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Cover: Heavy equipment works to clear Interstate 40 after Hurricane Helene mudslide. Credit: BlackBoxGuild / Getty Images.

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Looking south to Cradle Mountain from Dove Lake. Folded Precambrian metasediments underlie Late Carboniferous-Permian Wynyard Formation diamictites. Photo credit: Lon D. Abbott.

Insights into Widespread Landsliding in Southern Appalachia from Hurricane Helene

Lauren N. Schaefer,*[,1] Francis K. Rengers,[1] Benjamin B. Mirus,[1] Liam Toney,[1] Kate E. Allstadt,[1] Richard Wooten,[2] Patrick Moore,[3] Paula M. Burgi,[1] Anne Witt,[4] Eric L. Bilderback,[1] Jennifer Bauer,[5] David Korte,[2] and Matthew Crawford[6]

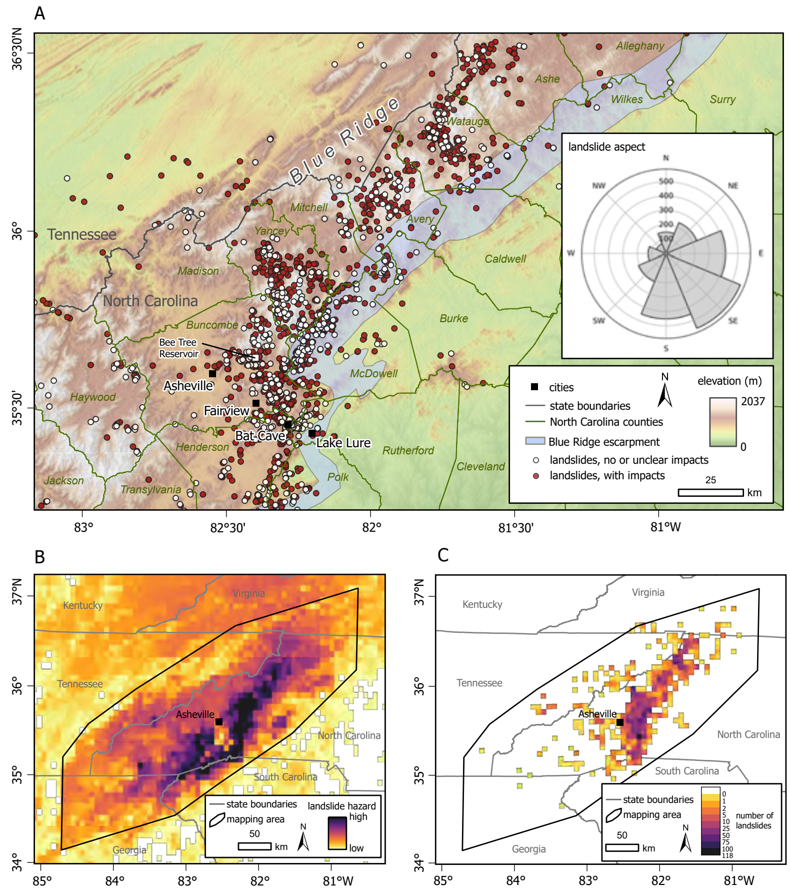

Figure 1. Hurricane Helene landslides and landslide hazard map created during the emergency response. (A) Area of concentrated landsliding (Burgi et al., 2025) and geographic locations on top of U.S. Geological Survey (USGS) 10-m-resolution digital elevation model. Inset shows graph of landslide aspect, predominately on windward-facing (southeast-facing) slopes. Blue Ridge escarpment is from Latham et al. (2007). (B) Relative landslide hazard map based on early estimates of Hurricane Helene precipitation combined with USGS landslide susceptibility proxies (Martinez et al., 2024). Emergency mapping area, shown with black outline, was based on this hazard map. Cell size is 6.5 km². (C) Number of landslides mapped in each 6.5 km² cell.

ABSTRACT

Between 23 and 27 September 2024, antecedent rain followed by Hurricane Helene produced one of the most damaging weather events in southern Appalachia history. The back-to-back storm events resulted in a maximum cumulative rainfall of 848 mm and hurricane-force wind gusts over 170 km/h in western North Carolina, eastern Tennessee, and southwestern Virginia. The resulting regional flooding, landslides, and tree blowdown caused over 100 fatalities, damaged or destroyed critical infrastructure and thousands of structures, and severed connectivity across the region. Over the next several weeks, a multi-agency landslide response produced a rapid hazard assessment and mapped 2217 landslides, 55% of which damaged infrastructure or property. Orographic uplift enhanced rainfall, resulting in concentrated landsliding along the ~250 km swath of the Blue Ridge escarpment in western North Carolina. Landslides initiated predominantly on windward-facing (southeast-facing) slopes, and localized clustering of initiation points indicated a strong influence of hillslope-scale meteorological and geomorphic factors. Many shallow landslides mobilized into larger, highly mobile, and damaging debris flows that graded into floods. Here, we put our preliminary observations in the context of historical storm-driven landslide events and open new avenues for investigating the nature and extent of landslides and their effects in southern Appalachia and similar environments.

INTRODUCTION

The southern Appalachian Mountains are characterized by steep, rugged terrain and complex geology. The Blue Ridge escarpment forms a notable mountain front running from northern Georgia through western Virginia (Fig. 1A; Spotila

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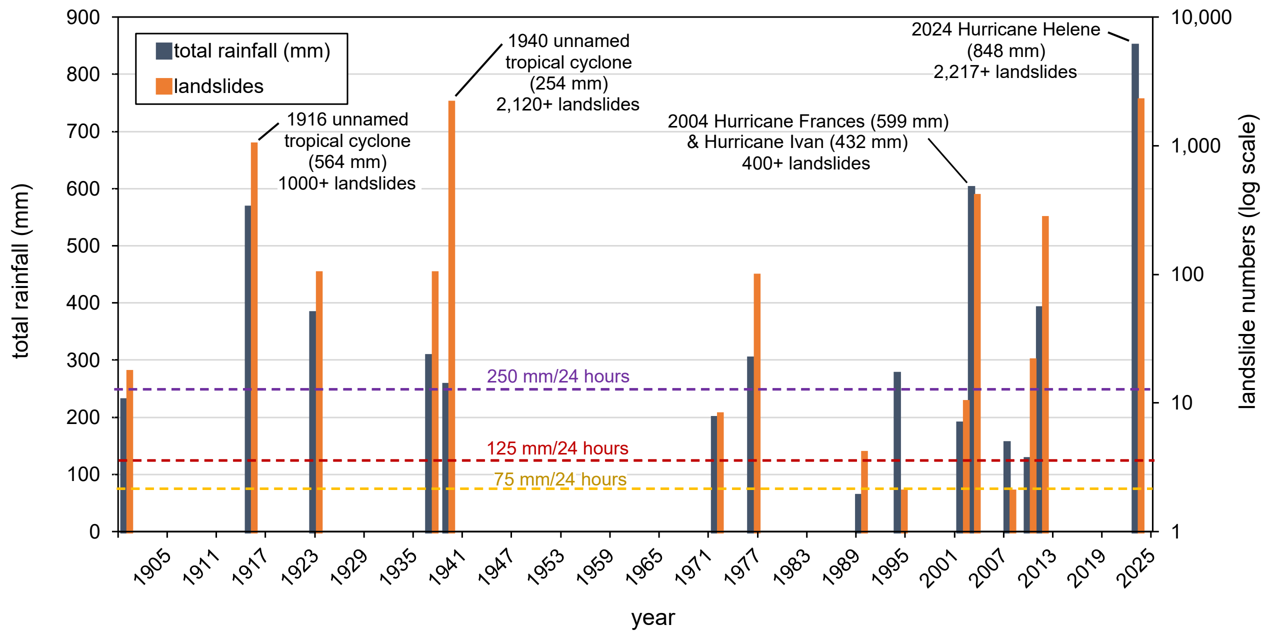

Figure 2. Landslides associated with storm events in western North Carolina. Data for all events excluding Hurricane Helene are from Wooten et al. (2016) and references therein. Back-to-back storm events, such as those which occurred during Hurricane Helene, are labeled. Dashed lines show 24 h rainfall thresholds: yellow line at 75 mm (3 inches) indicates the threshold for landslides on some modified slopes (Wooten et al., 2017); red line at 125 mm (5 inches) indicates the threshold for landslides on unmodified (forested) slopes; and purple line at 250 mm (10 inches) indicates the threshold for widespread landsliding (based on Appalachia region; Eschner and Patrick, 1982).

et al., 2004). The bedrock geology of the Blue Ridge includes highly deformed and metamorphosed rock including metasedimentary slate, phyllite, marble, schist, and gneiss, meta-igneous amphibolite and greenstone, granitic gneiss, and unmetamorphosed granitic rock, the oldest of which formed between 1.8 and 1 Ga (Wooten et al., 2016). The associated steep topography of the Blue Ridge escarpment, with abundant faults and fracture zones, is prone to a variety of landslide types (Hill et al., 2024). Debris flows, some with markedly high velocity and long runout, have resulted in numerous fatalities and destruction across the region (Latham et al., 2007; Wooten et al., 2022; Wieczorek et al., 2000, 2009). Extreme rainfall–triggered landsliding events with broad and severe consequences occur every 9 to 25 yr, with hundreds to thousands of landslides, respectively (Wooten et al., 2016). Notable examples include back-to-back tropical cyclones in July 1916 and August 1940, Hurricanes Frances and Ivan in 2004 (Fig. 2), and Hurricane Camille in 1969.

Compared to these historical events, Hurricane Helene in 2024 was exceptional because of its large spatial extent, record-breaking cumulative rainfall amounts, and widespread landslide occurrence (Fig. 2). On the evening of 26 September, the center of circulation of Hurricane Helene made landfall over the Florida Big Bend region as a category 4 hurricane, but scattered convection had already been producing rain in parts of southern Appalachia since 23 September (Fig. 3). From the early morning of 25 September, tropical moisture that had separated from the circulation associated with Hurricane Helene interacted with a meteorological boundary to produce heavy rain prior to the arrival of the tropical cyclone, called a predecessor rain event (PRE; Cote, 2007; Galarneau et al., 2010). The PRE was followed by the Helene tropical system as the storm moved north through Georgia and into Tennessee. The combination of the antecedent convection, the PRE, and Hurricane Helene between 23 and 27 September produced nearly continuous rain and wind gusts up to hurricane force (wind speeds exceeding 119 km/h) in the southern Blue Ridge (Fig. 3; Hagen et al., 2025).

In western North Carolina, the storm caused over 100 fatalities along with widespread, catastrophic damage due to flooding and landsliding (Figs. 1 and 4; Hagen et al., 2025). Herein, we provide some scientific insights to inform the broader community about storm-triggered landsliding in this region.

RESPONSE EFFORTS AND DATA

Together with state, federal, and local partners, the U.S. Geological Survey (USGS) activated their landslide emergency response team (Landslide Assessments, Situational awareness and Event Response research [LASER]) to support partner agencies, emergency responders, and search and rescue efforts. LASER coordinated a large interagency effort, which included rapid remote, aerial, and field mapping of landslides and impacts, hazard modeling and assessments, daily situational reports relaying landslides of concern, and educational and outreach material development (Allstadt et al., 2024, 2025; Rengers and Mirus, 2024; USGS, 2024a).

Efforts to assess the extent and severity of landsliding were initially hampered because mostly cloudy conditions affected aerial and satellite imagery during the first week of October (Fig. 4E; Fig. S1 in the Supplemental Material[7]).

[7] Supplemental Material. Figures S1–S6. Additional details about the response timeline and landslide characteristics.
Please visit https://doi.org/10.1130/GSAT.S.30888593 to access the supplemental material; contact editing@geosociety.org with any questions.

