientists find their paths. Mentors from all geoscience sectors including industry, government, nonprofits, and academia are welcome. You can serve as a table mentor for a career mentoring luncheon, or mentor for career workshops. **Would you like to learn more, or sign up to mentor? Send an email to** gsamentors@geosociety.org.

Please include your full name, job title, employer, a brief description of what you do in your job (one sentence is fine), and what Section Meeting(s) you plan to attend.

Triple Joint 75th Southeastern / 60th North-Central / 60th South-Central Annual Section Meeting

Memphis, Tennessee, USA
8–11 March 2026
https://www.geosociety.org/se-mtg

Location
Renasant Convention Center
255 N Main St.
Memphis, Tennessee 38103

Schedule of Events

6–8 March: Pre-Meeting Field Trips
8 March: Short Courses and Opening Reception
9–11 March: Technical Sessions
12–13 March: Post-Meeting Field Trips

Field Trips

FT26SE01. Exploring the Geologic Setting, Production, and Regulations of Natural Resources in West Tennessee and the Northern Mississippi Embayment.
Saturday–Sunday, 7–8 March, 8 a.m. (first day)–noon (last day). US$63 for students; US$88 for ECPs; US$125 for professional members; US$150 for non-members. CEUs 1.2.

FT26SE02. From Source to Sink (Literally!): Hydrogeology of the Wilcox and Claiborne Aquifer Systems in Western Tennessee.
Saturday–Sunday, 7–8 March, 8 a.m. (first day)–5 p.m. (last day). US$145 for students; US$203 for ECPs; US$290 for professional members; US$348 for non-members. CEUs 1.6.

FT26SE03. Discovering a Cretaceous Lagerstätte: Fossil Field Trip to Coon Creek, Tennessee.
Saturday, 7 March, 8 a.m.–5 p.m. US$48 for students; US$67 for ECPs; US$95 for professional members; US$114 for non-members. CEUs 0.8.

FT26SE04. Toxic Tour: Legacy Contamination and Impacts to Memphis Communities.
Saturday, 7 March, 8:30 a.m.–noon. US$23 for students; US$32 for ECPs; US$45 for professional members; US$54 for non-members. CEUs 0.4.

FT26SE05. Virtual Reality Field Trip of the Alabama Appalachian Mountains.
Trip will be offered in the Exhibit Hall throughout the meeting.

FT26SE06. Recent Mapping of Upper Cretaceous Strata in Western Tennessee: Reevaluating Regional Correlations Based on Litho-Bio-Chemostratigraphic Relationships.
Thursday–Friday, 12–13 March, 7:30 a.m. (first day)–6 p.m. (last day). US$145 for students; US$203 for ECPs; US$290 for professional members; US$348 for non-members. CEUs 1.6.

FT26SE07. Reelfoot Scarp, Reelfoot Lake, and Landslides: Signatures of the Great 1811–1812 New Madrid Earthquakes.
Thursday, 12 March, 8 a.m.–5 p.m. US$48 for students; US$67 for ECPs; US$95 for professional members; US$114 for non-members. CEUs 0.8

FT26SE08. From Plum Bayou Mounds to Crowley's Ridge: Exploring Archaeology and Fluvial Landscapes.
Thursday, 12 March, 8 a.m.–5 p.m. US$48 for students; US$67 for ECPs; US$95 for professional members; US$114 for non-members. CEUs 0.8.

Short Courses

SC26SE01. Designing Transformative Geoscience Learning Experiences.
Sunday, 8 March, 1–5 p.m. US$48 for students; US$67 for ECPs; US$95 for professional members; US$114 for non-members. CEUs 0.4.

SC26SE02. Ground Penetrating Radar: Principles and Practice.
Sunday, 8 March, 2–5 p.m. US$38 for students; US$53 for ECPs; US$75 for professional members; US$90 for non-members. CEUs 0.3.

61st Annual Meeting of the GSA Northeastern Section

Hartford, Connecticut, USA
21–24 March 2026
https://www.geosociety.org/ne-mtg

Location
Connecticut Convention Center
100 Columbus Blvd.
Hartford, Connecticut 06103

Schedule of Events

21 March: Pre-Meeting Field Trips, Short Courses, and Opening Reception

22–24 March: Technical Sessions

Field Trips

FT26NE01. Connecticut's Jurassic Park: The Theropod Tracksite at Dinosaur State Park. Saturday, 21 March, 9 a.m.–noon. US$10 for students; US$25 for ECPs; US$30 for professional members; US$40 for non-members. CEUs 0.3.

FT26NE02. Shifting Sand: Barrier Spit Migration and Science Based Management: The Napatree Point Conservation Area. Saturday, 21 March, 8 a.m.–4 p.m. US$13 for students; US$18 for ECPs; US$25 for professionals; US$30 for non-members. CEUs 0.8.

FT26NE03. Tectonometamorphic Evolution of Northern Manhattan: Constraints on (Neo)Acadian Tectonism. Saturday, 21 March, 7:30 a.m.–5 p.m.; US$43 for students; US$60 for ECPs; US$85 for professional members; US$100 for non-members. CEUs 1.0.

FT26NE04. Triassic–Jurassic Great Lakes of the Connecticut Valley Rift Basin: Exemplars of the Deep-Water, Stratified Lake Paradigm and Why Walther's "Law" Does Not Apply. Saturday, 21 March, noon–5:30 p.m. US$20 for students; US$28 for ECPs; US$40 for professional members; US$48 for non-members. CEUs 0.6.

Short Courses

SC26NE01. Methods and Applications in (U-Th)/He Thermochronology. Saturday, 21 March, 1 p.m.–5 p.m. US$48 for students; US$67 for ECPs; US$95 for professional members; US$114 for non-members. CEUs 0.4.

SC26NE02. Teaching the Anthropocene. Saturday, 21 March, 1 p.m.–5 p.m. US$48 for students; US$67 for ECPs; US$95 for professional members; US$114 for non-members. CEUs 0.4.

SC26NE03. CoreNET: Best Practices in Coring and Analyzing Lake and Other Terrestrial Records. Saturday, 21 March, 8 a.m.–5 p.m. US$60 for students; US$84 for ECPs; US$120 for professional members; US$140 for non-members. CEUs 0.8.

SC26NE04. Machine Learning for Groundwater Science. Saturday, 21 March, 1–5 p.m. US$48 for students; US$67 for ECPs; US$95 for professional members; US$114 for non-members. CEUs 0.4.

SC26NE05. Ground Penetrating Radar: Principles and Practice. Saturday, 21 March, 2–5 p.m. US$38 for students; US$53 for ECPs; US$75 for professional members; US$90 for non-members. CEUs 0.3.

122nd Annual Meeting of the GSA Cordilleran Section

Loreto, Baja California Sur, México
21–24 April 2026
https://www.geosociety.org/cd-mtg

Location

La Misión Hotel
Rosendo Robles #1
Col. Centro
Loreto B.C.S., México

Early Registration and Travel Grant Deadline:
19 March 2026
Standard Registration Deadline:
2 April 2026

Schedule of Events

18–21 April: Pre-Meeting Field Trips
21 April: Short Courses and Opening Reception
22–24 April: Technical Sessions
25 April: Post-Meeting Field Trips and Post-Meeting Short Course

Lodging

La Misión Hotel serves as both the primary meeting venue in the heart of Loreto. Just steps from the waterfront and historic downtown, it offers modern amenities, ocean views, and seamless access to sessions, dining, and the charm of this coastal destination.

La Misión Hotel is sold out. Check website and see below for additional hotel options.

Hotel Santa Fe Loreto is available as the overflow hotel accommodation. CALL IN reservations only to access the GSA Group Rate.

+52 613 134 0400 or +011 52 613 134 0400

More Information: https://hotelsantafeloreto.mx/

Field Trips

FT26CD01. Transition from Subduction to Rifting and Marine Incursion in the San Ignacio-Santa Rosalía-Isla San Marcos Region, Central Baja California Peninsula, México. Saturday–Tuesday, 18–21 April, 8 a.m. (first day)–5 p.m. (last day). US$340 for students; US$476 for ECPs; US$680 for professional members; US$816 for non-members. CEUs 3.2.

FT26CD02. Espíritu Santo and La Partida Islands, BCS, México: Links Between the Comondú and Sierra Madre Occidental Volcanic Fields? Sunday–Tuesday, 19–21 April, 5 p.m. (first day)–5 p.m. (last day). US$195 for students; US$273 for ECPs; US$390 for professional members; US$468 for non-members. CEUs 1.6.

FT26CD03. Ancient Rock Art and Loreto Basin. Monday–Tuesday, 20–21 April, 8 a.m. (first day)–5 p.m. (last day). US$145 for students; US$203 for ECPs; US$290 for professional members; US$348 for non-members. CEUs 1.6.

FT26CD04. Wildlife and Snorkeling Tour Around Coronados Island. Tuesday, 21 April, 8 a.m.–3 p.m., US$43 for students; US$60 for ECPs; US$85 for professional members; US$100 for non-members. CEUs 0.7.

FT26CD05. Revisiting the Mesozoic Subduction Complex of the Vizcaíno Peninsula. Saturday–Tuesday, 25–28 April, 8 a.m. (first day)–5 p.m. (last day). US$340 for students; US$476 for ECPs; US$680 for professional members; US$816 for non-members. CEUs 3.2..