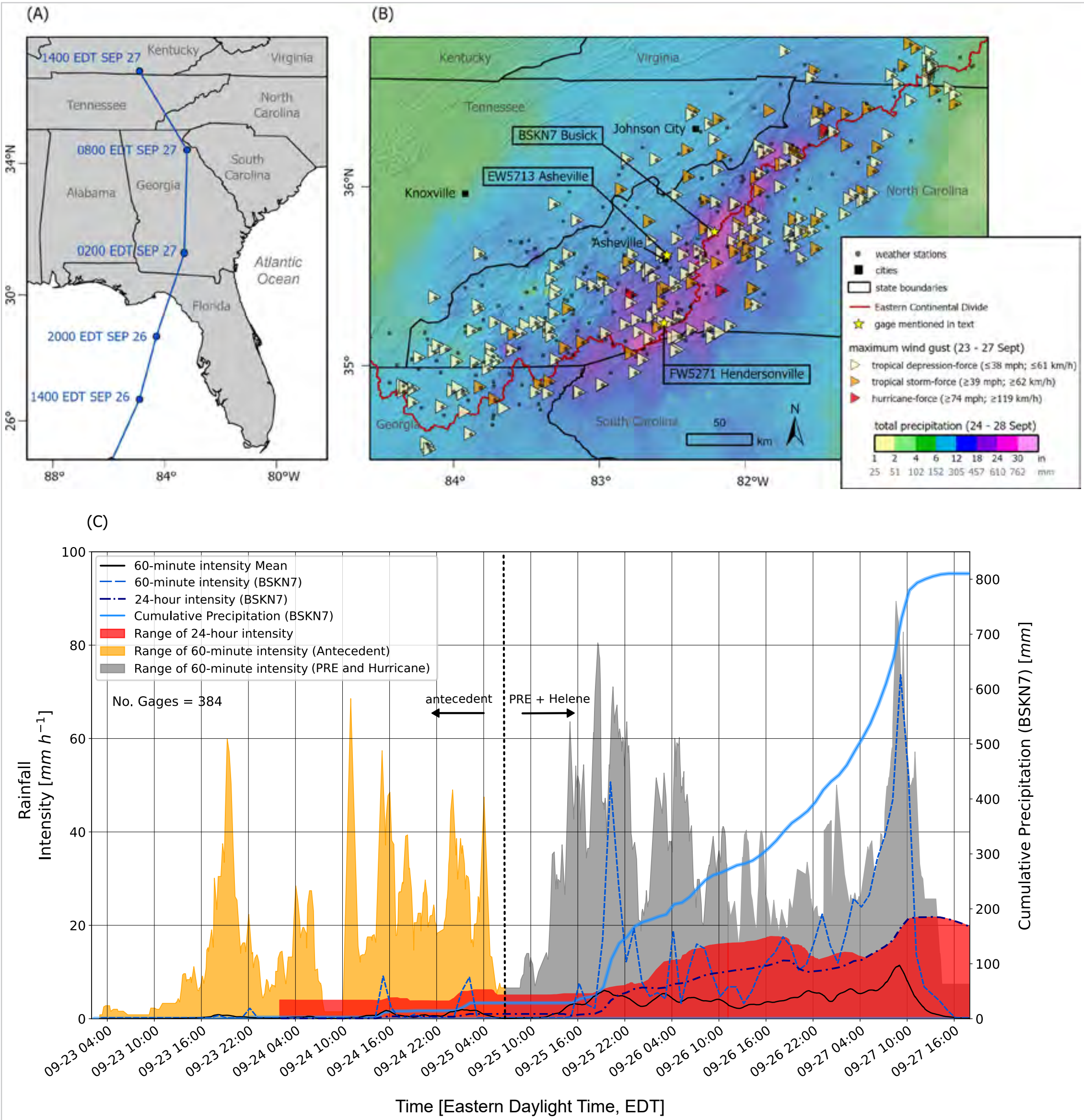

Figure 3. Precipitation and wind gusts in southern Appalachia before and during Hurricane Helene. (A) Storm best track for Hurricane Helene. Data are from National Oceanic and Atmospheric Administration (NOAA) National Hurricane Center (Hagen et al., 2025). (B) Final gridded estimates of rainfall based on radar, gage data, and ground-truth reports (Martinez et al., 2024), and maximum wind gusts measured on weather stations. Weather stations shown in part B were those used to obtain rainfall and wind data for the storm timing and precipitation pattern analysis herein. (C) Time series showing rainfall intensity (60 min and 24 h) as well as cumulative rainfall from the BSKN7 gage (NOAA, 2020). The intensities are shown as a range with the highest and lowest rainfall from each of 384 gages at each minute. PRE—predecessor rain event.

During this period of uncertainty, preliminary relative landslide hazard models were developed to assess where landslides may be concentrated (Fig. 1B). These models used preliminary estimates of precipitation based on radar and rain gage data provided by the National Weather Service (NWS) Greenville-Spartanburg Office combined with USGS landslide susceptibility proxies from Mirus et al. (2024) (see Martinez et al., 2024). The models were provided to emergency responders for early situational awareness and used to prioritize remote mapping and field reconnaissance. Final quality-controlled precipitation estimates used in this study (Fig. 3B) were not available until April 2025 (for preliminary and final rainfall totals, refer to Martinez et al., 2024).

As part of the response, an interagency group of 31 participants from 10 agencies rapidly mapped landslide point locations and impacts between 28 September and 23 October (Figs. 1A and 1C). These results were shared publicly and updated in real time via a Web-based dashboard map (USGS, 2024b). Data used to inform landslide mapping included satellite imagery, oblique aerial photos, media and social media reports, North Carolina Department of Transportation reports, personal communications (e.g., from emergency managers, residents), and field observations from partners on the ground (refer to details in Burgi et al., 2025). During the response, satellite normalized difference vegetation index (NDVI) change maps, a measure of vegetation damage, were used to highlight debris-flow paths and aided mapping efforts (Fig. 4G). After this initial response period, the USGS conducted a review and quality assessment of the mapped landslides, providing the initiation (headscarp) point location and a simplified impact classification for a total of 2217 landslides (Fig. 1; Burgi et al., 2025), which we analyze herein. It was not possible to capture all landslide features or details during the response efforts due to factors such as imagery with poor lighting and/or low spatial resolution, or landslide source areas obscured by dense canopy.

We calculated the elevation, slope angle, and slope aspect for each initiation location using the USGS 10-m-resolution digital elevation models (DEMs; USGS, 2019). We also analyzed storm timing and precipitation patterns (Fig. 3C; data from NOAA, 2020) using NWS geospatial estimates of storm precipitation totals, as well as rainfall time-series data from 384 weather stations and wind gust data from 254 stations using FlowAlert (King et al., 2024). The propensity for shallow landsliding in this region has been linked to both rainfall intensity and event accumulation (e.g., Wieczorek et al., 2009); thus, we examined 60 min and 24 h intensities as well as cumulative rainfall between 23 and 27 September 2024.

STORM TIMING AND PRECIPITATION PATTERNS

The storm was characterized by a long period of heavy rain with bursts of high intensity across a large region (Fig. 3C), accompanied by maximum wind gusts that reached tropical storm to hurricane-force wind speeds throughout the mountains (Fig. 3B). The storm sequence started with antecedent rain occurring from 17:00 h on 23 September (note all times are in Eastern Daylight Time), followed by the PRE and Hurricane Helene occurring from ~5:00 to 9:00 h on 25 September to 16:00 h on 27 September (Fig. 3C). Prior to Hurricane Helene making landfall in Florida (23:10 h on 26 September; Fig. 3A), the region had a median rainfall of 111 mm, considering all gages analyzed, with a maximum of 486 mm at the FW5271 Hendersonville gage. The peak 60 min rainfall intensity of 79.7 mm/h at the EW5713 Asheville gage at 18:33 h on 25 September exceeded the 100 yr rate (79 mm/h) at that location (NOAA, 2020).

Rainfall waned in intensity several times; however, there was no distinct break between the beginning of the PRE and the arrival of the tropical cyclone (Fig. 3C). During Helene, rainfall intensities continued to increase, peaking at ~08:45 h on 27 September and ending by ~16:00 h the same day. The peak 60 min rainfall rate of 89.4 mm/h observed at the FW5271 Hendersonville gage was close to the 100 yr rainfall (92 mm/h) for that location (NOAA, 2020). The 24 h rainfall intensity peaked at 13:17 h on 27 September with 21.79 mm/h at the BSKN7 Busick RAWS gage; this approached the peak of 23.5 mm/h recorded at Altapass during the July 1916 event (Wieczorek et al., 2009) and exceeded the 1000 yr recurrence interval (14 mm/h) at this location (NOAA, 2020). Between 23 and 27 September, gages showed a median rainfall total of 218 mm (excluding gages that recorded 0 mm) and a maximum of 848 mm at the FW5271 Hendersonville gage, but storm totals in many locations may be underestimated because 182 stations lost power between 09:16 h on 26 September and 16:00 h on 27 September (NOAA, 2020).

LANDSLIDE CHARACTERISTICS AND IMPACTS

Most landslides occurred in western North Carolina, concentrated in a north-south trend east of Asheville, North Carolina, and in a southwest-northeast trend along the Blue Ridge (Fig. 1A), corresponding to locations where orographic uplift enhanced rainfall (Fig. 3B). We noted a predominance (64%) of landslides initiated on southeast-facing slopes (azimuths between 68° and 202°; Fig. 1A, inset). Landslides initiated over a wide range of elevations (200–1800 m above sea level), primarily on slopes between 15° and 35° (Figs. S2A and S2B), and in colluvial hollows (i.e., convergent landforms; Fig. S2D). Landslides initiated in colluvium or at the colluvium-bedrock boundary, some of which left large scars that excavated soil and regolith to expose fractured, weathered bedrock (Fig. 4E). While previous studies have underlined the importance of bedrock structural discontinuities, differential weathering, and subsurface morphologies on landslide and debris-flow initiation (e.g., Hill et al., 2024; Wooten et al., 2016), further field observations are required to assess the importance of these various factors during Hurricane Helene.

At the time of publication, there are 107 verified Hurricane Helene–related fatalities in North Carolina reported by the North Carolina Department of Health and Human Services, and 24 of these deaths have been attributed directly to landslides (Hagen et al., 2025). Landslides blocked and undermined roads and railroads and damaged and destroyed buildings (Figs. 4A, 4B, and 4F); of the 2217 mapped landslides considered herein, 1227 (55%) directly impacted infrastructure or property (Fig. 1A). Many residents were isolated as road damage and tree blowdown severed transportation, power, and communication across the region. Debris and sediment from landslides and flooding flowed into reservoirs, resulting in debris jams, high turbidity, and degraded water quality (Fig. 4C).

Many landslides observed during field and remote efforts were debris flows that initiated as one or more shallow landslides or, less commonly, were due to mobilization of soil by overland flow. Some of the largest and most damaging debris flows were fed by multiple upslope source areas, where they initiated as shallow landslides and then traveled for several kilometers and entrained channel and bank materials, further augmenting the destructive flooding. For example, one of the deadliest single debris flows in Flat Creek, which caused 13 fatalities in Fairview, initiated from at least five distinct source areas that converged into a large debris flow with multiple surges that destroyed 14 structures ~2.5 km downstream from the most upstream source area (Figs. 4F and 4G; Medina, 2024). There were also many shallow landslides that did not mobilize into channelized debris flows but were still highly destructive (Fig. 4A). Many slides originated from fill or cut slopes along roads, rails, trails, and other modified slopes (Fig. 4B), which may reflect the influence of human alteration of slopes and drainages (e.g., Collins, 2008; Wooten et al., 2017). In addition to landslides, tree blowdown and vegetation damage were also widespread (Figs. 4D and 4H; Fig. S3). In many areas, winds were strong enough to rip tree root balls from the ground (Fig. 4D).

IMPLICATIONS FOR LANDSLIDE HAZARDS

The extreme nature of Hurricane Helene, with thousands of landslides and widespread devastation over a broad swath of southern Appalachia, may raise concerns of a trend toward more large-scale damaging storms for the region (Fig. 2). Long-term records of daily rainfall demonstrate an increasing trend in the cycles between protracted dry periods to years with extreme rainfall (Laseter et al., 2012; Burt et al., 2017). Although the short-term influence of climatic

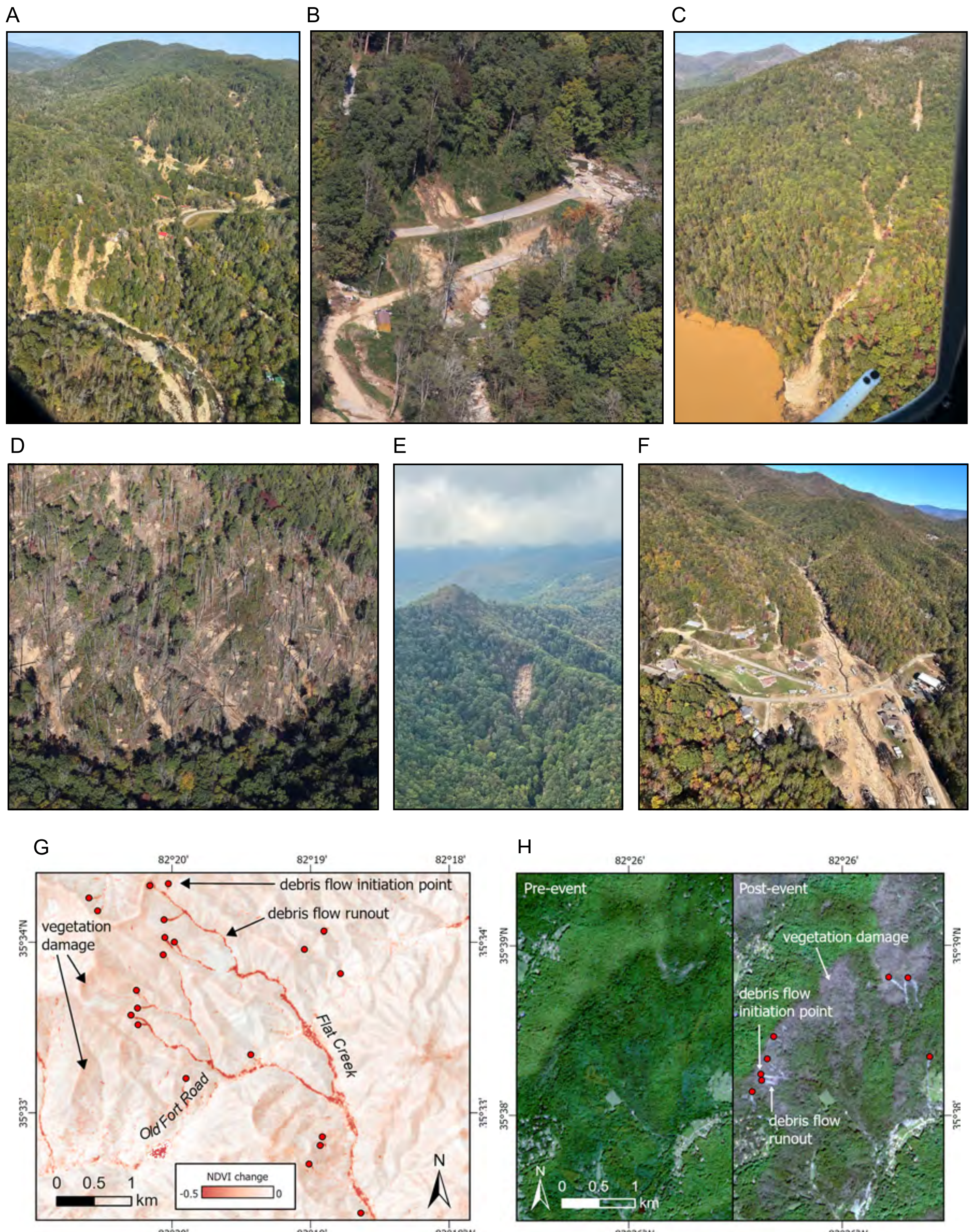

Figure 4. Oblique aerial photos (Allstadt et al., 2024; Rengers and Mirus, 2024) and satellite images of landslides and their impacts. (A) Multiple landslides in Bat Cave, an area which experienced a high density of landsliding on the order of 15 landslides/km^2. Photo by U.S. Geological Survey (USGS)/K. Allstadt. (B) Example of landslide and flood damage to roads. Photo by USGS/S. Slaughter. (C) Debris flow that flowed into Bee Tree Reservoir, a main water supply to the City of Asheville and parts of Buncombe and Henderson Counties. Orange water color indicates high turbidity of the reservoir. Photo by USGS/K. Allstadt. (D) Debris flows among tree blowdown and other vegetation damage. Rounded patches of soil show where windthrown trees ripped root balls out of the ground. Photo by USGS/S. Slaughter. (E) Landslide that excavated soil and regolith to expose fractured, weathered bedrock. Note low cloud cover, which prevented remotely sensed imagery mapping in early October. Photo by USGS/B. Mirus. (F) Lower portion of long-runout debris flow along Flat Creek that caused 13 fatalities and destroyed several homes and roads and augmented flooding downstream. Photo by USGS/J. Godt. (G) Sentinel-2 normalized difference vegetation index (NDVI) image highlighting multiple source areas that converged into Flat Creek and traveled downstream (south in image), producing a long-runout debris flow. Negative values highlight areas where vegetation was present pre-event and was subsequently removed or damaged postevent. (H) Pre-event (22 September 2024) and postevent (12 October 2024) red-green-blue (RGB) Sentinel-2 imagery highlighting debris flows among areas of extensive vegetation damage and tree blowdown.

extremes can be characterized (Mirus et al., 2019), longer-term projected increases in the frequency of landslide-triggering storms may be overshadowed by the slow pace of diffusive sediment transport processes that “reload” hillslope hollows over the time scale of landscape evolution (Parker et al., 2016). Hurricane Helene created numerous landscape disturbances, and in general, we may anticipate exacerbated landslide hazards where source areas were not fully excavated, in oversteepened areas above new landslide scarps, where slopes experienced some deformation and cracking but did not yet fail, where root reinforcement was reduced, where undercutting or oversteepening may have occurred due to flood erosion, or in road cuts and modified slopes with lower established rainfall thresholds (e.g., Wooten et al., 2016, 2017).

Although many factors are at play in controlling storm-driven landslide location, the overall pattern for landsliding during Hurricane Helene appears to have been strongly influenced by total storm rainfall extents (Fig. S4). Approximately 95% of mapped landslides occurred in areas that received cumulative rainfall of 254 mm (10 inches) or more, and no landslides were mapped in areas that received 127 mm (5 inches) or less (Fig. S4). This result underscores previously reported 24 h rainfall thresholds required to initiate widespread landsliding in the southern Appalachians (Eschner and Patrick, 1982; Witt, 2005; Wooten et al., 2016), and the broad utility of the current guidelines used operationally by NWS for alerting thresholds in this region (Wooten et al., 2017). We found that landslides were prevalent near most gages with 24 h rainfall intensities ≥12 mm/h in steep mountainous areas, close to the minimum 24 h threshold of 14 mm/h required to trigger debris flows in the Blue Ridge of central Virginia (Fig. S6; Wieczorek et al., 2009). Several areas with lower 24 h rainfall intensities also experienced landsliding. Thus, we expect that in addition to rainfall patterns, landslide initiation or lack of initiation may also have been influenced by finer-scale structures, differential weathering, and bedrock geologic variability (Hill et al., 2020; Wooten et al., 2016), forest cover and spatial vegetation patterns (Hales et al., 2009), and/or recent history of debris flows that may have depleted sediment from hillslope hollows and channels (Parker et al., 2016; Wooten et al., 2016).

Although landsliding was regionally extensive, we also found evidence of smaller-scale spatial clustering and preferential landslide initiation on windward-facing (southeast-facing) slopes (Fig. S5). Considering a 6.5 km^2 cell size from our relative landslide hazard model, the maximum density was 2.7 landslides/km^2 (Fig. 1C), but with a 1 km^2 cell size, this increases to a maximum of 15 landslides/km^2 (e.g., Bat Cave area; Fig. 4A), emphasizing the uneven spatial distribution of landsliding at smaller spatial scales. Although previous storm-driven landsliding shown in Figure 2 does not account for variables such as spatial footprint, susceptibility, or geology, all of which would greatly affect number of landslides, in general, historical patterns indicate an exponential relationship between rainfall totals and number of landslides. Given the high rainfall totals during Hurricane Helene, we thus can anticipate that the total number of landslide initiation points may increase substantially with the acquisition of high-resolution topographic data, poststorm high-resolution leaf-off orthophotography, and ongoing field mapping efforts.

The preliminary landslide hazard models (Fig. 1B; Martinez et al., 2024) correctly captured much of the area that experienced heavy landsliding in regions of high susceptibility as determined by Mirus et al. (2024) (see Fig. S4) and were exceptionally useful for guiding early response efforts when limited cloud-free satellite imagery was available. In general, the models correctly estimated high concentrations of landsliding to the north of the Blue Ridge escarpment and east of Asheville and lower concentrations to the south of the Blue Ridge escarpment (Fig. 1). The models overestimated landsliding in southern portions of the Blue Ridge to the west of Asheville where preliminary NWS precipitation estimates were high but landslide impacts were sparse (Fig. 1; Fig. S4). Additional detailed landslide mapping and analysis of rainfall temporal and spatial variability can help to clarify discrepancies between the model and landslide occurrence.

Like landsliding, tree blowdown was widespread during Hurricane Helene, occurring preferentially on windward-facing (southeast-facing) slopes (Fig. 4H; Fig. S3). Estimates of forest damage from the U.S. Forest Service (USFS, 2024) indicate that ~580 km^2 of forest experienced large continuous areas of entirely or mostly blown down and broken trees, and 2400 km^2 experienced severe or mixed damage including moderate to major downed wood accumulation (Fig. S3). The widespread tree blowdown and resulting alteration of soil structure, root reinforcement, and hydrology may affect hillslope stability, potentially encouraging future shallow landsliding (Sidle et al., 2006; Ulanova, 2000; Mauri and Tarolli, 2023), although the time scale of this disturbance-recovery cycle for southern Appalachia remains unclear. Widespread tree mortality also increases fuel loading on forest floors that could enhance burn severity for future wildfires (e.g., Kulakowski and Veblen, 2007).

The widespread impacts of Hurricane Helene confirm the significance of sustained heavy rainfall on landsliding in southern Appalachia and highlight the role of wind in exacerbating this deadly and destructive hazard. Our assessments, modeling, and response efforts provided timely analysis and communication to aid emergency responses, and these new data can also provide a foundation for additional research to help inform future landslide loss reduction in the region.

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We acknowledge the widespread devastation and disruption Hurricane Helene caused across the southeastern United States. We thank the many participants who contributed to our landslide response and mapping effort. Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. government.

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Discorditarianism: A New Paradigm for Geological Interpretation

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INTRODUCTION

The fundamental geological paradigm of uniformitarianism played a foundational role in establishing geology as a modern science (Gould, 1965; Alvarez, 1989), though today, it is reductively defined as "the present is the key to the past" (Romano, 2015). Early interpretation of Earth's evolution centered around catastrophism, which posited that sudden extreme events, such as floods, could erase species and form thick layers of rock and fossils within a timeline consistent with biblical understanding. As knowledge of Earth grew, and its great age became apparent, gradualism developed, from roots such as Comte de Buffon's early observations, recognizing that many rocks on Earth likely accumulated slowly and steadily, so allowing for inference of rates and processes between the present and the past (Buffon, 1778; Rudwick, 2014). William Whewell coined the term uniformitarianism in 1832 as an opposite to catastrophism, such that geological discussion became the Uniformitarians versus the Catastrophists (Whewell, 1832). Over time, catastrophism became realigned with modern understandings of Earth that diverged from biblical studies, to become neocatastrophism, which remains an important element of modern event stratigraphy.

Uniformitarianism has been revisited and revised many times (e.g., Gould, 1965; Rudwick, 1972; Mayr, 2011), with the aim of clarifying its definition, though this has arguably led to today's "semantic chaos" (Dresow, 2023). Through such discussions, uniformitarianism has developed a new meaning beyond the principles of gradualism and has essentially become a law of simplicity based on Charles Lyell's entire theoretical system (Rudwick, 1972; Alvarez et al., 1989). As such, all events, be they rapid or gradual, could be encompassed within the modern principle of uniformitarianism (Romano, 2015), based on three factors:

1. Process continuity: The same types of processes have always occurred and in the same manner.
2. Rate consistency: Processes have occurred at generally comparable rates over geological time, similar in principle to gradualism.
3. Uniformity of physical laws (essentially coincident with actualism): Actualism dictates that the same physical laws apply across all of Earth's history.

Nevertheless, there are significant cases where no direct analogues exist, such as Earth's accretion or the emplacement of large igneous provinces, so non-uniformitarianism is invoked when we rely on geological inference for interpretation (Dresow, 2023). However, this Earth-centric perspective overlooks some contemporary extraterrestrial observations, like the atmospheric cycle on Titan and fluvial meanders on Mars, which obey elements of uniformitarianism in non-Earth settings. As such, some of these "non-uniform" processes may have universally uniform elements, and analogues for interpreting Earth may just be constrained by our immediate observational bias.

LIMITATIONS OF UNIFORMITARIANISM

The Lyellian view of uniform rates, processes, and laws (i.e., "substantive uniformitarianism") is often incorrect and can be misleading (Gould, 1965; Alvarez, 1989; Alley, 2001; Dresow, 2023). Actualism persists in the currents of a river, and gravity, yet many Earth processes lead to complex systems displaying nonlinearity, time lags, and feedback loops, in which uniformitarianism can be difficult to apply. "Methodological uniformitarianism," through which present-day understanding is applied to the past or future, remains vital for advancing scientific understanding and for hypothesis generation (Gould, 1965; Dresow, 2023), though it is still inadequate for brief, transformational events (Alvarez, 1989).

Where systems are said to "not obey uniformitarianism," this is an exclusion, not an analytical framework. Such exclusion from uniformitarianism is increasing due to novel kinds of Earth surface processes associated with human-driven geological change, and so a philosophical forum is needed to properly consider a difference that is not simply exclusionary. Uniformitarianism's lack of epistemological space for difference is central to its limitations for geological reasoning, which have affected geology via a resistance to accept changes and catastrophes in the geological past due to a general oversimplification of Earth's history (Alvarez, 1989), and may have delayed the study of the origins and early evolution of Earth (Alley, 2001).

Today's challenge is that we live amongst a higher degree of landscape complexity than has ever existed in geological time, such that a "law of simplicity" is difficult to uphold.

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Human-altered landscapes are not wholly driven by physical laws, but include sociopolitical and economic drivers, which means that, crucially, the cause-and-effect relationships underpinning our understanding of the environment are, to varying degrees, decoupled from geohistorical baselines and entangled with human agency. This is critical because if we cannot meaningfully understand cause-and-effect relationships, we cannot make testable hypotheses, and therefore we cannot do inductive science.

INTRODUCING DISCORDITARIANISM

We introduce the paradigm of discorditarianism to crystallize the conceptual space that presents an objective bridge between process-based earth system science and evidence-based stratigraphy, such that we may more methodologically analyze uniformity and discordance in geological history. Discorditarianism is a complementary, not competing, paradigm to uniformitarianism. The term "discorditarianism" offers epistemic traction and adds a structured way to identify, define, and, ideally, quantify geological discordance.

Discorditarianism expands the potential for geological science to incorporate "human impact" without oversimplistically collapsing it into a homogeneous force; however, it is importantly not human-centric and may be applied to any change or difference in geological history. For example, transformation of geomorphological patterns may be due to the emergence of forests (Gibling et al., 2014) or the inception of plate tectonics (Palin et al., 2020), as well as various changes to physio-chemical conditions, including climate and the biosphere.

The paradigm of discorditarianism allows for a long-needed methodological consistency in forming structured descriptions of complex phenomena formed by geological processes that range from uniformity to discordance. It aids in finding opportunities to apply existing knowledge, to identify knowledge gaps, and to develop interdisciplinary collaborations. The methodology is:

1. Determine exactly what is being compared. Consider what temporal scales or specific time horizons, landscapes, or objects are being compared and why.
2. Identify which elements of uniformitarianism apply. Consider similarities in process, rate, flux, event frequency, physical laws, or broader consistencies and their extent.
3. Describe the spatial character of the discordance. Consider its scale, patterns, and its lateral and vertical extent (e.g., local, regional, or global).
4. Describe the temporal character of the discordance. Consider its longevity frequency, and any changes in intensity, distribution, or impact over time.
5. Outline the forces that led to, and are impacted by, the discordance, and identify which have increased or decreased. Consider *all* forces, from a newly appeared plant species changing soil stability to a new law or socioeconomic policy that has affected landscape engineering.

Consider, say, a river downstream of a dam before and 10 years after a dam installation intended to stabilize the water supply for surrounding farmland. Locally, the river will reflect processes driven by the physical laws consistent with uniformitarianism. At a regional scale, the dam emplacement was a geologically rapid event, with prolonged impact on the river's discharge, sediment supply, composition, and much more. As such, the river reach is clearly discordant to its geological past as a range of socioeconomic forces led to physical changes that now impact the river's natural progression toward landscape equilibrium.

The paradigm of discorditarianism provides a structured method to evaluate the extent to which, and nature with which, Earth's deposits reflect uniformity (simplicity) and discordance (complexity) within Earth's systems, including evaluating the extent to which the present is not the key to the past.

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Beyond the Compass

Redefining Field Education in Geoscience

GSA President Nathan A. Niemi

At GSA Connects 2025, GSA highlighted themes of transition, dissolving borders, and reaching for the stars—mirroring the shifting landscape of geoscience field education. Changing student interests, rapid technology, and ongoing barriers are reshaping what field training must become. Inspiring the next generation to tackle society's geoscience challenges has never been more urgent.

I would like to thank all of you for attending the Presidential Awards Ceremony, to recognize and honor our members for their scientific and community accomplishments. I would like to thank the GSAF, and their leaders, including new ED Sean O'Brien, for their support, as well as incoming GSA President Glenn Thackray, treasurer Brian Katz, and the rest of the GSA Council. And I would like to please give an ovation to Chuck Bailey, who has been a tremendous support to me this year, and who is stepping up for a 4th year of service to GSA.