FT26CD06. Alluvial Fan Stratigraphy of Southern Baja California. Saturday–Monday, 25–27 April, 8 a.m. (first day)–5 p.m. (last day). US$243 for students; US$340 for ECPs; US$485 for professional members; US$582 for non-members. CEUs 2.4.

FT26CD07. The Geology and Biology of Isla del Carmen, México. Saturday, 25 April, 8 a.m.–5 p.m., US$48 for students; US$67 for ECPs; US$95 for professional members; US$114 for non-members. CEUs 0.8.

FT26CD08. Birdwatching Around Loreto. Saturday, 25 April, 6:30–11:30 a.m., US$10 for students; US$25 for ECPs; US$30 for professional members; US$40 for non-members. CEUs 0.5.

FT26CD09. Oasis and Ranch Bio-experience in the Loreto Sierra Foothills. Saturday, 25 April, 8 a.m.–3 p.m. US$43 for students; US$60 for ECPs; US$85 for professional members; US$100 for non-members. CEUs 0.7.

Short Courses

SC26CD01. An Introduction to Magnetotellurics: Imaging the Earth's Subsurface at Different Depths. Tuesday, 21 April, 9 a.m.–5 p.m. US$60 for students; US$84 for ECPs; US$120 for professional members; US$144 for non-members. CEUs 0.8.

SC26CD02. Introduction to Thermochronology: Principles, Methods, and Thermal History Modelling. Tuesday, 21 April, 8 a.m.–5 p.m. US$60 for students; US$84 for ECPs; US$120 for professional members; US$144 for non-members. CEUs 0.8.

SC26CD03. Living and Multifunctional Soil: The Importance of Caring for It and Tools to Assess Its Health. Tuesday, 21 April, 8 a.m.–5 p.m. US$60 for students; US$84 for ECPs; US$120 for professional members; US$144 for non-members. CEUs 0.8.

SC26CD04. North America Cordilleran Plate Tectonics Using GPlates Paleo-GIS Software. Tuesday, 21 April, 8 a.m.–5 p.m. US$38 for students; US$53 for ECPs; US$75 for professional members; US$90 for non-members. CEUs 0.8.

SC26CD05. Educational Resources on Plate Tectonics That Cross Borders. Tuesday, 21 April, 1–5 p.m. US$10 for students; US$20 for ECPs; US$30 for professional members; US$30 for non-members. CEUs 0.4.

SC26CD06. Radar de Penetración Terrestre: Principios y Práctica. Tuesday, 21 April, 2–5 p.m. US$38 for students; US$53 for ECPs; US$75 for professional members; US$90 for non-members. CEUs 0.3.

SC26CD07. Melanges in the Western North American Cordillera. Tuesday, 21 April, 3–5 p.m. US$13 for students; US$18 for ECPs; US$25 for professional members; US$30 for non-members. CEUs 0.2.

SC26CD08. Hands-On Experience Using the StraboField Application. Saturday, 25 April, 8 a.m.–5 p.m. US$60 for students; US$84 for ECPs; US$120 for professional members; US$144 for non-members. CEUs 0.8.

76th Annual Meeting of the GSA Rocky Mountain Section

Albuquerque, New Mexico, USA
17–20 May 2026
https://www.geosociety.org/rm-mtg

Location
Hotel Albuquerque at Old Town
800 Rio Grande Boulevard NW
Albuquerque, New Mexico 87104

Early Registration and Travel Grant Deadline:
16 April 2026

Standard Registration Deadline:
30 April 2026

Schedule of Events

16 May: Pre-Meeting Field Trips

17 May: Short Courses and Opening Reception

18–20 May: Technical Sessions

20–22 May: Post-Meeting Field Trip and Post-Meeting Short Course

Lodging

A block of rooms has been reserved at Hotel Albuquerque at Old Town, 800 Rio Grande Blvd NW, Albuquerque, NM 87104, for attendees of the GSA 2026 Rocky Mountain Section Meeting.

Hotel registration deadline: 17 April 2026. After this date, any requests will be subject to availability and may not receive the group rate.

Negotiated GSA Group Rate: $209.00 per night, plus a $25 amenity fee and applicable taxes (pre/post nights included).

https://geosociety.co/ReservationsRM

For reservations by phone, contact our reservations team at +1-866-505-7829 and provide the following details:

Call-in code: 0526GSARMS
Group name: GSA 2026 Rocky Mountain Section Meeting

Field Trips

FT26RM01. What You Can Do with Superb Rift Basin-Fill Exposures: Recent Lithostratigraphic, Paleoclimatic, Biostratigraphic, and Structural Studies of the Española Basin, New Mexico (USA). Saturday, 16 May, 6:30 a.m.–7 p.m. US$48 for students; US$67 for ECPs; US$95 for professional members; US$114 for non-members. CEUs 1.0.

FT26RM02. Indigenous Geology in New Mexico. Saturday, 16 May, 8 a.m.–4:30 p.m. US$48 for students; US$67 for ECPs; US$95 for professional members; US$114 for non-members. CEUs 0.9.

FT26RM03. Stratigraphy, Age Control, and Evolution of Lake Socorro, a Late Miocene Playa Lake in the Socorro Basin: Implications for Early Downstream-Directed Integration of the Ancestral Rio Grande. Thursday–Saturday, 21–23 May, 6 a.m.–7 p.m. US$48 for students; US$67 for ECPs; US$95 for professional members; US$114 for non-members. CEUs 1.0.

Short Courses

SC26RM01. An Introduction to the Developing Field of Climate Psychology for Geoscience Professionals. Sunday, 17 May, 9 a.m.–1 p.m. US$38 for students; US$53 for ECPs; US$75 for professional members; US$90 for non-members. CEUs 0.4.

SC26RM02. Ground Penetrating Radar: Principles and Practice. Sunday, 17 May, 2–5 p.m. US$38 for students; US$53 for ECPs; US$75 for professional members; US$90 for non-members. CEUs 0.3.

SC26RM03. Field-Based Geologic and Geomorphic Information for Long-Term Flood Frequency Analyses. Wednesday–Friday, 20–22 May, 1:30–5:30 p.m. (first day), 8 a.m.–5 p.m. (second day), 8 a.m.–noon (third day). US$43 for students; US$60 for ECPs; US$85 for professional members; US$100 for non-members. CEUs 2.0.

Earn Continuing Education Units at Section Meetings

Section Meetings offer an excellent opportunity to earn CEUs toward your continuing education requirements for your employer, K–12 school, or professional registration.

The CEU certificate may be downloaded from the meeting website after the meeting.

www.geosociety.org/CEUs

Where the Caves Have No Name: A Subterranean Excursion at GSA Connects 2025

Phoebe Bathje

My first GSA meeting commenced with an underground adventure. As a recipient of a GSA/Chevron Field Trip Grant for GSA Connects 2025, I joined "Cave Monitoring in Central Texas: Insights into Paleoclimatology, Karst Vadose Zone Hydrogeology, and Cave Geomorphology."

Led by UT Austin's Alex Janelle and Dr. Jay Banner, our group of nine participants ventured into two show caves on the Texas Edwards Plateau: Cave Without a Name and Natural Bridge Caverns. These caves have been the focus of long-term cave monitoring that records speleothem growth in fixed locations to develop a climate proxy.

Even before arriving at our first destination, the car ride was spent asking and answering questions about the surrounding karst terrain. Upon arriving, we reviewed Texas's geologic history, speleothems, and speleogenesis. After this surface lesson, it was finally time to descend away from the Texas sun and into Cave Without a Name. In addition to the regular tour route, we visited multiple monitoring sites that have been collecting precipitating calcite to be used to reconstruct paleoclimate. We were guided through analyzing expertly constructed figures that compiled cave monitoring and trace element data and mineral-solution reactions. I love that cave science still has questions to be answered. My only remaining question regards the cave's lack of eponym.

The next stop was to the less ambiguously named Natural Bridge Caverns. More monitoring sites revealed similarities and differences between this cave and the previous one's origin and growth. While discussing structural controls on fluid flow and karstification, staff members guided our group through cathedrals of glittering speleothems not just limited to stalactites and stalagmites. No matter how many caves I visit, nature's artwork continues to astound me. We were instructed to "ooh and aah" periodically. It took no prompting! With the help of the belt-assisted transport, abbreviated as B.A.T., we ascended out of the Cretaceous limestone and into natural light again.

Photo Credit: Phoebe Bathje.

As a sophomore undergraduate student and budding cave scientist, I am grateful for the opportunity to spend time with enthusiastic karst experts and passionate fellow participants curious about caves. I even got to reconnect with them throughout the conference. This highlight of a field trip experience reinforced my excitement for cave science and enriched my participation in GSA Connects 2025.

I would encourage other students and early career professionals to apply for field trip grants that help foster engagement between geoscientists from varying backgrounds and experiences. Getting to go on this field trip helped me engage with GSA Connects 2025 by allowing me to explore an interest and a new place through a geologic lens. This was a great introduction to some of the amazing resources the national meeting has to offer. Thank you to GSA and Chevron for helping make this opportunity possible, to Alex Janelle and Dr. Banner for their expertise and high-quality leadership, and to *GSA Today* for letting me share my experience.

How GSA Field Trip Funds Help Make Meaningful Connections

Ariel Strubel Iram

The GSA/Chevron Field Trip Grant enabled me to participate in a field trip that explored the Paradise Mountain Caldera Complex and the Davis Mountains Volcanic Field in West Texas. The field trip took place in the days leading up to GSA Connects 2025.

As we drove away from San Antonio, we traveled down Interstate 10 across the Edwards Plateau, through the Permian Basin, to the Chihuahua Desert in the Trans-Pecos region. The Davis Mountains rose from the desert landscape. Our first drive through the volcanic field took my breath away. The road wound through cliffs and mesas with the ignimbrites, rhyolites, volcanic tuff, and more, all jutting out from the dramatic topography.

On the second day, we drove from Alpine, Texas, to the University of Texas at Austin's McDonald Observatory. After exploring an over-70-m-thick outcropping of Fort Davis Tuff made up of breccia that overlays volcanic clastic sedimentary rocks, we ate lunch with a stunning view at the McDonald Observatory Astronomers Lodge and donned high-vis vests to examine road cuts nearby. The road cuts exposed bubbly chalcedony that we could pick off the volcanic rocks.

It was rewarding to see the caldera complex and the surrounding region alongside geologists who had extensively researched the sites we explored. From dating the rocks to explaining the local geology on the maps they created, the passion they poured into the region was evident. Their work provided the foundation for this enriching field trip.

Photo Credit: Ariel Strubel Iram.

The field trip was an opportunity that brought students and geologists together, from undergraduates like myself, to master's and PhD students, to career geologists and professors.This wide range of backgrounds gave me a glimpse into future possibilities and an opportunity to connect with like-minded geologists. By the end of the field trip, we were already making plans to support each other by attending each other's poster sessions and talks.

I want to thank GSA and Chevron for making my field trip to the Paradise Mountain Caldera Complex possible. I also want to thank John C. White, Shannon F. Rudine, Gary Henderson, and Kevin Urbanczyk for their guidance on the trip. Lastly, I want to thank Don F. Parker, who drove my van, answered all my (many) questions, and, as a first-time visitor to Texas, helped me understand the geology that passed by our windows throughout West Texas.

This Year's Inspiring Themes:

- **Celebrating a Century of Continental Drift:** Understanding Earth in Motion: Honoring a century of discovery that reshaped Earth science.
- **Riverscapes in Transition: Dynamics, Hazards, and Human Futures:** Science at the intersection of water, climate, landscape, and society.
- **Innovations in Exploration from Deep Earth to Deep Space:** From AI to Yttrium: Developing technologies to transform earth science.

Abstracts Submission Portal Opens:
Early May

Registration Opens:
Early June

Exhibit at GSA Connects 2026 in Denver

https://s2.goeshow.com/gsa/connects/2026/become_an_exhibitor.cfm

We're back on our home turf in Denver—and we're gearing up for our most exciting exhibit hall yet! GSA Connects 2026 will host 150+ vendors showcasing the latest in geoscience research, technology, and education. Exhibiting is a prime way to connect with thousands of attendees, highlight your organization's impact, and support professional development and meeting programs across the Society. Don't miss this opportunity to be part of GSA's signature event in the heart of the Rockies—visit the GSA Connects website to reserve your space.

Sponsor GSA Connects 2026 in Denver

https://s2.goeshow.com/gsa/connects/2026/become_a_sponsor.cfm

Help shape the GSA Connects experience by sponsoring programs that inspire and support our community. From student travel grants and field trips to networking events and professional development workshops, your sponsorship directly contributes to the success of thousands of geoscientists. As we return to our home base in the front range of the Rockies, we're excited to offer expanded opportunities for visibility, engagement, and impact. Partner with us to make a difference!

International Participants: Plan Ahead and Submit Your Abstract Early

Planning to attend GSA Connects 2026? Submitting your abstract early can be especially valuable for participants who require a visa. Early abstract submission allows accepted presenters to receive early decisions, which can be used to support visa applications and help ensure sufficient time for travel planning. This early review option is designed specifically to facilitate international participation and reduce last-minute challenges.

Early Action Submission Deadline: 19 May

Don't wait. Submit early and give yourself the best chance to join us at GSA Connects 2026.

More Than Data: How a Travel Grant Reignited My Science and Community

Matias Barrionuevo

Vineyards and the Cordillera in Mendoza

In April 2024, I was struggling with my samples at the Thermochronology Lab at the University of Chile when I received an email from GSA announcing that I had been selected as an International Travel Grant awardee to attend GSA Connects 2024 in Anaheim. It was such wonderful news! It felt like a breath of fresh air, balancing the discouraging results I was getting from my samples. At that moment, when every grain mount and every measurement for fission tracks seemed to be failing, this message felt like a reminder that science moves forward in more ways than just producing good data.

I felt both excited and nervous. It was going to be my first time attending GSA Connects, and I recognized the magnitude of the opportunity: the chance to learn from leading geoscientists, to present my research to an international audience, and to build connections that could shape future collaborations.

However, I carried a sense of frustration. I had high expectations for the thermochronology samples I was working on, but none of them were yielding interpretable results. These samples came from my study area in the Southern Central Andes, where I investigate the tectonic evolution of the Andean orogen since the Late Cretaceous.

The area lies in southern Mendoza, a province in Argentina famous for its Malbec wines and its landscape dominated by the Andes. I moved to Mendoza ten years ago, not only for the excellent wines but also for the opportunity to join an excellent research group focused on Andean tectonics. Here, I had the opportunity to learn on this subject and completed my PhD using two complementary tools: traditional structural geology based on detailed fieldwork, and geodynamic modeling to test conceptual hypotheses about the orogen's evolution.

After completing my PhD, I continued as a researcher at CONICET, our National Research Council, trying to incorporate new techniques, such as thermochronology, into my work to investigate the exhumation of the different ranges that compose the Andes.

At the Thermochronology Lab at the University of Chile, after reading the email about the GSA grant.

Although the Central Andes, at this latitude, had its main deformation and uplift phase during the Neogene, there is some discussion about the onset of the orogeny, back in Late Cretaceous. The main debate is related to the magnitude of that earlier phase, or in other words, how big the Andes were at that time. By means of thermochronology, my group and I were trying to evaluate this. That was part of the work I was doing at the University of Chile. But, as I mentioned before, my samples weren't good enough for this.

Thankfully, we had other data, from the structural fieldwork that allowed us to address parts of our hypothesis. Those were the results I presented at GSA Connects 2024.

The meeting was incredible for me! I took a field trip to the San Andreas fault, one of the legendary fault systems I had read about but never seen. And the landscape was so similar to Mendoza! It was sunny, hot and dry, and surprisingly the vegetation even resembled the "jarillas" (*Larrea divaricata*) we have there.

Plant found in California, similar to the jarilla tree we have in Mendoza.

Field trip to the San Andreas fault.

During the meeting, I attended talks on Andean tectonics, orogenic systems, structural geology, and thermochronology.

Some sessions gave me new ideas and helped contextualize my research within broader global questions. When the day of my own presentation arrived, I was a little bit nervous but I finally enjoyed it! Afterward, I had enriching conversations with colleagues who were also studying the early stages of the orogeny. We discussed possible collaborations and even the potential of future joint fieldwork.

I also met the team behind GSA International Programs. They had been so helpful when I was preparing everything for my trip. I knew that people from several countries were able to attend the meeting thanks to the grants.

Recipients of the grants and awards at Connects 2024 in Anaheim.

One thing that surprised me was finding out that three Argentine geologists (myself included) had been selected as International Travel Grant awardees that year. This felt deeply meaningful. Since 2023, Argentina has experienced severe cuts in science funding, and the national research system has faced significant challenges. Many scientists have left the country to continue their careers elsewhere, and those of us who stay feel the weight of uncertainty and frustration. In this context, receiving recognition and support from the international scientific community felt not only like personal encouragement, but also like a reminder that our work has value beyond our borders.

Another highlight was gathering and spending time with some people I had met at previous conferences and meetings. We enjoyed a barbecue, or like we say in Argentina "hicimos un asado" looking at the Pacific coast.

I came back to Argentina and in January I received an email from the Argentine Geological Association, inviting some people to be part of an international project aimed at updating the classic chart *The Geology of Plate Tectonics*, originally created by Greg Wessel in 1985. One of the people involved and leading the project was Ester Sztein, director of GSA International Programs, whom I had met in Anaheim.

The project took some months, in which we met by video call with colleagues from the U.S., Mexico and Chile. We discussed how to update the chart, the text, modernize the figures, and finally produce a Spanish translation. This last step was particularly meaningful to me. I truly believe the Spanish version will widen access for students and professionals across Latin America. I can already envision the chart hanging on the walls of the National University of Cuyo, where I teach.

Fieldwork with some of my colleagues of the Grupo de Tectónica in Mendoza.

Somehow, I feel like participating in the tectonic chart project was one of the doors that opened thanks to receiving the travel grant to attend GSA Connects.

Among the things I enjoy in my career, communicating geoscience is one of my favorites. I remember taking some notes about science communication in related talks at GSA Connects. Living in Mendoza, where the Andes form part of the daily landscape, people naturally ask questions about their origin and if there is a link between the earthquakes we feel in Mendoza and the mountains. I enjoy talking about these questions and helping others see Earth as a system of ongoing processes that produce beautiful landscapes such as the Andes.

This year, a colleague received the travel grant to attend GSA Connects in San Antonio. I was so happy that she also had that opportunity. For anyone considering applying for a travel grant, my message is simple: go for it. The experience extends far beyond the conference itself. These meetings are not only about presenting research; they are about becoming part of a community. They are moments to exchange ideas, build friendships, share concerns about science in our home countries, and imagine new ways to collaborate. And of course, to enjoy an "asado" with new friends.