As Melanie said earlier, we are incredibly excited to be here in San Antonio for the 2025 GSA Connects meeting. This meeting will be the largest since the COVID pandemic, with a rich and diverse array of scientific sessions, invited lectures, field trips, short courses, and social activities. We are pleased at the success of this meeting, which is due to the commitment of the Annual Program Committee, local planning committee, GSA staff, GSA volunteers, and GSA members, such as yourselves, who have chosen to invest your time and resources here in San Antonio.

That being said, it needs to be acknowledged that it has been, at times, a tumultuous path to get here—a challenging year for many in this room, personally, and a difficult year for science in general, as underscored by the absence of many of our colleagues who work for the federal government at the USGS, NOAA, NASA, DOE, or other agencies, as earth scientists.

The topic of my Presidential Address—one of the things that I'm most passionate about, and which gets me out of bed, even on difficult days—is teaching geology in the field. I am a field geologist by training, and research grounded in field-based study typifies the work I continue to do with my graduate students.

I have been fortunate to teach field geology courses for nearly 25 years, and to direct the University of Michigan's Earth and Environmental Science field station for the last 12 years. My connection to field geology is intricately connected to GSA. GSA Graduate Research Grants supported my PhD research, as well as that of my students, and I have been fortunate to teach field geology from two past GSA Presidents: Clark Burchfiel and John Geissman.

Over the past few years, I have spent a lot of time thinking about the future of field camps, field courses, and field trips in the geological sciences, as the landscape around field

geology courses, which was slowly evolving, has begun to more rapidly shift. These shifts have a variety of causes.

Cost is certainly one factor—both the cost to an institution of offering field or place-based learning (as I am constantly reminded by our Dean), and the cost to students of taking field courses, especially if the payment of summer tuition or the loss of a summer job is involved.

Additionally, many faculty trained as field geologists were hired in the wake of the acceptance of plate tectonics, and during the heyday of oil and gas exploration. As these faculty retire, departments are moving in new and different research directions, often eliminating the courses thought of as preparatory for field geology courses, as well as the field geology courses themselves. And, as new faculty are hired, with different research interests and changing expectations in academia, the impetus, or incentives, to develop a multi-week course taught during summer are usually not especially attractive.

Field geology courses are already being eliminated due to declining enrollment and costs, or replaced with shorter field trips, locally based, and taught during traditional academic terms.

What might the future of field education look like for the next generation of students?

To answer that question, it seems reasonable to ask why field geology is taught at all. The answer to that question may be more obvious to those of us who live on boundless expanses of glacial till that are covered by snow five months of the year than to others, and so for many schools, field trips or field camps are an opportunity to see geology in ways that simply isn't possible from local or even regional excursions.

From a curricular perspective, I suspect that many field geology instructors would point to a set of skills (e.g., using a Brunton compass, measuring a stratigraphic section, making a geologic map), and the intention to develop a deeper level of thought processes in students, including:

- thinking in both space and time—a uniquely geologic way to think;
- making a plan to collect data to test a hypothesis;
- drawing an inference from incomplete data; and
- defending that inference, accounting for incompleteness and uncertainty.

A growing body of geoscience education research into field courses and field experiences supports the importance of developing these critical skills through field work.

In addition, for many students, field camps and extended field excursions can be opportunities for personal growth through travel and experiential learning in a new environment. Some students thrive with the ability to focus on one subject, or to get away from distractions at home, or whose strengths are in synthesis and conceptual thinking.

The COVID pandemic in 2020 was a remarkable stimulus in thinking about different ways to achieve field camp teaching objectives. Overnight, every field camp and field course in the country was cancelled, and every institution pivoted to teaching an alternative version of field camp online. To do this effectively, it was critical to start with the key learning outcomes of field camp, and then to ask how those outcomes could be achieved through virtual exercises. An NSF RAPID grant, led by and involving multiple GSA members, convened virtual workshops of field camp instructors across the country to assess the critical learning outcomes of field camps, and then to design and distribute exercises that could be used by any field camp instructor in their virtual field courses.

If you look at some of the key learning outcomes in this framework, it's obvious why teaching a student to make a geologic map, or measure a geologic section, while using pen and paper and traditional data collection methods is effective—these exercises teach many of the crucial skills identified as important learning outcomes of field camp.

Having identified these key learning outcomes opens up horizons beyond developing virtual field exercises based on traditional field camp approaches. This framework provides an opportunity to think about new approaches to teaching in the field, and the possibilities of incorporating different technologies, topics, and themes into field courses.

Traditional field tools remain unquestionably useful for developing quantitative thinking skills and reinforcing student learning by connecting thinking to doing. However, many students (reasonably) don't see use of traditional geologic tools as marketable skills. Students are aware of the importance of geospatial skills in the job market. We are aware that fewer and fewer of the students we graduate will end up with jobs titles "geologist."

We are fortunate that the barriers to using technology in the field have rapidly dissolved. The revolution in computing power over the past two decades has been astonishing. Attempts to use computers in the field 15 or 20 years ago were met with the complaint that students couldn't get up the hill carrying 5 lbs of water and 20 lbs of batteries (they weren't really wrong). Students now carry infinitely more powerful computers in their pockets all the time (well, in their pockets some of the time....)—computers that have batteries that last all day, screens that you can read in direct sunlight, and have Global Positioning System data accurate enough for the teaching of field geology. They are also inexpensive enough to almost completely be ubiquitous.

The revolution in computing has been followed by a revolution in software and app development. This revolution has spearheaded a transition from the use of complex, expensive proprietary software systems that were cumbersome and challenging for students to learning to an ecosystem of lighter-weight, specialized apps aimed specifically at geologic field work and programmed and designed by geologists. The apps work together to accomplish many field geology-oriented tasks, and are easy and intuitive for students to learn and navigate.

Among these I will highlight some developed by GSA members, including StraboSpot, developed by Basil Tikoff and Doug Walker, which is designed for the nested collection of geological data at scales, from geologic mapping, to outcrop description, to thin section analysis. This app is easily modified to simplify its use for field teaching, and students pick up its use quickly.

StraboSpot interacts with apps built by other developers, such as GSA member Rick Allmendinger. One of these is a digital compass app that collects orientation data and allows users to analyze that data on a stereonet in real time while in the field. Rick's own geologic mapping program for field use, Geologic Map Data Explorer, has unique features, including the ability to calculate three-point problems and project geologic contacts, transitioning the app from a tool in which to collect geologic observations and data to one that helps to generate hypotheses that students can test through further field observation. Through such technologies, we can enhance the learning of fundamental field skills that are critical to a practicing geologist, while also teaching computational and geospatial skills that are transferable to other job markets and sectors.

The expense of teaching with technology, including the planned obsolescence of equipment, computers, and software, is one of the biggest impediments to any single institution or entity incorporating technology into field teaching. While the sharing of expensive field-based research equipment has been a long-established practice (e.g., IRIS for seismometers, or UNAVCO for GPS equipment), the practice of pooling and sharing technological equipment for field teaching has had a later genesis.

If not the pioneers of this practice, EarthScope was involved relatively early in the idea of sharing research-grade geodetic equipment with field camps, including GPS and LIDAR (laser scanners). This practice continues, and has expanded, with a suite of geodetic and geophysical equipment available for loan to field education programs. Many earlier adopters of these programs have contributed curriculum, best practices, and instructional ideas to shared teaching resource centers, such as SERC (Science Education and Research Center), Teach the Earth, or GETSI, lowering the barrier to adopting these new technologies. New equipment availability opens the doors to field-based coursework in geodesy, geomorphology, natural hazards, and environmental geology, expanding the range of adoptable field study topics to encompass a greater breadth of student interests, as the need for a new and expanded conception of the topics that can be taught at field camps is crucial.

Student interest in environmental topics, particularly related to the habitability of our planet—from climate change, to water quality, to wild fire and natural hazards—has increased markedly over the past several years. In my own department, the number of students interested in pursuing environmentally oriented degrees outpace those interested in a more traditional earth science degree by a factor of two. This shift in student interests presents a challenge and an opportunity.

The challenge is that differentiating field studies as a component of "only" the "traditional" path through the earth sciences, and not as an integral part of an "envirionmental" path through a degree program, will inevitably lead to diminishing participation in field camps or field studies. It will also minimize the opportunity to train all of our students in some of the fundamental aspects of understanding earth science, whether over millions of years, or over the past millennia.

The opportunity presented to us is to incorporate environmental science as inherently linked to geology, and vice versa. This is perhaps more easily said than done, and I am fortunate to be teaching in a department of earth and environmental sciences with wonderful colleagues who are committed to field teaching, and who have been actively engaged in developing field courses with topics that engage students interested in environmental science, but which also connect to geological sciences.

Field studies are place-based, and so there is no one-size-fits-all model to use in developing new field topics, but at our field station, in northwestern Wyoming, my colleagues have developed several unique projects. These include an analysis of water chemistry—particularly as a function of catchment of geology, measuring water temperature and observing ideal stream bed habitats, which are influenced by both the geologic substrate and its spatial patterns representative of Sevier fold and thrust belt development. Or an exploration of the elevational diversity of modern plants. The elevation diversity reflects temperature gradients, while spatial diversity may reflect substrate and soil type. Modern diversity can be compared to exposures of Eocene paleosols and paleobotantical collections to ask questions about long-term changes in temperature and aridity, and to probe the causes of those changes as tectonic or due to Cenozoic climatic changes.

Modern observations can be conceptually related to glacial outburst floods or pluvial lake floods during the Holocene, and the role of surface processes in shaping our planet through time can be assessed.

Many in this room could certainly come up with additional ideas, examples, and topics. Discussing and sharing ways in which we can retain fundamental earth science–oriented learning outcomes in field courses, while pivoting the subject matter in directions that are more closely aligned to current student interests, and the careers that they are likely to have, is crucial for the long-term continuation, and relevance, of field education.

I've thought a lot about the topics discussed so far, with regards to new technology and new topics, in part because my oldest daughter started college this fall. She is studying conservation biology at CU Boulder, and I am curious, and concerned, about what the world that she will graduate into will look like. I am also deeply aware that spending a month each summer of her life at our field station near Grand Teton and Yellowstone National Parks played no small role in the college major that she chose to pursue (today is also her birthday, so happy birthday, Zoe!).

In general, however, students have increasingly less exposure to earth sciences in secondary education, and participation in recreational outdoor pursuits is also in decline among many demographics. Raising student awareness around college programs and career opportunities in earth science is crucial. Once awareness is raised, creating a sense of community and belonging to attract students to the earth sciences is important to attract new students and diversify the population of students who are pursuing earth science degrees. Considering these challenges in the context of field programs is especially important.

We can perhaps take some lessons from programs that have had successes in this regard. Several institutions have established cohorting programs to introduce high school students to the earth sciences over progressive summers through both on-campus instruction and field education. These include GeoForce here in Texas at UT Austin, or Earth Camp at my own institution, the University of Michigan. These programs have a remarkable placement rate of high school students into STEM fields in college and increasing participation in the earth sciences through cohorting and community building..

At the next career stage, GSA's On To the Future program has had similar success, connecting undergraduate through early career geoscientists with mentors, peer groups, and professionals to build a sense of belonging in the earth science community.

At my own field camp, we teach both upper-level and lower-level courses in geology and environmental sciences. The upper-level field courses are populated by students in our major, who typically know one another from courses on campus, while it is much less likely that the students in the lower-level courses will know one another. We have recognized that issues of anxiety, isolation, and loneliness are more common among the lower-level students, who don't feel part of a cohort prior to arriving at our field station.

Proactively working to build such cohorts through multiple pre–field camp meetings, including informational sessions, social events, casual hikes, and overnight camping trips, are ways to help establish a sense of belonging and camaraderie, demystify the expectations of field camp, and build confidence in students that they have the skills and abilities to be successful in a field course.

That being said, it's also important to recognize that attending a field course in-person isn't a viable, or successful, strategy for everyone, and that there need to be alternatives to in-person field courses for students with accessibility, health, or travel limitations. A notable outcome of the COVID pandemic has been the persistence of several virtual field courses offered each summer, demonstrating the need and demand for virtual options. Some of these courses are "digital twins" of the projects undertaken by in-person field courses, while others are novel constructions of virtual geologic landscapes and problems inside of existing video game environments.

The GeoSPACE program at the University of Florida has developed a particularly novel approach to field teaching by developing a hybrid course, with in-person and fully virtual participants. The program is designed around the geologic themes of planetary geology and volcanology, with "astronauts" in the field and "mission control specialists" providing remote guidance and planning. Although designed specifically to address accessibility issues, one can see how such a model could be modified to remotely include students who are not able to participate in an in-person field camp for any other number of reasons.

Field education has been a core part of undergraduate education in the earth sciences because it's an ideal means by which to teach some of the concepts and learning outcomes which are most unique and fundamental to our field. With new tools and new technology available to us, it's time to think about how field education should evolve to meet the changing needs and interests of our students, and the future careers that they are likely to have.

GSA and its members have been at the forefront of supporting field education, building new field technologies, researching field education, and promoting field camp accessibility. I look forward to GSA continuing to lead in addressing the challenges presented to us in re-envisioning field education, and to increasing participation and accessibility to the unique opportunities that field education provides.

Thank You for Making GSA Connects 2025 a Success!

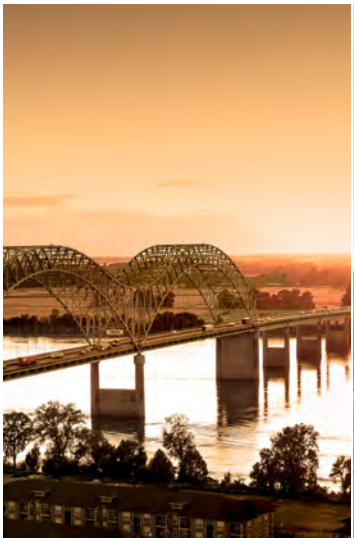
Thank you to all attendees, presenters, volunteers, exhibitors, sponsors, mentors, and program leaders who made GSA Connects 2025 outstanding.