Figure 1. View of the Main Gulf Escarpment from the Gulf of California off the coast of Loreto. Credit: Rafael Sandaña via Wikimedia Commons.

Loreto, Mexico: A Natural Laboratory for Study of the Interaction Between Faulting and Sedimentation

Lon D. Abbott*,[1] and Terri L. Cook[2]

GSA's 122nd annual Cordilleran Section Meeting in Loreto, Mexico, will unfold astride the Loreto normal fault, whose Pliocene motion raised the mountains west of town and formed the Loreto Basin in which the town nestles; Loreto owes its dramatic setting, where the mountains meet the sea (Fig. 1), to its namesake fault. The Loreto fault is the western rift-bounding fault along which Baja separated from mainland Mexico during opening of the Gulf of California (Fig. 2). Loreto is an especially fitting venue for tectonics- and sedimentation-focused technical sessions, short courses, and field trips because the Loreto Basin and its surroundings constitute a world-class natural laboratory in which to study interactions between faulting and sedimentation. Details of the basin's sedimentary architecture record variations in past fault slip rates; Pliocene strata on nearby Isla del Carmen provide mute testimony to the tectonic beheading of its drainage network; and seismic detective work on an 1810 earthquake and tsunami revealed the timing of a submarine landslide that would otherwise have gone undetected.

LORETO'S TECTONIC TRANSFORMATION: FROM SUBDUCTION TO RIFT ZONE

The Baja Peninsula's bedrock spine consists of Cretaceous granites belonging to the Peninsular Ranges Batholith, which formed during Farallon plate subduction beneath North America. That long-lived subduction was disrupted when the Farallon-Pacific plate spreading center reached the trench at ~28 Ma near the latitude of the international border (Fig. 2). That first contact between the Pacific and North American plates grew in length through time as the Mendocino triple junction migrated north and the Rivera triple junction migrated south, extending the San Andreas transform fault and extinguishing the volcanic arc as they traveled. The Rivera triple junction reached the latitude of central Baja by 16 Ma and the peninsula's southern tip by 10 Ma, transforming Baja from a subduction zone to a place of right-lateral strike-slip motion combined with extension (transtension; Fig. 2), opening the proto-Gulf of California as it went (Lonsdale, 1991; Sedlock, 2003).

*lon.abbott@colorado.edu
[1] Department of Geological Sciences, University of Colorado, Boulder, Colorado 80309, USA
[2] Down to Earth Science, Boulder, Colorado 80305, USA
CITATION: Abbott, L.D., and Cook, T.L., 2026, Loreto, Mexico: A natural laboratory for study of the interaction between faulting and sedimentation: GSA Today, v. 36, p. 28–31, https://doi.org/10.1130/GSATG123GH.1

The Mexican volcanic arc associated with Farallon subduction simultaneously migrated westward from a ~25 Ma locus in mainland Mexico's Sierra Madre Occidental to the modern Loreto coast by 12 Ma. The 30–12 Ma volcanic and volcaniclastic rocks of the Comondú Group, which unconformably overlie Cretaceous granite in the Loreto area, record that short-lived Oligo-Miocene arc's westward wanderings (Umhoefer et al., 2001).

Following passage of the Rivera triple junction, movement began ~8–6 Ma on the 35-km-long oblique-slip Loreto fault to accommodate the new transtensional tectonic setting (Mark et al., 2014). Uplift of the fault's footwall raised the Main Gulf Escarpment, the imposing mountain range west of Loreto; hangingwall subsidence created the Loreto Basin (Fig. 3; Dorsey and Umhoefer, 2000) east of the fault. Continental rifting evolved to seafloor spreading in the Gulf of California sometime between ~6–2.5 Ma, but normal faulting continues today from Loreto southward (Fig. 2). This simultaneous "rifting-while-drifting" defies the conventional wisdom that the transition from continental rifting to seafloor spreading is a discrete event (Umhoefer et al., 2020).

FROM STACKED GILBERT DELTAS TO SEISMIC SWARMS

Slip on the Loreto fault ended by ~2 Ma as extension shifted eastward to faults along the modern Gulf coastline and farther offshore. That shift was fortuitous, as it placed the Loreto Basin in the new fault's rising footwall, where it was uplifted and dissected, allowing geologists to scrutinize its Pliocene basin fill. It consists of two subbasins—the central and southeast—that share a common four-sequence stratigraphy, but the southeast subbasin's sedimentary column is thinner. Its sequence architecture also differs markedly from its central subbasin sibling, revealing that the northern and southern portions of the Loreto fault slipped at different rates (Dorsey et al., 1995; Dorsey and Umhoefer, 2000).

Four tuff beds in the central subbasin have been $^{40}Ar/^{39}Ar$ dated, enabling geologists to reconstruct the area's sedimentation rates. Tuff #1, near the base of Sequence 2, erupted 2.61 Ma, and tuff #2, 64 m higher in the section, is 2.46 Ma, indicating an accumulation rate of ~0.4 mm/yr. Tuff #3 is 765 m higher, near the base of Sequence 4, but is a mere 100 k.y. younger at 2.36 Ma, requiring a much faster sediment accumulation rate of 8 ± 5 mm/yr. The range in rates is due to the dates' analytical uncertainties. Finally, tuff #4, near the top of Sequence 4, 160 m above, is 1.97 Ma (Umhoefer et al., 1994), documenting that the sedimentation rate had returned to ~0.4 mm/yr during Sequence 4 deposition.

Combined analysis of basin architecture and accumulation rates has enabled geologists to reconstruct a detailed slip history for the Loreto fault. Sequence 1 consists of nonmarine conglomerate whose provenance and paleocurrents indicate two source directions—from the Main Gulf Escarpment in the west and from the coastal Sierra Microondas massif, 10 km north of Loreto, in the east. The fill is exclusively nonmarine, showing that sedimentation easily kept pace with both basin subsidence and eustatic sea-level fluctuations, which dictates that the fault slip rate was modest (Fig. 3A). But subsidence had to keep pace with sedimentation to create accommodation space, so the fault slip rate 2.6–2.46 Ma (Umhoefer et al., 1994) was ~0.4 mm/yr. Provenance analysis suggests a similar slip rate was maintained from fault inception to the start of Sequence 2 (Mortimer and Carrapa, 2007).

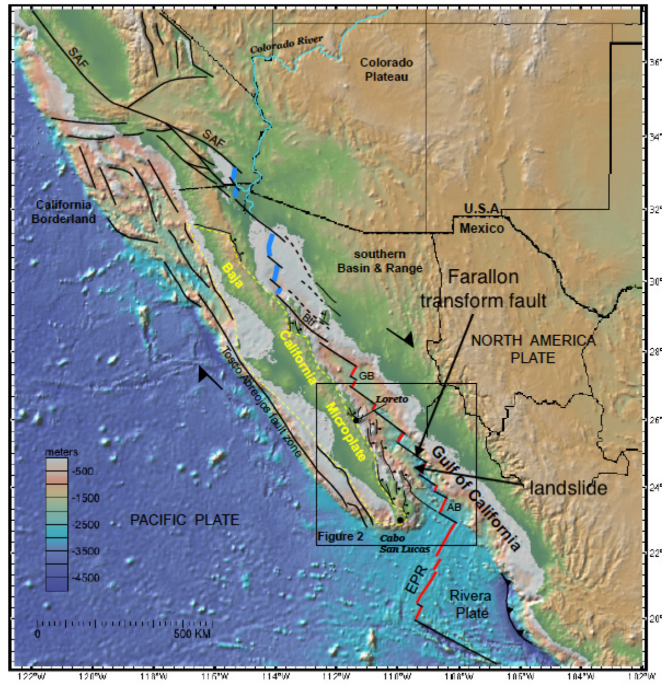


Figure 2. Tectonic map of the Gulf of California plate boundary, with Loreto, the Farallon transform, and tsunami-generating landslide location marked. Black lines are transform faults, black lines with the ball-and-stick pattern are normal faults with the ball-and-stick on the hangingwall, red lines are spreading centers, and blue lines are nascent or buried spreading centers. SAF = San Andreas fault, GB = Guaymas basin, AB = Alarcón basin, EPR = East Pacific Rise, Btf = Ballenes transform fault. Credit: Umhoefer et al. (2020).

The Sequence 1–2 boundary is a marine shell bed that records abrupt drowning of the basin. The age of tuff #1, just above the sequence boundary, implies that a 2.62 Ma eustatic sea-level rise (Raymo et al., 1992) triggered the flooding event (Dorsey and Umhoefer, 2000). Soon thereafter the central subbasin sedimentation rate increased abruptly to 8 ± 5 mm/yr; a commensurate increase in basin subsidence rate was necessary to produce the required accommodation space (Fig. 3B). The central subbasin's Sequence 2 consists of 14 stacked Gilbert deltas containing both nonmarine and marine conglomerate and turbidites with steep foresets up to 35 m tall (Dorsey and Umhoefer, 2000; Mortimer et al., 2005). Each delta prograded 1–2 km into the basin, then was drowned by a rapid transgression marked by a marine shell bed. Each cycle of delta construction and drowning unfolded in just a few thousand years, much too fast to be explained by 41 k.y. glacio-eustatic sea-level changes driven by Milankovitch cycles (Raymo et al., 1992). Instead, researchers conclude the stacked Gilbert deltas record brief periods of rapid fault slip, with the slip rate fluctuating from <2 mm/yr to 8 mm/yr across the duration of a cycle (Mortimer et al., 2005). Basins produced by strike-slip faulting have long been known to experience brief periods of rapid subsidence; the Loreto Basin's stratigraphic relationships allowed such behavior in an ancient basin to be quantified for the first time (Dorsey et al., 1995, 1997). Numerical fault models predict the occurrence of episodic earthquake swarms across families of normal faults, like the family here in southern Baja (Fig. 2). Seismic swarms are triggered in the model by complex stress interactions between faults (Cowie, 1998); the activity of past swarms provides a plausible explanation for the central Loreto Basin's cycles of fast and slow subsidence (Mortimer et al., 2005).

In contrast to the central subbasin, Sequence 2 possesses only four sediment packages separated by flooding surfaces in the southeastern subbasin. These four local transgressions nicely match the four eustatic transgressions recorded in the marine isotopic record during the interval of Sequence 2 deposition. The southern Loreto Fault was slipping then at ~1.5 mm/yr, a rate slow enough that fault slip was unlikely to overwhelm the sedimentary signal recorded by glacio-eustatic sea-level fluctuations (Dorsey and Umhoefer, 2000).

Paleocurrent data reveal that the eastern sediment source active during Sequence 1 (Fig. 3A) shut off during Sequence 2 (Fig. 3B) but was reactivated during Sequence 3 deposition (Fig. 3C). Shutdown of the source was likely due to rapid subsidence during Sequence 2. Researchers hypothesize its rejuvenation was likely caused by initiation of a new fault east of the Loreto Basin 2.37 Ma, which placed the basin on that fault's rising footwall, thus re-exposing the Sierra Microondas source. Sequence 4 records deepening of the central subbasin to 100–150 m water depth, which likely records a final spasm of rapid slip 2.36–2.0 Ma, before Loreto Fault activity ceased (Dorsey and Umhoefer, 2000).

ISLA DEL CARMEN: A TECTONIC DECAPITATION

Isla del Carmen, the fourth-largest island in the Gulf of California, lies 20 km east of Loreto. Marine terraces as old as 400 ka (marine isotope stage 11) and up to 68 m elevation are etched on the island's limestone flanks, recording recent tectonic uplift (Johnson et al., 2016). Paleomagnetic data indicate the island has also rotated 30–40º clockwise, which accounts for its unusual NE-SW orientation compared to the typical NW-SE trend of other Gulf islands. Its northwest and southeast coasts are bounded by normal faults that GPS data show are currently pulling the island away from Baja toward the southeast at 3.2 ± 1.8 mm/yr (Umhoefer et al., 2020). The island's stratigraphy helps constrain when it first separated from the peninsula.

The Tiombó conglomerate fills a broad channel across the island that's interpreted to be a middle Pliocene (~3.6 Ma) fan delta with an estimated volume >200 million m^3. That is much too large to be sourced from the island's diminutive drainage basins, which means the island remained connected to the Baja peninsula throughout the middle Pliocene. Based on the delta's size and orientation, researchers suggest that modern arroyos stretching from Loreto to just south of the town of Nopoló once converged in what is today the Carmen Passage and flowed east to feed the island's delta. They estimate the paleodrainage basin area at 525 km^2, which is 400 km^2 larger than the modern Loreto delta (Johnson et al., 2016).

The presence of the Tiombó fan delta implies that the current normal fault separating the island from Loreto, whose hangingwall subsidence drowned the Carmen Passage, is younger than 3.6 Ma. That fault's initiation in later Pliocene or Pleistocene time then decapitated the delta (Johnson et al., 2016).

In addition to recording a tectonic decapitation, the Isla del Carmen stratigraphy also records clues to Baja's paleoclimate. Seemingly paradoxically, the Tiombó fan delta grew adjacent to rhodolith-bearing limestones, which form only in clear, low-turbidity waters (Johnson et al., 2016). Pliocene Loreto Basin sediments likewise contain a mixture of mollusk-rich bioclastic limestone and volcaniclastics, a combination that requires juxtaposition of abundant clastic sedimentation with a clear water carbonate factory. Upwelling of cool, nutrient-rich water has been invoked to explain the abundant Pliocene mollusks (Dorsey and Kidwell, 1999). Aridity punctuated by more frequent hurricanes than occur today, a feature of the sustained El Niño-like climate that models predict characterized the Pliocene Warm Period, could plausibly produce the voluminous clastic sediment needed to feed large Pliocene fan deltas while maintaining a clear water carbonate factory most of the time (Johnson et al., 2016).

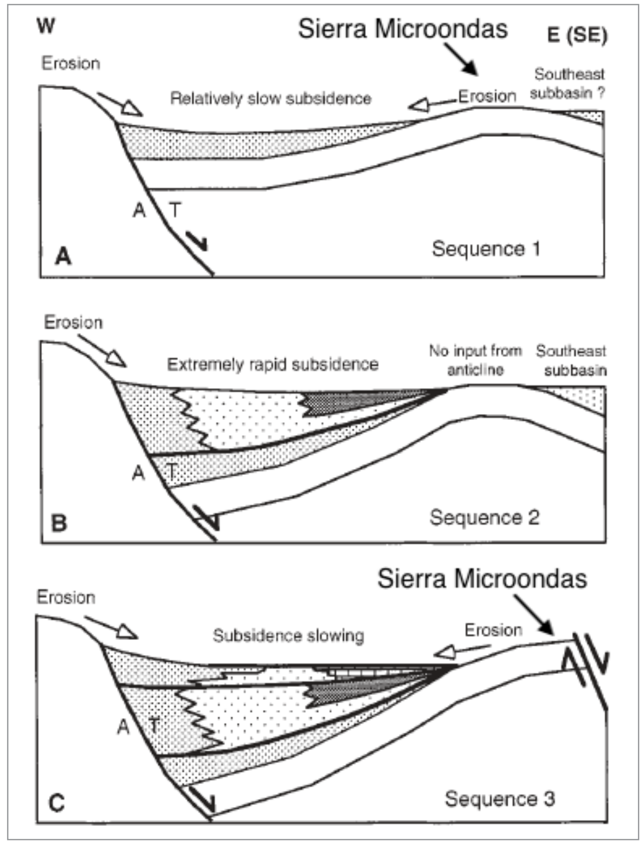


Figure 3. Schematic cross section depicting the evolution of the central subbasin of the Loreto basin. (A) Slow slip on the Loreto normal fault results in slow basin subsidence during deposition of Sequence 1. Paleocurrents reveal two sediment sources, from the Main Gulf Escarpment west of the Loreto fault and from the Sierra Microondas to the east. (B) Accelerated slip on the Loreto fault produces rapid basin subsidence during Sequence 2 deposition. The eastern sediment source has shut off. (C) Slip on the Loreto fault has slowed once again during deposition of Sequence 3. The Sierra Micoondas sediment source has been rejuvenated by uplift on the footwall of a new normal fault to the east. The dense stippled pattern denotes terrestrial conglomerate deposition, the lighter stipple is marine conglomerate of Gilbert delta foresets, and the gray shading marks distal marine turbidites. Credit: Dorsey and Umhoefer (2000).

THE TSUNAMI THAT SHOULDN'T HAVE HAPPENED

A major earthquake (estimated at Mw = 7.4) shook Loreto on 27 August 1810. The earthquake, combined with a tsunami that arrived one hour later and surged up to 5 km inland, caused considerable damage along 200 km of the eastern Baja coastline. Strong earthquakes have been common in the Loreto area since European arrival (Suter, 2018), but tsunamis are rare (Ramírez-Herrera et al., 2019) due to the predominantly strike-slip nature of Gulf seismicity (Umhoefer et al., 2020).

Analysis of Loreto's historical seismicity indicates a puzzle: the 1810 earthquake nucleated on the right-lateral Farallon transform fault (Fig. 2; Suter, 2018), but the tsunami's estimated 25-m height far exceeded the <1.5-m height that models predict for a magnitude 7.4 strike-slip earthquake. Equally mysterious is the 1 h delay between the quake and the tsunami's arrival; a wave produced at the Farallon fault should reach Loreto in just 24 min. What could account for these discrepancies? Ramírez-Herrera et al. (2019) decided to do some seismic sleuthing. They postulated that a submarine landslide triggered by the earthquake was responsible for the tsunami, rather than the earthquake itself. Their scrutiny of Gulf of California bathymetry revealed 22 candidate submarine landslide scars, each of which they modeled as a potential tsunami source. The best-fit candidate, which matches the amplitude and timing of the 1810 tsunami, is a 21 km × 12 km slump 70 km northeast of the coastal town of Tembabichi, 80 km south of Loreto (Ramírez-Herrera et al., 2019).

Loreto's combination of tectonic dynamism and arid-region sedimentary processes has produced an exquisite natural laboratory that enables geologists to probe interactions between faulting and sedimentation in fine detail. Past work has constrained the timing of one fault's initiation, identified a past earthquake as the trigger for a specific mass-wasting deposit, and quantified ancient fault slip rates in unprecedented detail. We look forward to reading about the future groundbreaking research that will undoubtedly be inspired by the gathering of geoscientists in this place of noteworthy geoheritage for GSA's 122nd annual Cordilleran Section Meeting.

REFERENCES CITED

Cowie, P.A., 1998, A healing-reloading feedback control on the growth rate of seismogenic faults: Journal of Structural Geology, v. 20, p. 1075–1087, https://doi.org/10.1016/S0191-8141(98)00034-0.