Special thanks to all short course and field trip leaders; Joint Technical Program Committee; Annual Program Committee; and GSA 2025 Organizing Committee:

General Chair: Saugata Datta
Technical Program Chair: Dave Bush
Vice Technical Program Chair: Ginny Peterson
Field Trip Co-Chairs: Matt Cannon and Zachariah Fleming
Sponsorship Chair: John Casian

Connects 2025 By the Numbers

- **Total Attendees:** 4,217
- **Professionals:** 1,543
- **Early Career Professionals:** 637
- **Students:** 1,906
- **K–12 Teachers:** 41
- **International Attendees:** 297
- **Countries Represented:** 50
- **Abstracts:** 3,211
- **Short Courses:** 408 Participants attended 18 Short Courses
- **Field Trips:** 547 Participants attended 27 Field Trips




Explore the Geoscience of Your Region at the 2026 GSA Section Meetings

Join colleagues across North America for four dynamic Section Meetings featuring field trips, short courses, and opportunities to present your latest research. Early registration and abstract submissions are now open—connect, collaborate, and make your mark in 2026.

Early Registration and Travel Grants

Early registration and travel grant submissions are open! The Sections are pleased to offer support for the cost of student travel to the 2026 Section Meetings. These travel grants provide students with the opportunity to network, present their research, and gain invaluable experience. See each Section Meeting's website for more information.

Registration

Category	2026 Early Registration	2026 Standard Registration
Professional Member	$225	$425
Professional Non-Member	$265	$465
Professional Senior Member	$150	$245
Lifetime Member	$225	$425
Early Career Professional Member	$195	$295
Early Career Professional Non-Member	$235	$335
Student Member	$95	$110
Student Non-Member	$150	$165
K-12 (Member and Mon-Member)	$115	$145
Guest	$75	$95

Contribute to the Conversation—Submit Your Abstract

Abstract submissions are open for GSA 2026 Section Meetings! Start planning now to share your research and ideas with a global community of geoscientists.

Abstract submission deadline for MOST Section Meetings: 13 January

Abstract deadline for Rocky Mountain Section Meeting: 24 February

Visit each Section Meeting website for more information about submitting an abstract: **www.geosociety.org/GSA/Events/Section_Meetings**

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.

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

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

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)–5 p.m. (last day)

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)

FT26SE03. Discovering a Cretaceous Lagerstätte: Fossil Field Trip to Coon Creek Tennessee
Saturday, 7 March, 8 a.m.–5 p.m.

FT26SE04. Toxic Tour: Legacy Contamination and Impacts to Memphis Communities
Saturday, 7 March

FT26SE05. Virtual Reality Field Trip of the Alabama Appalachian Mountains
Offered 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)–6:00 p.m. (last day)

FT26SE07. Reelfoot Scarp and Reelfoot Lake: Signatures of the Great 1811–1812 New Madrid Earthquakes
Thursday, 12 March

FT26SE08. From Plum Bayou Mounds to Crowley's Ridge: Exploring Archaeology and Fluvial Landscapes
Thursday, 12 March, 8 a.m.–5 p.m.

Short Courses

SC26SE01. Designing Transformative Geoscience Learning Experiences
Sunday, 8 March, 1–5 p.m.

SC26SE02. Ground Penetrating Radar: Principles & Practice
Sunday, 8 March, 2–5 p.m.

Early Registration and Student Travel Grant Deadline: 12 February 2026

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

Short Courses

SC26NE01. Methods and Applications in (U-Th)/He Thermochronology
Saturday, 21 March, 1 p.m.–5 p.m.

SC26NE02. Teaching the Anthropocene
Saturday, 21 March, 1 p.m.–5 p.m.

SC26NE03. CoreNET—Best Practices in Coring and Analyzing Lake and other Terrestrial Records
Saturday, 21 March, 8 a.m.–5 p.m.

SC26NE04. Machine Learning for Groundwater Science
Saturday, 21 March, 1–5 p.m.

SC26NE05. Ground Penetrating Radar: Principles & Practice
Saturday, 21 March, 2–5 p.m.

Early Registration and Student Travel Grant Deadline: 12 February 2026

Field Trips

FT26NE01. Connecticut's Jurassic Park: The Theropod Tracksite at Dinosaur State Park
Saturday, 21 March, 9 a.m.–noon

FT26NE02. Shifting Sand: Barrier Spit Migration and Science Based Management: The Napatree Point Conservation Area
Saturday, 21 March, 8 a.m.–4 p.m.

FT26NE03. Tectonometamorphic Evolution of Northern Manhattan: Constraints on (Neo)Acadian Tectonism
Saturday, 21 March, 7:30 a.m.–5 p.m.

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.

122nd Annual Meeting of the GSA Cordilleran Section

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

Location

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

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)

FT26CD02. Espíritu Santo and La Partida Islands, BCS, Mexico: 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)

FT26CD03. Ancient Rock Art and Loreto Basin
Monday–Tuesday, 20–21 April, 8 a.m.(first day)–5 p.m. (last day)

FT26CD04. Wildlife and Snorkeling Tour Around Coronados Island
Tuesday, 21 April, 8 a.m.–3 p.m.

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)

FT26CD06. Alluvial Fan Stratigraphy of Southern Baja California
Saturday–Monday, 25–27 April, 8 a.m. (first day)–5 p.m. (last day)

FT26CD07. The Geology and Biology of Isla del Carmen, México
Saturday, 25 April, 8 a.m.–5 p.m.

FT26CD08. Birdwatching around Loreto
Saturday, 25 April, 6:30–11:30 a.m.

FT26CD09. Oasis and Ranch Bio-experience in the Loreto Sierra Foothills
Saturday, 25 April, 8 a.m.–3 p.m.

Short Courses

SC26CD01. An Introduction to Magnetotellurics: Imaging the Earth's Subsurface at Different Depths
Tuesday, 21 April, 9 a.m.–5 p.m.

SC26CD02. Introduction to Thermochronology: Principles, Methods, and Thermal History Modelling
Tuesday, 21 April, 9 a.m.–5 p.m.

SC26CD03. Living and Multifunctional Soil: The Importance of Caring for It and Tools to Assess Its Health
Tuesday, 21 April, 9 a.m.–6 p.m.

SC26CD04. North America Cordilleran Plate Tectonics Using GPlates Paleo-GIS Software
Tuesday, 21 April, 8 a.m.–5 p.m.

SC26CD05. Educational Resources on Plate Tectonics That Cross Borders
Tuesday, 21 April, 1 p.m.–5 p.m.

SC26CD06. Radar de Penetración Terrestre: Principios y Práctica
Tuesday, 21 April, 2 p.m.–5 p.m.

SC26CD07. Melanges in the Western North American Cordillera
Tuesday, 21 April, 3 p.m.–5 p.m.

SC26CD08. Hands-On Experience Using the StraboField Application
Saturday, 25 April, 8 a.m.–5 p.m.

Early Registration and Student Travel Grant Deadline: 19 March 2026

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

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.

FT26RM02. Indigenous Geology in New Mexico
Saturday, 16 May, 8 a.m.–4:30 p.m.

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, 21 May, 6 a.m.–7 p.m.

Short Courses

SC26RM01. An Introduction to the Developing Field of Climate Psychology for Geoscience Professionals
Sunday, 17 May, 9 a.m.–1 p.m.

SC26RM02. Ground Penetrating Radar: Principles & Practice
Sunday, 17 May, 2–5 p.m.

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)

Early Registration and Student Travel Grant Deadline: 16 April 2026

Student Volunteers

Are you a student looking to get involved with GSA and connect with geoscientists across your region? Sign up to volunteer at one of the 2026 GSA Section Meetings!

Student volunteers play a vital role in supporting sessions, registration, and meeting logistics—and in return, receive complimentary meeting registration. Volunteer spots are filled on a first-come, first-served basis, so don't wait to secure your place!

To be eligible, you must be a current GSA student member. Not a student member yet?

Visit www.geosociety.org/join to take advantage of this opportunity and more!

Student memberships are only $25/year.

Questions? Email gsastudents@geosociety.org.

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 (fieldtrips@geosociety.org) for more information.

Attending a Section Meeting? Consider Mentoring

Please share your experiences and career insights as a mentor at GSA Section Meetings! Whether you are an early career or established professional, your wisdom and experience will help young geoscientists find their paths. Mentors from all geoscience sectors, including industry, government, and academia, are welcome. You can serve as a table mentor for a career mentoring luncheon, or mentor for career workshops.

Send an email expressing your interest in mentoring to gsamentoring@geosociety.org. Please include your full name, job title, and employer.

Student Opportunities at GSA Section Meetings

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 or $10 student non-members, and advance registration is required.

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!

The Geological Society of America
CONNECTS
11–14 October 2026 Denver, Colorado, USA

GSA Connects 2026
11–14 October 2026
Denver, Colorado, USA

Shape the Meeting—Submit Your Proposal

https://gsameetings.secure-platform.com/connects26/

Proposal Deadline: 19 February 2026

Do you have a technical session, field trip, or short course idea you'd like to see at GSA Connects 2026? Here's your chance to help shape the meeting program! We invite all members of the geoscience community to contribute ideas that showcase cutting-edge research, cross-disciplinary collaboration, and impactful field experiences. Whether you're a seasoned organizer or a first-time contributor, your proposal will play a vital role in creating a dynamic and inclusive meeting.

Exhibit

https://s2.goeshow.com/gsa/connects/2026/exhibit_sales.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

https://s2.goeshow.com/gsa/connects/2026/exhibit_sales.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!

GEOHERITAGE

Fire and Ice: The Geoheritage of Tasmania's Cradle Mountain–Lake St. Clair National Park

Lon D. Abbott*,[1]

Tasmania's Cradle Mountain–Lake St. Clair National Park displays rugged alpine scenery carved by Australia's biggest Pleistocene glaciers (Fig. 1). It is an integral part of the much larger Tasmanian Wilderness World Heritage Area—1.5 million hectares of wilderness that contains seven national parks and encompasses 20% of the island state (Fig. 2). Most World Heritage Areas are inscribed because they meet one or two of UNESCO's ten criteria for outstanding universal value; the Tasmanian Wilderness satisfies seven, a tally only one other World Heritage Area can match (Tasmania Parks and Wildlife Service, 2025a). Cradle Mountain–Lake St. Clair National Park was included because of its exceptional natural beauty and its outstanding examples of major stages in Earth's history.

You can immerse yourself in the park's beauty and exquisite geology for days while traversing the 65-km-long Overland Track from Cradle Mountain to Lake St. Clair, which is hailed as one of the world's great walks (Tasmania Parks and Wildlife Service, 2025b). For those with less time or stamina, the mountain's north face, looming over Dove Lake—the Overland Trail's starting point—exemplifies the geologic attributes that justified World Heritage status. The bedrock geology's simple, three-part architecture (Fig. 1) can be appreciated from the Dove Lake parking area or the moderate 6-km walk around the lake. It consists of folded and metamorphosed Precambrian and early Paleozoic sedimentary rocks overlain by nearly flat-lying conglomerate of the Upper Carboniferous-Permian Wynyard Formation, all capped by Jurassic dolerite. Together, these three elements narrate seminal chapters in the history of the Gondwana supercontinent, from its origins in the breakup of Rodinia to the Phanerozoic's largest glacial episode to the massive Karoo-Ferrar Large Igneous Province (LIP), an event that heralded the beginning of the supercontinent's protracted dismemberment.

THE BASEMENT ROCKS: FROM RODINIAN BREAKUP TO GONDWANAN ACCRETION

Tasmania's oldest exposed rocks are Mesoproterozoic (1450–1300 Ma) siliciclastic metasediments. Those are unconformably overlain by a Neoproterozoic (730–640 Ma) sequence that include two diamictites (glacial tills) that resemble the South Australian diamictites constituting the type sections for the Sturtian and Marinoan glacial episodes. That similarity has led researchers to conclude that Tasmania and South Australia were neighbors already by Cryogenian (720–635 Ma) time (e.g., Calver and Walter, 2000). However, these "Snowball Earth" glacial episodes likely spanned the globe, so similarity in glacial records doesn't require proximity during the Cryogenian. In fact, detrital zircon records of contemporaneous South Australian and Tasmanian sandstones are distinct, with that of Tasmania's Oonah Formation more closely resembling time-equivalent sandstones in East Antarctica and Death Valley, California. That similarity, plus matching carbon isotope records in the overlying Tasmanian and Death Valley dolomites, caused Mulder et al. (2018) to place Tasmania between East Antarctica and western Laurentia (modern North America), far from the rest of modern-day Australia, in their reconstruction of Rodinia.

The volcaniclastic Oonah sediments and a ca. 730 Ma syndepositional dolerite they contain both suggest the basin belongs to a series of rifts that sundered Rodinia, setting the stage for the assembly of Gondwana. The picture that emerges is of Tasmania parting ways with Laurentia just prior to Snowball Earth and only later uniting with Australia.

That picture is reinforced by the characteristics of Tasmania's Middle Cambrian Tyennan Orogeny (515–505 Ma). It is synchronous with the Ross-Delamerian Orogeny, which entailed subduction beneath the 5000-km-long paleo-Pacific margin of the newly formed Gondwana supercontinent, including Tasmania's present-day neighbor South Australia (Bradshaw, 2023). But the Tyennan Orogeny is distinctly different, recording thrusting of an allochthonous Cambrian volcanic arc onto northwestern Tasmania's Proterozoic craton (Mulder et al., 2018). Tasmania appears to be an exotic terrane accreted to the Australian margin at the leading edge of Gondwana during the Middle Cambrian (Cayley, 2011; Bradshaw, 2023).

THE WYNYARD FORMATION: GONDWANA'S LATE PALEOZOIC ICE AGE

The Precambrian basement rocks that underlie Cradle Mountain were folded during the Tyennan Orogeny and then again in the Middle Devonian Tabberabberan Orogeny. This marked the last folding episode in Tasmania, as the overlying Late Carboniferous Wynyard Formation is nearly horizontal (Fig. 1; Fielding et al., 2010).

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Looking south to Cradle Mountain from Dove Lake. The mountain consists of three rock units. Folded Precambrian metasediments (A) underlie Late Carboniferous-Permian Wynyard Formation diamictites (B). Both Cradle Mountain (right) and its sub-peak Little Horn (left) are constructed from a thick sill of Jurassic dolerite (C) carved by Pleistocene glaciers. Photo credit: Lon D. Abbott.