Dorsey, R.J., and Umhoefer, P.J., 2000, Tectonic and eustatic controls on sequence stratigraphy of the Pliocene Loreto basin, Mexico: GSA Bulletin, v. 112, p. 177–199, https://doi.org/10.1130/0016-7606(2000)112<177:TAECOS>2.0.CO;2.

Dorsey, R.J., and Kidwell, S.M., 1999, Mixed carbonate-siliciclastic sedimentation on a tectonically active margin: Example from the Pliocene of Baja California Sur, Mexico: Geology, v. 27, p. 935–938, https://doi.org/10.1130/0091-7613(1999)027<0935:MCSSOA>2.3.CO;2.

Dorsey, R.J., Umhoefer, P.J., and Renne, P.R., 1995, Rapid subsidence and stacked Gilbert-type fan deltas, Pliocene Loreto Basin, Baja California Sur, Mexico: Sedimentary Geology, v. 98, p. 181–204, https://doi.org/10.1016/0037-0738(95)00032-4.

Dorsey, R.J., Umhoefer, P.J., and Falk, P., 1997, Earthquake clustering and stacked Gilbert-type fan deltas in the Pliocene Loreto Basin, Baja California Sur, Mexico: Geology, v. 25, p. 679–682, https://doi.org/10.1130/0091-7613(1997)025<0679:ECIFPG>2.3.CO;2.

Johnson, M.E., Ledesma-Vázquez, J., and Backus, D.H., 2016, Tectonic decapitation of a Pliocene mega-delta on Isla Del Carmen in the Gulf of California (Mexico): And a river ran through it: The Journal of Geology, v. 124, p. 55–74, https://doi.org/10.1086/684206.

Lonsdale, P., 1991, Structural patterns of the Pacific floor offshore of Peninsular California, *in* Dauphin, J.P., and Simoneit, B.T., eds., Gulf and Peninsula Province of the Californias: American Association of Petroleum Geologists Memoir 47, p. 87–125, https://doi.org/10.1306/M47542C7.

Mark, C., Gupta, S., Carter, A., Mark, D.F., Gautheron, C., and Martin, A., 2014, Rift flank uplift at the Gulf of California: No requirement for asthenospheric upwelling: Geology, v. 42, p. 259–262, https://doi.org/10.1130/G35073.1.

Mortimer, E., and Carrapa, B., 2007, Footwall drainage evolution and scarp retreat in response to increasing fault displacement: Loreto fault, Baja California Sur, Mexico: Geology, v. 35, p. 651–654, https://doi.org/10.1130/G23690A.1.

Mortimer, E., Gupta, S., and Cowie, P.A., 2005, Clinoform nucleation and growth in coarse grained deltas, Loreto basin, Baja California Sur, Mexico: A response to episodic accelerations in fault displacement: Basin Research, v. 17, p. 337–359, https://doi.org/10.1111/j.1365-2117.2005.00273.x.

Ramírez-Herrera, M.T., Corona, N., and Castillo-Aja, R., 2019, Revealing the source of the 27 August 1810 Loreto, Baja California, tsunami from historical evidence and numerical modelling: Pure and Applied Geophysics, v. 176, p. 2951–2967, https://doi.org/10.1007/s00024-019-02161-z.

Raymo, M.E., Hodell, D., and Jansen, E., 1992, Response of deep ocean circulation to initiation of Northern Hemisphere glaciation (3–2 Ma): Paleoceanography, v. 7, p. 645–672, https://doi.org/10.1029/92PA01609.

Sedlock, R.L., 2003, Geology and tectonics of the Baja California peninsula and adjacent areas, *in* Johnson, S.E., Paterson, S.R., Fletcher, J.M., Girty, G.H., Kimbrough, D.L., and Martín-Barajas, A., eds., Tectonic Evolution of Northwestern México and the Southwestern USA: Geological Society of America Special Paper 374, p. 1–42, https://doi.org/10.1130/0-8137-2374-4.1.

Suter, M., 2018, The historical seismicity of the Loreto Region, Baja California Peninsula, Mexico (1684–1878): Seismological Research Letters, https://doi.org/10.1785/0220170204.

Umhoefer, P.J., Dorsey, R.J., and Renne, P., 1994, Tectonics of the Pliocene Loreto basin, Baja California Sur, Mexico, and the evolution of the Gulf of California: Geology, v. 22, p. 649–652, https://doi.org/10.1130/0091-7613(1994)022<0649:TOTPLB>2.3.CO;2.

Umhoefer, P.J., Dorsey, R.J., Willsey, S., Mayer, L., and Renne, P., 2001, Stratigraphy and geochronology of the Comondú Group near Loreto, Baja California Sur, Mexico: Sedimentary Geology, v. 144, p. 125–147, https://doi.org/10.1016/S0037-0738(01)00138-5.

Umhoefer, P.J., Plattner, C., and Malservisi, R., 2020, Quantifying rates of "rifting while drifting" in the southern Gulf of California: The role of the southern Baja California microplate and its eastern boundary zone: Lithosphere, v. 12, p. 122–132, https://doi.org/10.1130/L1132.1.

The Geological Society of America ON TO THE FUTURE®

Scholar and Mentor Applications Open: 12 March 2026

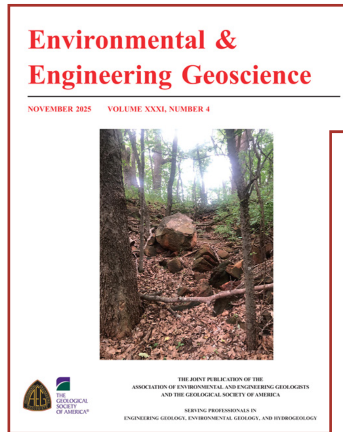
Scholar and Mentor Application Deadline: 7 May 2026

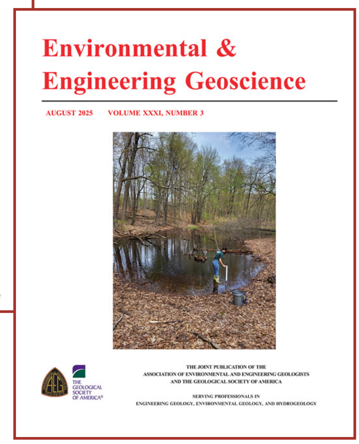
Apply for GSA's On To the Future® Program

GSA's On To the Future® (OTF) program supports geoscience students interested in attending GSA Connects by offering partial travel funding, meeting registration, GSA membership, mentorship, and special sessions with leadership during the meeting. OTF scholars benefit from a vibrant network, community, and opportunities to build social capital within the geosciences.

Complete our General Interest Form to be notified when the application goes live. **https://geosociety.co/gsa-otf**

Submit Your Research to Environmental & Engineering Geoscience





Environmental & Engineering Geoscience (*E&EG*) is a joint publication of the Association of Environmental & Engineering Geologists (AEG) and The Geological Society of America. The journal is published quarterly and hosted at GeoScienceWorld (**https://pubs.geoscienceworld.org/eeg**).

E&EG publishes peer-reviewed, high-quality original research, case studies, and technical notes (manuscripts of fewer than 10 pages) on environmental geology, engineering geology, engineering geophysics, geotechnical engineering, geomorphology, low-temperature geochemistry, applied hydrogeology, and near-surface processes.

The journal encourages Special Issues, managed by a Guest Editor, that focus on a particular topic. For more information or to discuss possible special issue topics, please contact a co-editor: Thomas Oommen (**toommen@olemiss.edu**) or Eric Peterson (**ewpeter@ilstu.edu**).

For more information and to submit your paper, visit the *E&EG* manuscript submission platform at **www.editorialmanager.com/eeg/**. Be sure to read the Style Guide for Authors, which contains valuable information about the topics and types of manuscripts they're looking for, as well as how to prepare your manuscript for submission, what to expect from the review, revision, and publication processes.

GSA Award

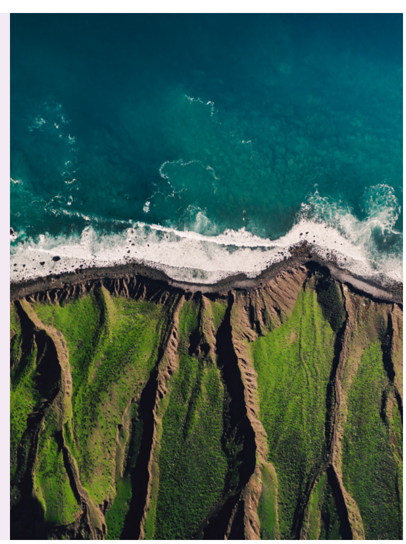
John C. Frye Environmental Geology Award

Nominations due: 31 March

www.geosociety.org/GSA/About/awards/GSA/Awards/Frye.aspx

In cooperation with the Association of American State Geologists and supported by endowment income from the GSA Foundation's John C. Frye Memorial Fund, GSA makes an annual award for the best paper on environmental geology published either by GSA or by a state geological survey.