The Wynyard Formation consists of diamictite deposited during the acme of the Late Paleozoic Ice Age (LPIA), the largest glacial episode in the last 600 million years. Peak glaciation occurred during the Late Carboniferous–Early Permian, when the South Pole lay in Antarctica and Tasmania was at ~75–80°S latitude (Henry et al., 2012).

By the late 1800s, geologists recognized that all the southern continents experienced simultaneous LPIA glaciation; Alfred Wegener used this fact in the early 1900s as evidence to support his continental drift hypothesis (Rosa and Isbell, 2021). Early workers thought the Wynyard Formation was deposited as continental moraines, but it is now interpreted as having been deposited on oceanic grounding-line fans that formed just outboard of tidewater glaciers. The Wynyard glacier(s) occupied a 40-km-wide trough in northwest Tasmania (Henry et al., 2012). The edge of that trough is visible at Cradle Mountain, as the Wynyard Formation underlies the Jurassic dolerite at Little Horn, a subsidiary peak, but it pinches out toward Cradle Mountain, leaving dolerite directly overlying folded basement (Fig. 1).

The LPIA had global effects, most notably by causing eustatic sea level to fluctuate on 1–10 m.y. timescales, which triggered cyclic deposition of shallow marine through coal swamp sequences on the vast coastal plains of then-tropical North America and Eurasia. These are the famous cyclothems, which have profoundly influenced human history because they produced the coal that fueled the industrial revolution (Abbott and Cook, 2023).

TASMANIAN DOLERITE: THE FERRAR LIP AND THE BEGINNING OF GONDWANA'S END

Like most of Tasmania's mountains, Cradle Mountain is capped by polygonal columns of dolerite (Fig. 1), a shallow intrusive equivalent of basalt. More than 30,000 km^2 of Tasmania is covered by dolerite that injected as sills into the flat-lying Parmeener Supergroup, of which the Wynyard Formation is the lowermost unit (Ware et al., 2023). This is the largest expanse of dolerite on Earth, but it is just a small part of the vast Early Jurassic Karoo-Ferrar Large Igneous Province (LIP), which has an estimated volume of 2.5 million km^3 and stretches over 5000 km across Gondwana (Fig. 3), from southern Africa, through Antarctica and Tasmania, to New Zealand and southeastern Australia (Courtillot and Renne, 2003; Ivanov et al., 2017).

The cause of LIP eruptions is debated (Hastie et al., 2014). Furthermore, LIP volcanism commonly precedes continental breakup events (Manu Prasanth et al., 2022), extreme environmental disruptions, and mass extinction events (Courtillot and Renne, 2003; Rampino et al., 2024). These correlations present three fundamental questions about LIPs and their effects on Earth's climate and lifeforms that analysis of Tasmanian magmatism and its comparison with the eruptive history in southern Africa, then 5000 km away, can shed light on. They are:

1. Are LIPs generated by rising mantle plumes or in response to plate interactions?
2. Do mantle plumes drive continental breakup?
3. Are LIP eruptions the proximal cause of the world's most extreme environmental disruptions and biggest mass extinction events?

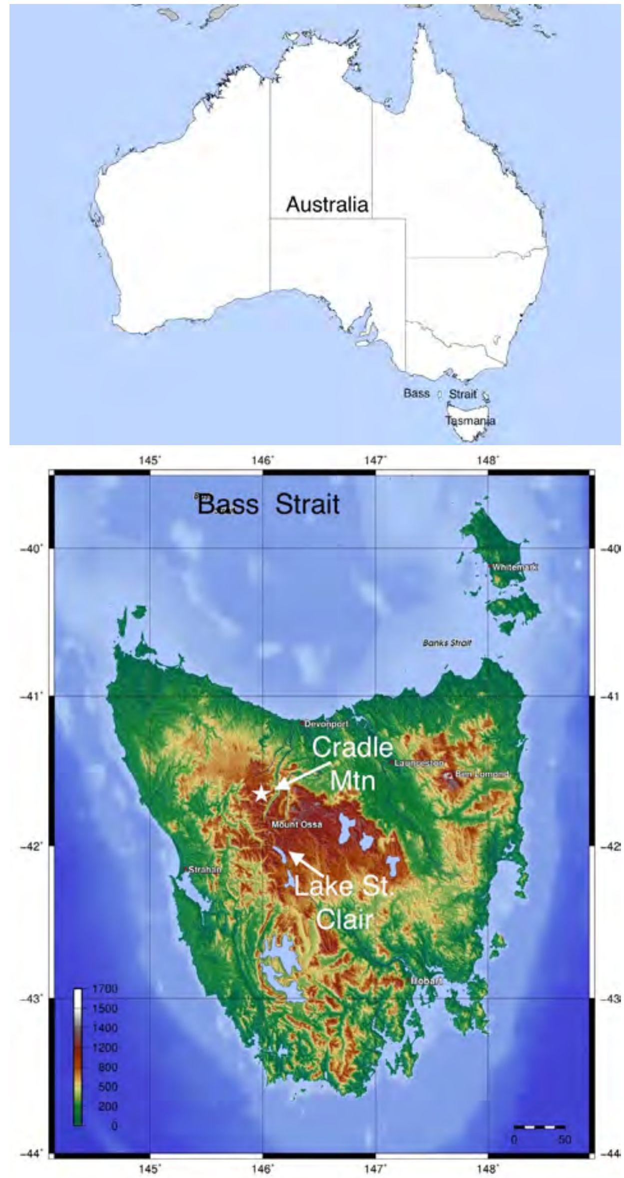

Figure 2. Topographic map of Tasmania, with Cradle Mountain and Lake St. Clair marked. The inset map of Australia shows Tasmania's separation from the mainland of southeastern Australia by the Bass Strait, which is underlain by continental crust thinned by short-lived rifting during the Cretaceous. Credit: Zamonin via Wikimedia Commons; inset: Diceman-commonswiki via Wikimedia Commons

The unusual length of the Karoo-Ferrar LIP, combined with the fact that it immediately preceded the initial breakup of Gondwana and was broadly contemporaneous with a ca. 183 Ma, two-stage environmental and biotic crisis (Kemp et al., 2024; Abbott and Cook, 2024), makes it an ideal place to probe these questions.

When considering the first question, plume models easily explain the huge LIP eruptive volumes but struggle to explain their geochemical details. No oceanic plumes possess the Karoo-Ferrar low-Ti basalts' distinctive combination of $\delta^{18}O$ values indicative of a mantle source and trace element compositions associated with the upper crust (Hergt and Brauns, 2001). Lower mantle plume source areas don't have a crustal signature, so plume models posit that plume-derived magma was contaminated during its ascent through the crust. An alternative is that LIPs aren't sourced from plumes but rather from depleted upper mantle that acquired a crustal signature during refertilization by subduction zone–derived fluids. Hergt and Brauns (2001) tested these two hypotheses using Re-Os isochrons for seven Tasmanian dolerites. Osmium is a compatible element that is strongly enriched in the mantle. They reasoned that if rising plume magmas were contaminated during passage through the crust, the Re-Os isochron values of western Tasmanian dolerites should differ from those of eastern dolerites because western Tasmania is a Precambrian craton, whereas eastern Tasmania lacks a cratonic keel. They found no regional isochron differences, so concluded that Tasmanian dolerites are derived from refertilized upper mantle, not a plume.

Ivanov et al. (2017) also rejected the plume hypothesis based on high precision U/Pb geochronology for African, Antarctic, and Tasmanian dolerites. Previous U/Pb and $^{40}Ar/^{39}Ar$ dating had suggested that Tasmanian dolerites were several million years younger than the ~183 Ma Karoo rocks, suggesting a Karoo-Ferrar plume might have migrated eastward through time. But previous dating was not sufficiently precise to reach a definitive conclusion. The recent advent of ultra-high precision U/Pb dating of single zircon and baddeleyite crystals using isotope dilution thermal ionization mass spectrometry (ID-TIMS) made it possible to test for time-transgressive LIP behavior. Ivanov et al.'s (2017) ID-TIMS results for Tasmanian dolerites dated their emplacement to 182.90 ± 0.21 Ma. That value is statistically indistinguishable from ID-TIMS dates obtained previously from South African and Antarctic rocks (Svensen et al., 2012; Burgess et al., 2015), indicating magmatism was synchronous across the entire 5000 km length of the Karoo-Ferrar LIP. It also limited the Karoo-Ferrar LIP duration to <1 m.y. For a single plume head to stretch from Africa's Karoo to Tasmania (Fig. 3) in less than 1 m.y., the lateral spreading rate must exceed 5 m/yr, an order of magnitude faster than the 0.5 m/yr rate calculated for "ultrafast" plumes. Ivanov et al. (2017) found such a rate improbable and rejected the plume hypothesis. They argued instead that if the Phoenix Plate, which was subducting beneath Gondwana's Pacific-facing margin during the Jurassic, was subducting faster than ~20 cm/yr, the slab could retain fluids down to the mantle transition zone, where dewatering would produce Karoo-Ferrar melts. So, to them, neither the Karoo-Ferrar LIP nor the rifting of Gondwana were associated with a mantle plume.

Turning to the third question, the clustering of all high-precision U-Pb dates across the LIP from South Africa to Tasmania at 183 Ma strengthened the case that LIP eruptions were synchronous with, and likely triggered, the environmental crisis that began at the Pliensbachian–Toarcian stage boundary (~183 Ma) and was followed a few hundred thousand years later by the Toarcian Oceanic Anoxic Event, an event marked by ocean anoxia, a large negative carbon isotope excursion, 5 °C ocean warming, and enhanced terrestrial chemical weathering (e.g., Kemp et al., 2024). But it didn't confirm synchrony, because now age precision for the LIP was much higher than for the environmental crisis itself. Two studies of especially good Japanese exposures recording the two-stage crisis determined that it is indeed synchronous with Karoo-Ferrar eruption ages, making a causal link stronger still (Ikeda et al., 2018; Kemp et al., 2024).

The ID-TIMS U/Pb zircon ages are not the last word, though, on the duration of Karoo-Ferrar volcanism. The precision of

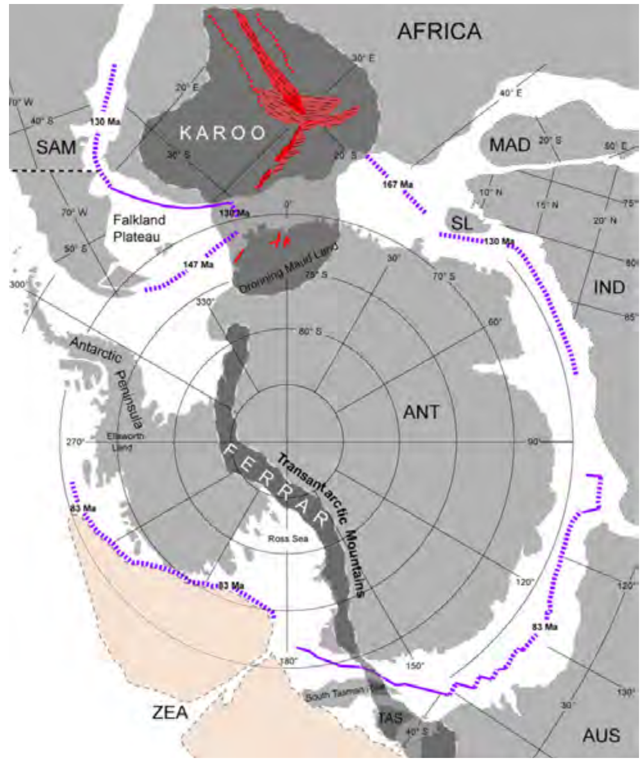

Figure 3. Positions of the continents in southern Gondwana at ~180 Ma. The inferred extent of Karoo-Ferrar LIP magmatism, from southern Africa, through Antarctica to Tasmania and southeastern Australia, is shown in dark gray. Major dike swarms in southern Africa and Antarctica's Dronning Maud Land analyzed by Hastie et al. (2014) are in red. Oceanic rifts that dismembered Gondwana are shown by purple hachured lines with the age of the oldest known seafloor anomalies shown in millions of years. The Weddell Sea opened between Africa and Antarctica at 147 Ma and the first seafloor to separate Western Australia from Antarctica formed at 83 Ma. The solid purple lines are transform faults that were active during Gondwana breakup. ANT = Antarctica, AUS = Australia, IND = India, MAD = Madagascar, SAM = South America, SL = Sri Lanka, TAS = Tasmania, ZEA = Zealandia. From Hastie et al. (2014).

$^{40}Ar/^{39}Ar$ dating has improved apace with that for U/Pb of zircon; Ware et al. (2023) reported $^{40}Ar/^{39}Ar$ ages on plagioclase from four Tasmanian dolerites that range from 184.27 ± 0.24 to 182.69 ± 0.54 Ma. The plagioclase and zircon ages broadly agree, reinforcing confidence that the Karoo-Ferrar LIP is the proximal cause of the contemporaneous environmental crisis. But the plagioclase dates indicate Tasmanian magmatism lasted 1.6 ± 0.4 My—longer than the duration suggested by zircon dates. Ware and colleagues (2023) argued that the conditions necessary for zircon crystallization were not met in the dolerites' mafic magma chambers until the final cooling stage—thus zircons merely date the end of the magmatic event. In contrast, plagioclase crystallizes throughout the solidification process, making it the most reliable recorder of the magmatic event's duration.

TASMANIA CHOOSES AUSTRALIA: GONDWANA'S FINAL DEMISE

The first cracks in Gondwana began to form between Antarctica and Africa ~167 Ma, soon after eruption of the Karoo-Ferrar LIP, and oceanic crust began to form in the Weddell Sea by 147 Ma (Fig. 3; Hastie et al., 2014). Incipient continental rifting between Antarctica and Australia started then, propagating from west to east, reaching a point just west of Tasmania by the end Jurassic. But by 118 Ma, Australia and Antarctica had only separated by ~180 km (Veevers, 2012).