2025 Awardee: McLaughlin, P.P., Tomlinson, J.L., and Lawson, A.K., 2023, Bulletin 22: Aquifers and Groundwater Withdrawals, Kent and Sussex Counties, Delaware: *Delaware Geological Survey, 120 p.*



Call for Nominations
GSA Division Awards

CONTINENTAL SCIENTIFIC DRILLING (CSD) DIVISION

Distinguished Lecturers
Nominations due: 25 March
Submit to: Mike McGlue, michael.mcglue@uky.edu
Three awardees will be outstanding scientists who, through a series of lectures at academic institutions, GSA events, and the public during the year of the award, highlight the outstanding discoveries and science undertaken through continental drilling.
https://geosociety.co/4apUjX4

Andrew S. Cohen Award
Nominations due: 31 March
Submit to: Mike McGlue, michael.mcglue@uky.edu
The Andrew S. Cohen Award is designed to recognize remarkable contributions made by our mid-career members and encourage their continued success. The nominee will be a mid-career scientist within 11–20 years of receiving the terminal degree who has made outstanding contributions to earth and environmental science using continental scientific drilling/coring/subsurface sampling, emphasizing breadth and impact of research, student mentoring successes, and demonstrable efforts at inclusion or community building. The nominee should be an active member of the CSD Division.
https://geosociety.co/4qjQNC5

Early Career Research Support Grants
Nominations due: 21 July
Submit to: Mike McGlue, michael.mcglue@uky.edu
The CSD Division will offer a new grant-making program designed specifically to support early career scientists conducting research in areas that touch the CSD mission (scientific drilling, coring, subsurface investigation, etc.). The Division aims to provide bridge support for postdoctoral scholars and pre-tenure faculty at institutions of higher education in the U.S. to bolster scholarship and expand opportunities in an otherwise challenging federal funding ecosystem. Each grant will be valued at US$12,500. Grants will be awarded competitively through an application process. Funds are reserved for research activities and may include costs associated with: fieldwork-related travel, fieldwork permitting, laboratory-related travel, laboratory analyses, student/technician salary support, field or lab consumables/supplies, conference/workshop travel, or similar.
https://geosociety.co/4jckcMp

ENERGY GEOLOGY DIVISION

Gilbert H. Cady Award
Nominations due: 1 March
Submit to: (Max) Qinhong Hu, huqinhong@upc.edu.cn
The Gilbert H. Cady Award, first presented in 1973, recognizes outstanding contributions in the field of coal geology that advance the science both within and outside of North America.
https://geosociety.co/4jckK4V

Curtis-Hedberg Award
Nominations due: 31 March
Submit to: (Max) Qinhong Hu, huqinhong@upc.edu.cn
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.
https://geosociety.co/3YaGkgo

ENVIRONMENTAL AND ENGINEERING GEOLOGY DIVISION (EEGD)

Distinguished Practice Award
Nominations due: 31 March
Submit to: W. Paul Burgess, Paul.Burgess@conservation.ca.gov
The Distinguished Practice Award recognizes outstanding individuals for their continuing contributions to the technical and/or professional stature of environmental and (or) engineering geology. A nominee need not be a member of the EEGD, but must have made a major contribution to environmental and (or) engineering geology in North America. Each nomination must be accompanied by a written citation.
https://geosociety.co/4jcmgE9

GEOARCHAEOLOGY DIVISION

Richard Hay Student Paper/Poster Award

Nominations due: 29 August
Submit to: gsa.agd@gmail.com
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 the 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.
https://geosociety.co/496CfyP

Claude C. Albritton, Jr. Award

Nominations due: 1 May
Submit to: gsa.agd@gmail.com
The Albritton Award provides scholarships and fellowships for graduate students in the earth sciences or archaeology for research. Recipients of the award are students who have (1) an interest in achieving a master's or Ph.D. degree in earth sciences or archaeology; (2) an interest in applying earth science methods to archaeological research; and (3) an interest in a career in teaching and academic research. Awards in the amount of US$650 are given in support of thesis or dissertation research, with emphasis on the field and/or laboratory aspects of the research.
https://geosociety.co/3MOC4ko

GEOLOGY AND HEALTH DIVISION

Distinguished Career Award

Nominations due: 15 March
Submit to: rachel.coyte@nmt.edu
The award recognizes the recipient's lifetime contributions to the field of geology and health. The awardee does not need to be a member of the Division.
https://geosociety.co/4j8WGzE

GEOLOGY AND SOCIETY DIVISION

E-an Zen Fund for Geoscience Outreach Grant

Applications due: 30 June
Submit to: Dr. Scott Harris, HarrisS@cofc.edu or Dr. Alan Benimoff, alan.benimoff@csi.cuny.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$1500 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.
https://geosociety.co/3YGixVI

GEOSCIENCE EDUCATION DIVISION

Biggs Award for Excellence in Earth Science Teaching

Nominations due: 1 March
Submit to: https://forms.gle/63q39SRLXQHs5v8Q8
The Biggs Award recognizes innovative and effective teaching in college-level earth science. Earth science instructors and faculty members from any academic institution engaged in undergraduate education who have been teaching full-time for 10 years or fewer are eligible (part-time teaching is not counted in this requirement). Both peer- and self-nominations will be accepted. This award, administered by the GSA Foundation, is made possible by support from the Donald and Carolyn Biggs Fund, the GSA Geoscience Education Division, and GSA's Education and Outreach Program. An additional travel reimbursement is also available to the recipient to enable him or her to attend the award presentation at GSA Connects.
https://geosociety.co/4jccXE9

HISTORY, PHILOSOPHY, AND GEOHERITAGE DIVISION

History and Philosophy of Geology Student Award

Nominations due: 31 August
Submit to: Christopher Hill, chill2@boisestate.edu
The History, Philosophy, and Geoheritage Division provides a student award in the amount of US$1000 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. The Awards Committee will assist the winner(s) with review of abstracts facilitating presentation according to GSA standards.
Currently enrolled undergraduates and graduate students are eligible as are students who received their degrees at the end of the fall or spring terms 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.
https://geosociety.co/3YFX0fV

KARST DIVISION

Karst Division Meritorious Contribution Award

Nominations due: 10 May
Submit to: awards.gsakarst@gmail.com; CC Josh Sebree, joshsebree@gmail.com
Awarded to the author of a published paper or body of work of distinction that has significantly influenced the intellectual direction of karst or broadly enhanced the knowledge of the discipline. If you are submitting a self-nomination, please include a letter of recommendation from a karst professional that can attest to your qualifications. Nominees do not need to be Karst Division members to be eligible for these awards, but it does add merit to the nomination.
https://geosociety.co/4paQWa7

Karst Division Early Career Award

Nominations due: 10 May
Submit to: awards.gsakarst@gmail.com; CC Josh Sebree, joshsebree@gmail.com
Awarded to a distinguished scientist (35 or younger throughout the year in which the award is to be presented, or within 5 years of their highest degree or diploma) for outstanding achievement in contributing to the karst profession through original research and service, and for the demonstrated potential for continued excellence throughout their career. If you are submitting a self-nomination, please include a letter of recommendation from a karst professional that can attest to your qualifications. Nominees do not need to be Karst Division members to be eligible for these awards, but it does add merit to the nomination.
https://geosociety.co/4paQWa7

Karst Division Distinguished Service Award

Nominations due: 10 May
Submit to: awards.gsakarst@gmail.com; CC Josh Sebree, joshsebree@gmail.com
Awarded as a highly esteemed award in recognition of distinguished personal service to the karst profession and to the Karst Division. If you are submitting a self-nomination, please include a letter of recommendation from a karst professional that can attest to your qualifications. Nominees do not need to be Karst Division members to be eligible for these awards, but it does add merit to the nomination.
https://geosociety.co/4paQWa7

MINERALOGY, GEOCHEMISTRY, PETROLOGY, AND VOLCANOLOGY (MGPV) DIVISION

MGPV Distinguished Geologic Career Award

Nominations due: 31 March
Submit to: J. Alex Speer, jaspeer@minsocam.org
The MGPV award will go to an individual who, throughout his/her career, has made distinguished contributions in one or more of the following fields of research: mineralogy, geochemistry, petrology, volcanology, with emphasis on multidisciplinary, field-based contributions. Nominees need not be citizens or residents of the United States, and GSA membership is not required. The award will not be given posthumously.
https://geosociety.co/44KBLNv

MGPV Early Career Award

Nominations due: 31 March
Submit to: J. Alex Speer, jaspeer@minsocam.org
The MGPV award will go to an individual near the beginning of his/her professional career who has made distinguished contributions in one or more of the following fields of research: mineralogy, geochemistry, petrology, volcanology, with emphasis on multidisciplinary, field-based contributions. Nominations are restricted to those who are within eight years past the award of their final degree. Extensions of up to two years will be made for nominees who have taken career breaks for family reasons or caused by serious illness. Nominees need not be citizens or residents of the United States, and GSA membership is not a requirement. The award will not be given posthumously.
https://geosociety.co/4jmALFp

PLANETARY GEOLOGY DIVISION (PGD)

G.K. Gilbert Award

Nominations due: 1 March
Submit to: Sam Birch, sambirch@brown.edu
The G.K. Gilbert Award will be considered annually in accordance with the bylaws of the Society. The award will be made for outstanding contributions to the solution of a fundamental problem(s) of planetary geology in its broadest sense, including planetary geology, geochemistry, mineralogy, petrology, and tectonics, geophysics, and the field of meteoritics. Such contributions may consist either of a single outstanding publication, or a series of publications that have had great influence on the field. The award is named for G.K. Gilbert, who, over one hundred years ago, clearly recognized the importance of a planetary perspective in solving terrestrial geological problems.
https://geosociety.co/4s6M8oR