The rift west of Tasmania went dormant during the Early Cretaceous. Active rifting shifted to the north, thinning the crust beneath the future Bass Strait, which separates Tasmania from the mainland (Fig. 2), until it shut off in the middle Cretaceous. The locus of rifting then returned to the spreading center west of Tasmania, keeping it attached to the Australian plate as slow rifting continued through the Cretaceous and early Cenozoic (O'Sullivan et al., 2000). Tasmania finally parted ways with Antarctica at 34 Ma, when faster spreading produced the final dismemberment of Gondwana (Veevers, 2012).

The combination of Tasmania's comparatively high latitude (42°S) and the 1500 m altitude of its highest peaks produced Australia's largest Pleistocene glaciers. The Central Plateau, home to Cradle Mountain (Fig. 2), was covered by a 7000 km^2 ice cap ~1 Ma and progressively smaller ice masses formed during six subsequent glaciations, culminating in 1085 km^2 of ice cover during the Last Glacial Maximum (LGM) at 20 ka (Colhoun et al., 2011).

During the LGM, Cradle Mountain's north face glacier terminated at Dove Lake and the Derwent glacier terminated at Lake St. Clair. These and other LGM glaciers carved the final scenic flourishes into a landscape shaped by repeated episodes of fire and ice that spanned Gondwana's long history, resulting in geologic scenery worthy of World Heritage recognition.

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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 $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://community.geosociety.org/continentaldrilling/awards/research-support-grants

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://community.geosociety.org/energydivision/awards/cady

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://community.geosociety.org/energydivision/awards/curtishedberg

ENVIRONMENTAL AND ENGINEERING GEOLOGY DIVISION

Edward B. Burwell, Jr. Award

Nominations due: 1 February
Submit to: Wendy Zhou, wzhou@mines.edu
The Edward B.Burwell, Jr., Award, established by the Division in 1968, honors the memory of one of the founding members of the Division and the first chief geologist of the U.S. Army Corps of Engineers. This award is made to the author or authors of a published paper of distinction that advances knowledge concerning principles or practice of engineering geology, or of related fields of applied soil or rock mechanics where the role of geology is emphasized. The paper that receives the award must: (1) deal with engineering geology or a closely related field; and (2) have been published no more than five years prior to its selection. There are no restrictions on the publisher or publishing agency of the paper.
https://community.geosociety.org/eegdivision/awards/burwell

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://community.geosociety.org/eegdivision/awards/new-item3

Richard H. Jahns Distinguished Lectureship

Nominations due: 31 January
Submit to: manager@aegweb.org
The Richard H. Jahns Distinguished Lectureship was established in 1988 by the Environmental and Engineering Geology Division and the Association of Environmental and Engineering Geologists to commemorate him and to promote student awareness of engineering geology through an annual series of lectures at academic institutions. The award is given

to an individual who through research or practice has made outstanding contributions to the advancement of environmental and/or engineering geology. The awardee will speak on topics of earth processes and the consequences of human interaction with these processes, or the application of geology to environmental and/or engineering works. Award funds are administered by the GSA Foundation. Contact W. Paul Burgess, Paul.Burgess@conservation.ca.gov, with any questions.
https://community.geosociety.org/eegdivision/awards/jahns

GEOARCHAEOLOGY DIVISION

Richard Hay Student Paper/Poster Award
Nominations due: 30 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://community.geosociety.org/geoarchdivision/awards/student/hay

Claude C. Albritton, Jr., Award
Nominations due: 30 April
Submit to: gsa.agd@gmail.com
The Claude C. Albritton, Jr. 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 degree or PhD 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://community.geosociety.org/geoarchdivision/awards/student/albritton

Rip Rapp Archaeological Geology Award
Nominations due: 28 February
Submit to: gsa.agd@gmail.com
In 1983, the Division established the "Archaeological Geology Division Award" for outstanding contributions to the interdisciplinary field of archaeological geology. In 1993, the award was officially renamed the "Rip Rapp Archaeological Geology Award" in honor of George "Rip" Rapp Jr. Rapp was one of the primary individuals responsible for establishment of the Division and generously established a Division award fund with the GSA Foundation. Donald L. Johnson was the first recipient of the renamed award. Nominationsnshould include a biographical sketch, a statement of outstanding achievements, and a selected bibliography of the nominee.
https://community.geosociety.org/geoarchdivision/awards/riprapp

GEOBIOLOGY AND GEOMICROBIOLOGY DIVISION

Distinguished Career Award
Nomination due: 15 February
Submit to: https://community.geosociety.org/gbgm/awards/nominations
The Division recognizes three exceptional researchers to receive pre-tenure, post-tenure, and distinguished career awards (or equivalent career stage in a non–tenure track position) each year. The Division requests nominations from our members in order to ensure a diverse and inclusive nominee pool, both in terms of academic fields and demographics. We also hope this process allows our members to feel involved and empowered to nominate the people who have made a difference to them or their (sub)field. Final nominees will be selected by the Division representation committee from among this pool and awarded based on the nominee's complete portfolio (research, mentoring, service, and leadership).
https://community.geosociety.org/gbgm/awards/award1

Excellence Awards
Nomination due: 15 February
Submit to: https://community.geosociety.org/gbgm/awards/nominations
There are two Excellence Awards: the Pre-Tenure Excellence Award and the Post-Tenure Excellence Award. Nominations for the Pre- and Post-Tenure Awards will be solicited from current Division members and based, specifically, on excellence in research, mentoring, service, and leadership for the geobiology and geomicrobiology community (appropriate to the candidate's position). From these nominations, the Division management board and appointed Division committee of awards will come to a consensus on the awardees. The awards will consist of both a plaque and an honorary membership to the Division, should the awardee not be a current member.
https://community.geosociety.org/gbgm/awards/award2

GEOCHRONOLOGY DIVISION

Geochronology Early Career Award

Nomination due: 15 February
Submit to: Mark Schmitz, markschmitz@boisestate.edu
The Geochronology Early Career Award is given to an individual near the beginning of their professional career who has made novel contributions toward the development or application of geochronology. Nominees for the Geochronology Early Career Award must be within ten years of receiving their final degree.
https://community.geosociety.org/geochron/awards/ecr-award

GEOINFORMATICS AND DATA SCIENCE DIVISION

M. Lee Allison Award for Geoinformatics

Nominations due: 28 February
Submit to: **https://forms.cloud.microsoft/r/cMKSQ79DKb**
The M. Lee Allison Award for Geoinformatics will be made to an individual who has contributed in an outstanding manner to geology through the application of the principles of geoinformatics. The individual will be a member of GSA. Normally, a single award will be made annually, but in any particular year may be withheld if the management board decides that no suitable candidate has been nominated. **https://community.geosociety.org/geoinformaticsdivision/awards**

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://community.geosociety.org/geologyhealthdivision/events32/upcoming-awards

GEOLOGY AND SOCIETY DIVISION

E-an Zen Fund for Geoscience Outreach Grant

Applications due: 30 June
Submit to: Scott Harris (HarrisS@cofc.edu) or 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 nongeoscientists 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://community.geosociety.org/gsocdivision/news/zenfund

GEOPHYSICS AND GEODYNAMICS DIVISION

George P. Woollard Award

Nominations due: 15 February
Submit to: Shannon Dulin, sdulin@ou.edu
The George P. Woollard Award recognizes outstanding contributions to geology through the application of the principles and techniques of geophysics. A highlight of the presentation is the honorary George P. Woollard Technical Lecture by the recipient before the award ceremony. Nominations should include the nominee's name, contact information, and a short paragraph stating the nominee's qualifications, including a short summary of their specific work or outcomes and how these have contributed to geology. A curricula vitae, if available, helps, but is not required.
https://community.geosociety.org/geophysicsdivision/awards/woollard

The Seth and Carol Stein Early Career Award in Geophysics and Geodynamics

Nominations due: 15 February
Submit to: Shannon Dulin, sdulin@ou.edu
The Seth and Carol Stein Early Career Award in Geophysics and Geodynamics is in recognition of significant contributions to geology through the application of geophysics and geodynamics by a young scientist of outstanding ability. Nominated candidates must be either no more than 35 years old or no more than six years beyond receiving a PhD or equivalent, must be a current Geophysics and Geodynamics Division member in good standing and have been a Division member in the prior two years, and must have either a published or in-press paper in a GSA journal, or have presented a talk or poster at GSA Connects or a GSA Section Meeting. The primary nominator must also be a member of the Geophysics and Geodynamics Division. The nominator should submit (1) the cover sheet (Word / PDF), available on the award website; (2) the candidate's CV; and (3) 2–3 letters of support, preferably in a single PDF.
https://community.geosociety.org/geophysicsdivision/awards/early-career-award-steins

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 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://community.geosociety.org/gedivision/awards/biggsaward

HISTORY, PHILOSOPHY, AND GEOHERITAGE DIVISION

Mary C. Rabbitt History and Philosophy of Geology Award

Nominations due: 15 February
Submit to: Christopher Hill, chill2@boisestate.edu
The Mary C. Rabbitt History and Philosophy of Geology Award is presented annually to an individual for exceptional scholarly contributions of fundamental importance to our understanding of the history of the geological sciences. Achievements deserving of the award include, but are not limited to, publication of papers or books that contribute new and profound insights into the history of geology based on original research or a synthesis of existing knowledge. Neither the nominator nor the nominee need be a member of the Division or of GSA. The nomination packet should include (1) a letter detailing the contributions that warrant the award; and (2) the nominee's current CV, including name, title, affiliation, education, degrees, honors and awards, major career events, and contributions that warrant the award. Monies for the award are administered by the GSA Foundation.
https://community.geosociety.org/histphildiv/awards/rabbitt

Gerald M. and Sue T. Friedman Distinguished Service Award

Nominations due: 15 February
Submit to: Christopher Hill, chill2@boisestate.edu
The Gerald M. and Sue T. Friedman Distinguished Service Award, established in 2005, is presented for exceptional service to the advancement of our knowledge of the history and philosophy of the geological sciences. Neither the nominator nor the nominee has to be a member of the Division or of GSA. Service to the history and philosophy of geology may include, but is not limited to, the discovery of and making available rare source materials; comprehensive bibliographic surveys; organizing meetings and symposia in the history and philosophy of geology; and exceptional service to the Division. The nomination packet should include (1) a letter detailing the contributions that warrant the award; and (2) the nominee's current CV, including name, title, affiliation, education, degrees, honors and awards, major career events, and the contributions that warrant the award.
https://community.geosociety.org/histphildiv/awards/dsa

History and Philosophy of Geology Student Award

Nominations due: 31 August
Submit to: Christopher Hill, chill2@boisestate.edu
The History and Philosophy of Geology 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://community.geosociety.org/histphildiv/awards/student

Michele Aldrich History and Philosophy of Geology Student Research Award

Nominations due: 18 February
If you are a graduate student, apply through the GSA Graduate Student Research Grants platform (www.geosociety.org/gradgrants). If you are an early career scholar, email your application to David Spanagel (davidspanagel@comcast.net). The History, Philosophy, and Geoheritage Division is soliciting proposals for a student research award. Up to US$4000 is available if justified with a supporting budget. The purpose of the fund is to support research grants through the Division for students who conduct historical research within the geosciences. Preference will be given to doctoral-level and then master's-level students. Graduates who received their PhD in the previous five years may also be considered. Annual awards will be made by the Division through a process involving initial selection of applicants by GSA's Research Grants Committee and final selection and/or ratification of the awarded recipients by the Division. Recipients of the award will be included in the annual GSA and/or GSA Foundation research award ceremonies, along with other student research award recipients.
https://community.geosociety.org/histphildiv/awards/aldrich

HYDROGEOLOGY DIVISION

O.E. Meinzer Award

Nominations due: 1 February
Submit to: gsa.hydro.nominations@gmail.com
The O.E. Meinzer Award recognizes the author or authors of a publication or body of publications that have significantly advanced the science of hydrogeology or a closely related field. The nomination must cite the publication(s) on which the nomination is based and describe the role of the publication(s) in advancing hydrogeology or a closely related discipline. Inclusion of up to three additional third-party letters in support of the nomination is encouraged. Contact **gsa.hydro.nominations@gmail.com** with any questions.
https://community.geosociety.org/hydrodivision/awards/meinzer

Kohout Early Career Award

Nominations due: 1 February
Submit to: gsa.hydro.nominations@gmail.com
The award will be presented to a distinguished early career scientist (35 years of age or younger throughout the year in which the award is to be presented, or within five years of receiving their highest degree or diploma) for outstanding achievement in contributing to the hydrogeologic profession through original research and service, and for the demonstrated potential for continued excellence throughout their career. How to nominate: The nomination package must include the following: (1) at least one letter of nomination with a description of the significant contributions or accomplishments; (2) a copy of the nominee's curriculum vitae with complete bibliography; and (3) at least four supporting letters.
https://community.geosociety.org/hydrodivision/awards/kohout

Birdsall-Dreiss Distinguished Lecturer

Nominations due: 1 February
Submit to: gsa.hydro.nominations@gmail.com
The lecturer shall be selected based on outstanding contributions to hydrogeology or a closely related field through original research and public communication, and the potential for continued contributions to the profession. Nominations should include at least one letter of nomination, a copy of the nominee's curriculum vitae, and at least two supporting letters describing the significant contributions or accomplishments constituting the basis for the nomination.
https://community.geosociety.org/hydrodivision/birdsall/about2019

Schwartz Award for Excellence in Mentoring and Education

Nominations due: 1 February
Submit to: gsa.hydro.nominations@gmail.com
The Schwartz Award for Excellence in Mentoring and Education will be considered annually in accordance with the bylaws of the Society. The award will be made to an individual (not multiple or group awardees) in recognition of distinguished personal service to the hydrogeology profession and to the Hydrogeology Division with respect to mentoring and education. A letter of nomination that describes the distinguished service in mentoring and education that warrants the nomination. Supporting letters are helpful but not required.
https://community.geosociety.org/hydrodivision/awards/schwartz2022

George Burke Maxey Distinguished Service Award

Nominations due: 1 February
Submit to: gsa.hydro.nominations@gmail.com
The George Burke Maxey Distinguished Service Award, first presented in 1984, honors noted American hydrogeologist George Burke Maxey. An esteemed mentor and pioneering researcher, Maxey's career spanned more than 35 years and helped establish hydrogeology as the discipline we know today. Presented annually, the award recognizes exemplary service "to the hydrogeology profession and to the Hydrogeology Division." The award will be made in recognition of distinguished personal service to the hydrogeology profession and to the Hydrogeology Division. The award is based on a history of sustained creditable service to the hydrogeology profession and to the Division. The recipient must be a member of the Division and not have previously received the award. A letter of nomination that describes the distinguished service that warrants the nomination. Supporting letters are helpful but not required.
https://community.geosociety.org/hydrodivision/awards/serviceaward