Eugene and Carolyn Shoemaker Impact Cratering Award

Nominations due: 5 September
Submit to: https://www.lpi.usra.edu/Awards/shoemaker/
The Eugene and Carolyn 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.
https://geosociety.co/3KXRS3J

Ronald Greeley Award for Distinguished Service

Nominations due: 15 August
Submit to: Lauren Jozwiak, Lauren.Jozwiak@jhuapl.edu
In 2011, the PGD 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.
https://geosociety.co/4srB466

The Pete Mouginis-Mark Prize in Planetary Volcanology

Deadline: 8 August
Submit to: Lauren Jozwiak, lauren.jozwiak@jhuapl.edu
The Pete Mouginis-Mark Prize in Planetary Volcanology recognizes outstanding undergraduate and graduate student presentations in planetary volcanology (talks or posters) at GSA Connects. Planetary volcanology, for the purpose of this prize, is defined as research into volcanoes and volcanic processes on the planets (Mercury, Venus, Mars, Moon), asteroids, or the moons of the outer planets. Volcano studies may include the geomorphology and tectonics of summit craters, the lava flows on their flanks, and the deformation of the flanks. Volcanic processes may include numerical modeling of eruptions, as well as petrologic studies of samples from known volcanic areas of the Moon, Mars, or asteroids. Remote sensing (spectral, radar, gravity) of volcanoes and their products is also appropriate. Studies of terrestrial volcanoes and volcanic processes are only eligible if the primary focus is on extraterrestrial volcanism.
https://geosociety.co/499E5iv

QUATERNARY GEOLOGY AND GEOMORPHOLOGY DIVISION

Farouk El-Baz Award for Desert Research

Nominations due: 1 April
Submit to: William Ouimet, william.ouimet@uconn.edu
Nominations should include (1) a statement of the significance of the nominee's research; (2) a curriculum vitae; (3) letters of support; and (4) copies of no more than five of the nominee's most significant publications related to desert research. Please submit electronically unless hardcopy previously approved. The Farouk El-Baz Award for Desert Research rewards excellence in desert geomorphology research worldwide. It is intended to stimulate research in desert environments by recognizing an individual whose research has significantly advanced the understanding of the Quaternary geology and geomorphology of deserts. Although the award primarily recognizes achievement in desert research, the funds that accompany it may be used for further research. Monies for the award are derived from the annual interest income of the Farouk El-Baz Fund, administered by the GSA Foundation.
https://geosociety.co/4pLLP1c

Distinguished Career Award

Nominations due: 1 April
Submit to: Lisa Ely, lisa.ely@cwu.edu
The Distinguished Career Award is presented annually to a Quaternary geologist or geomorphologist who has demonstrated excellence in their contributions to science. Nominations should include (1) a brief biographical sketch; (2) a statement of no more than 200 words describing the candidate's scientific contributions to Quaternary geology and geomorphology; (3) a selected bibliography of no more than 20 titles; (4) a nomination letter; and (5) optional additional letters from colleagues supporting the nomination. Please submit electronically unless hardcopy previously approved.
https://geosociety.co/3MSn44X

SOILS AND SOIL PROCESSES DIVISION

Peter W. Birkeland Distinguished Career Award

Nominations due: 1 May
Submit to: Steven Driese, Steven_Driese@baylor.edu
The Peter W. Birkeland Distinguished Career Award recognizes individuals who have made outstanding contributions to the general field of soil or paleosol (buried or fossilized soil) science. Dr. Birkeland's main area of research was soil geomorphology, and his steady stream of publications, often with his students, demonstrated the application of pedology to address landform and landscape evolution.
https://geosociety.co/499EbGT

Distinguished Service Award

Nominations due: 1 May
Submit to: Steven Driese, Steven_Driese@baylor.edu
The Soil and Soil Processes Division Distinguished Service Award recognizes individuals who have contributed significantly to the advancement of the Division either through service as an officer, service as a chair or member of a committee (or committees), or any other service-related activities (e.g., sponsorship of symposia or topical sessions, field trips, workshops, etc.) that draw positive attention to the research aims and activities of the Division. It includes lifetime membership in the Division.
https://geosociety.co/3YJsSjM

Gregory Retallack Young Scientist Annual Award

Nominations due: 1 May
Submit nominations to: Steve Dreise, Steven_Driese@baylor.edu
The award will cover any research within the scope of soil and soil processes section, including but not limited to pedogenesis, paleosols, ichnology, paleontology, astropedology, archeology, and remote sensing. The award is for research and publications by a scientist younger than 40 in the year of the award and comes with an honorarium of US$1000.

STRUCTURAL GEOLOGY AND TECTONICS DIVISION

Career Contribution Award

Nominations due: 1 March
Submit to: Eric Kirby, exk26@psu.edu
This award is for an individual who throughout his/her career has made numerous distinguished contributions that have clearly advanced the science of structural geology or tectonics. Nominees need not be citizens or residents of the United States, and membership in the Geological Society of America is not required. Nominations should include the following information: (1) name of nominee, present institutional affiliation, and address; (2) summary statement of nominee's major career contributions to the science of structural geology and tectonics; (3) selected key published works of the nominee; and (4) name and address of nominator.
https://geosociety.co/3Yutie1

Outstanding Publication Award

Nominations due: 1 March
Submit to: Julie Fosdick, julie.fosdick@uconn.edu
This award is given annually for a published work (paper, book, or map) of exceptional distinction that clearly advances the science of structural geology or tectonics. Nominations should include: (1) a full citation; (2) nomination (as short as a paragraph; letters or reviews may also be included); and (3) the name and address of the nominator.
https://geosociety.co/3YN4DRG

Sedimentary Geology Division and Structural Geology and Tectonic Division Joint Award: Stephen E. Laubach Structural Diagenesis Research Award

Nominations due: 1 May
Submit to: Devon Orme, devon.orme@montana.edu
The Stephen E. Laubach Structural Diagenesis Research Award Fund promotes research combining structural geology and diagenesis and curriculum development in structural diagenesis. This award addresses the rapidly growing recognition that fracturing, cement precipitation and dissolution, evolving rock mechanical properties, and other structural diagenetic processes can govern recovery of resources and sequestration of material in deeply buried, diagenetically altered and fractured sedimentary rocks. The award highlights the growing need to break down disciplinary boundaries between structural geology and sedimentary petrology, exemplified by the work of Dr. Stephen Laubach and colleagues. Graduate students, postgraduate, and faculty-level researchers are eligible.
https://geosociety.co/4p5VBKp

The Geography of Geology: The GSA Foundation's Impact on GSA Sections

The Geological Society of America (GSA) exists because of its members—their passion for inquiry, their desire to connect, and their commitment to the future of the geosciences. The GSA Foundation takes pride in securing resources to support the Society and its endeavors.

Regular meetings for networking, sharing, and dynamic partnership-building are crucial to GSA's vitality. Once a year, the entire community can unite at GSA Connects, but this is not the only way GSA brings geoscientists together. GSA's six geographic Sections host annual spring meetings to foster collaborations and discoveries and enable GSA members to address issues particular to their geographic affiliations. Students, professionals, researchers, and educators form bonds and share findings. Above all, Section Meetings strengthen GSA—empowering its members to solve the deepest mysteries of the planet and address the challenges of the present and future.

Funds raised by the GSA Foundation help sustain the vibrant intellectual life of the GSA Sections. Thanks in part to GSA Foundation support of GSA programs and scholarships, 94 Southeastern Section students were able to attend GSA Connects in 2025, a record number. Moreover, the Section made nine undergraduate student research grants, more than twice as many as usual.

Support for GSA Sections amplifies GSA's role as an incubator of innovation. In a note of thanks for their Southeastern Section award, Marina Ashurkoff, a student at the College of William & Mary, wrote, "It is truly an honor to get to do scientific work where I'm both learning the techniques attached to my project and how to be a researcher in general."

Figure 1. Southeastern Section student award recipient Marina Ashurkoff and GSA Immediate Past President Chuck Bailey at an outcrop of the Catoctin Greenstone.

At the GSA Foundation, we love hearing testimonials such as Marina's. They speak to how your donations have transformative impacts on students, often building lifelong bonds with GSA and its community.

Other Sections were similarly able to use GSA Foundation resources to deepen student engagement. In 2025, the Rocky Mountain Section combined internal and GSA Foundation resources to make eight student research awards and four undergraduate presentation awards. Moreover, this funding helped 25 students attend the 2025 Section meeting in Provo, Utah, and provided partial assistance for 50 students to attend GSA Connects in San Antonio.

In 2025, the GSA Foundation provided:

$64,448 to the Sections in total

$34,875 for travel grants

$29,573 for research grants

This was thanks to the generosity of donors, along with the GSA Foundation's careful stewardship of their gifts. But we would love to raise more and contribute more. We will be at meetings this spring to learn more about each Section's vision and priorities. We can't wait to contribute to GSA's goals in 2026 and beyond.

Figure 2. GSA Rocky Mountain Section members at GSA Connects in San Antonio. Left to right: Samantha Malavarca (graduate student rep), John Singleton (chair), Carolyn Tewksbury-Christle (chair-elect), Jim Gutoski (graduate student rep), Steve Harlan (secretary/treasurer), and Ben Laabs (member-at-large).

To support your Section today, please scan the QR code below or contact GSA Foundation Executive Director Sean O'Brien at **sean.obrien@gsa-foundation.org** to discuss different ways to make an impact. Thank you for being part of our community.