KARST DIVISION

Karst Division Meritorious Contribution Award

Nominations due: 10 May
Submit to: awards.gsakarst@gmail.com; CC Josh Sebree, joshsebree@gmail.com
The Karst Division Meritorious Contribution Award is presented 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://community.geosociety.org/karstdivision/awards/new-item

Karst Division Early Career Award

Nominations due: 10 May
Submit to: awards.gsakarst@gmail.com; CC Josh Sebree, joshsebree@gmail.com
The Karst Division Early Career Award is 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://community.geosociety.org/karstdivision/awards/new-item

Karst Division Distinguished Service Award

Nominations due: 10 May
Submit to: awards.gsakarst@gmail.com; CC Josh Sebree, joshsebree@gmail.com
The Karst Division Distinguished Service Award is 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://community.geosociety.org/karstdivision/awards/new-item

LIMNOGEOLOGY DIVISION

Israel C. Russell Award

Nominations due: 15 February
Submit to: David Finkelstein, finkelstein@hws.edu
The Israel C. Russell Award is awarded for major achievements in limnogeology through contributions in research, teaching, and service. Nominations should consist of a letter describing the nominee's accomplishments in the field of limnogeology (broadly defined and including limnogeology, limnology, and paleolimnology), service to students and teaching, and contributions to GSA, as well as a curriculum vitae.
https://community.geosociety.org/limnogeologydivision/awards/russell

Kerry Kelts Research Award

Nominations due: 15 February
Submit to: Elana Leithold, leithold@ncsu.edu
The Kerry Kelts Research Award is for undergraduate or graduate student research related to limnogeology, limnology, or paleolimnology.
https://community.geosociety.org/limnogeologydivision/awards/kerrykelts

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 Distinguished Geologic Career 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://community.geosociety.org/mgpvdivision/awards/dgca

MGPV Early Career Award

Nominations due: 31 March
Submit to: J. Alex Speer, jaspeer@minsocam.org
The MGPV Early Career 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://community.geosociety.org/mgpvdivision/awards/earlycareer

PLANETARY GEOLOGY DIVISION

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 of either 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://community.geosociety.org/pgd/awards/gilbert

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://community.geosociety.org/pgd/awards/shoemaker

Pellas-Ryder Award

Nominations due: 31 January
Submit to: Ashley King, a.king@nhm.ac.uk
This award, which is jointly sponsored by the Meteoritical Society and the GSA Planetary Geology Division, is awarded to an undergraduate or graduate student who is first author of the best planetary science paper published in a peer-reviewed scientific journal during the year prior to the award. Potential topics are listed on the cover of *Meteoritics & Planetary Science*, and include: asteroids, comets, craters, interplanetary dust, interstellar medium, lunar samples, meteors, meteorites, natural satellites, planets, tektites, and the origin and history of the solar system. The award has been given since 2001 and honors the memories of meteoriticist Paul Pellas and lunar scientist Graham Ryder.
https://community.geosociety.org/pgd/awards/pellas-ryder

Ronald Greeley Award for Distinguished Service

Nominations due: 15 August
Submit to: Lauren Jozwiak, Lauren.Jozwiak@jhuapl.edu
In 2011, the Planetary Geology Division established the Ronald Greeley Award for Distinguished Service. This award may be given to those members of the Division, and those outside of the Division and GSA, who have rendered exceptional service to the Division 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 Division 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 Division community, may be made by any Division member to the management board.
https://community.geosociety.org/pgd/awards/greeley

Dwornik Award

Nominations due: 7 January
Submit to: mtgawards@hou.usra.edu
The Dwornik Award was started in 1991 with a generous endowment by Dr. Stephen E. Dwornik, who wished to encourage U.S. students to become involved with NASA and planetary science. The award consists of a plaque and a monetary award given for outstanding student presentations (in both poster and oral categories) or a plaque for honorable mentions (poster and oral) at the annual Lunar and Planetary Science Conference (LPSC) hosted by the Lunar and Planetary Institute (LPI). The awards are managed and judged by the Planetary Geology Division.
https://community.geosociety.org/pgd/awards/dwornik

The Pete Mouginis-Mark Prize in Planetary Volcanology

Nominations due: 20 February
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, the 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://community.geosociety.org/pgd/awards/mouginis-mark-prize

QUATERNARY GEOLOGY AND GEOMORPHOLOGY DIVISION

Kirk Bryan Award for Research Excellence

Nominations due: 15 February
Submit to: Lisa Ely, lisa.ely@cwu.edu
The Kirk Bryan Award is bestowed upon the author or authors of a published paper of distinction advancing the science of geomorphology or some related field, such as Quaternary geology. The paper constituting the basis of the award must fulfill the following requirements: (1) the paper will deal with geomorphology or with a bordering field; and (2) the paper will have been published not more than five years prior to its selection for the award. Nominations should include (1) a letter (1–3 pages long) by the chief nominator outlining the significance and importance of the nominated publication; (2) a copy of the publication; (3) reviews of the publications that have appeared in journals, newsletters, or books (if any); and (4) one or more letters from other supporters of the nomination, via email to the division secretary.
https://community.geosociety.org/qggdivision/awards/kirkbryanaward

Farouk El-Baz Award for Desert Research

Nominations due: 1 April
Submit to: William Ouimet, william.ouimet@uconn.edu
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. 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.
https://community.geosociety.org/qggdivision/awards/el-baz

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; and (4) a nomination letter; (5) optional additional letters from colleagues supporting the nomination, via email to the Division secretary.
https://community.geosociety.org/qggdivision/awards/distinguished-career

SEDIMENTARY GEOLOGY DIVISION

Laurence L. Sloss Award for Sedimentary Geology

Nominations due: 15 February
Submit to: Joel Saylor, jsaylor@eoas.ubc.ca
The Laurence L. Sloss Award for Sedimentary Geology is given annually to a sedimentary geologist whose lifetime achievements best exemplify those of Larry Sloss—i.e., achievements that contribute widely to the field of sedimentary geology and service to GSA. Nominations should include: (1) a cover letter describing the nominee's accomplishments in sedimentary geology and contributions to GSA; (2) a curriculum vitae; and (3) any additional supporting letters electronically. Nomination materials remain active for three years. Monies for the award are derived from the annual interest income of the Laurence L. Sloss Award for Sedimentary Geology Fund, administered by the GSA Foundation.
https://community.geosociety.org/sedimentarygeologydiv/awards/sloss

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://community.geosociety.org/soilsdivision/awards/peter-w-birkeland-distinguished-career-award

Distinguished Service Award

Nominations due: 1 May
Submit to: Steven Driese, Steven_Driese@baylor.edu
The 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://community.geosociety.org/soilsdivision/awards/soils-and-soil-processes-division-distinguished-service-award

Gregory Retallack Young Scientist Annual Award

Nominations due: 1 May
Submit 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: (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://community.geosociety.org/sgt/awards/careercontribution

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://community.geosociety.org/sgt/awards/outstandingpublication

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

Nominations due: 1 May
Submit to: Andrew Zuza, azuza@unr.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://community.geosociety.org/sgt/awards/laubachaward

How GSA Supports Geology Students’ Experiences

Field camp is often described as a rite of passage for aspiring geologists—a place to apply classroom learning to real-world geology while building resilience, collaboration, and critical thinking. Thanks to the GSA J. David Lowell Field Camp Scholarship and support from Brunton, Inc., students are able to make the most of this transformative experience.

“The GSA J. David Lowell Field Camp Scholarship helped me afford the cost of field camp, allowing me to focus on my education and the experience of field camp,” says Xochitl Munoz, who mapped the stunning landscapes of interior Alaska.

For Stefany Wiszowaty, the combination of scholarship support and a new Brunton compass made all the difference: “This was the most real contact I have had with geology, and it has reaffirmed my commitment to the geosciences ... I was able to use every bit of knowledge I had learned to successfully carry out the activities in this class.”

Other students echo the transformative nature of the experience. Ursula Ziebolz shared, “Even though the Wichita State field camp was academically and physically demanding ... with the help of Dr. Parcell and the TAs, it didn’t feel like an obstacle I couldn’t overcome.” Grace Sandige added, “Field camp taught me more than how to map a fold or interpret a cross-section. It taught me the value of collaboration, resilience, and friendship.”

The practical skills gained in field camp—from mapping and structural analysis to teamwork—are enhanced by tools like the Brunton compass. Gabriel Wheaton noted, “With these skills and using tools like the Brunton Transit compass daily, I came to appreciate the precision and reliability in Brunton equipment and the mindset of a geologist that makes quality fieldwork possible.” Benjamin Matsumura reflected, “The Brunton I received was wonderful to use and reminded me to work hard in the field.”

For Grimm Vannoy, field camp was a rigorous test of both technical and soft skills: “Even if you had exemplary geological knowledge... you would absolutely learn these skills in this class. It was the most challenging class I have ever taken, and I see now how important it is as a stress test for graduating geologists.”

Silas Snead summed it up perfectly: “All of these ups and downs would not be as feasible without the scholarship ... the Brunton is very much appreciated as it worked much better than many of the other Bruntons that they loaned out. Helped me keep that little bit more of my sanity.”

Applications for the Summer 2026 **GSA Field Camp Scholarships** are now open. Prepare to take your field geology experience to the next level!

https://rock.geosociety.org/eo/moreInformation.asp?program=scholar

Photo credit: Grace Sandige

Photo credit: Ursula Ziebolz

Photo credit: Stefany Wiszowaty

Photo credit: Xochitl Munoz

Hydrogeology of High Mountains: An Emerging Frontier for Water Resources, Landslide Hazard, and Carbon Fluxes

18–22 May 2026 | Dhulikhel, Nepal

Conveners

- Deepak Chamlagain, Tribhuvan University, Kathmandu, Nepal
- Marin Clark, University of Michigan, Ann Arbor, USA
- Niels Hovius, GFZ German Research Centre for Geosciences, Potsdam, Germany
- Joshua West, University of Southern California, Los Angeles, USA

Sponsors

- Geological Society of America
- U.S. National Science Foundation

Description and Objectives

Over the past two decades, new observations from the Himalayas, the Andes, and other high mountain ranges have revealed that bedrock groundwater systems are far more extensive and influential than previously thought. These subsurface flow networks can sustain river discharge, contribute to lowland aquifers, influence slope stability, and regulate weathering processes that affect long-term carbon fluxes. Yet major questions remain concerning how these systems function, how they respond to a warming climate, and how they shape both hazards and water resources in steep terrain.

Much of the recent progress has arisen within individual disciplines, leaving substantial opportunities for synthesis. This Penrose Conference will bring together researchers working across hydrology, geomorphology, geochemistry, and related fields to evaluate the current state of knowledge, compare emerging approaches, and identify priorities for the coming decade. Nepal, situated within one of the world's most dynamic high mountain environments, provides an ideal setting for focused discussion and collective assessment of this rapidly evolving field.

Conference Participants and Size

Participation will be limited to approximately 60 attendees, ensuring a focused environment for scientific exchange. The conveners have identified about 20 invited participants, representing geographic, disciplinary, and career-stage diversity. Additional participants will be selected from open applications, with the goal of assembling a group that reflects the range of expertise central to high mountain hydrogeology.

Applications and Registration

GSA and the conveners encourage applications from researchers across hydrology, geomorphology, geochemistry, climate science, environmental engineering, and related fields. We particularly welcome early career scientists and researchers working in high mountain regions worldwide. Participants will be responsible for their own travel to Nepal. Registration fees will cover lodging, meals, field-trip transportation, and meeting facilities. Limited financial assistance may be available for students and early career researchers.

Key Dates

- **Applications Open:** 8 December 2025
- **Application Deadline:** 30 January 2025
- **Acceptance Letters Sent & Registration Opens:** 20 February 2026
- **Registration Deadline:** 6 March 2026
- **Cancellation Deadline:** 3 April 2026
- **Conference Dates:** 18 May–22 May 2026

More Information & Application

Scan the QR code below to visit the event webpage for full details and application access.

GTS2030 – Defining the Future of Geologic Timescale Calibration

30 May–5 June 2026 | University of Iowa, Iowa City, Iowa

Conveners

- Brad Cramer, University of Iowa
- Mark Schmitz, Boise State University
- Anne-Christine Da Silva, University of Liège

Supporting Organizations and Communities

- Geological Society of America
- International Commission on Stratigraphy
- U.S. National Science Foundation
- GSA Geochronology Division
- University of Iowa – International Programs Office

Description and Objectives

The construction and calibration of the Geologic Time Scale remains one of the field's most demanding collaborative efforts. The next iteration of the timescale (GTS2030) will require continued and coordinated progress across stratigraphy, geochronology, astrochronology, sedimentology, paleontology, and statistical modeling. Although the GTS is fundamental to nearly all geoscience, significant challenges persist in resolving numerical boundary ages and integrating diverse chronostratigraphic and geochronologic datasets to calibrate the timescale.

This Penrose Conference brings together experts who work at the center of these issues. Stratigraphers and geochronologists pursue a shared goal, yet their analytical frameworks and uncertainty structures often remain siloed. Effective calibration depends on direct collaboration, something not typically fostered in standard conference settings.

GTS2030 requires improved datasets and consistent strategies for synthesizing them: evaluating sections and datums, comparing age models, addressing uncertainty, and applying transparent statistical frameworks capable of integrating multiple chronometers. The Iowa meeting will provide a focused environment to assess these needs and to outline a coherent, community-driven approach for the next global timescale revision.

Applications and Registration

GSA and the conveners are committed to fostering an inclusive and diverse community of researchers engaged in geologic timescale development. We welcome interest from individuals of all backgrounds, and we particularly encourage participation from students, postdoctoral scholars, and early career faculty.

A total of 90 participants will attend this meeting including keynote addresses and invited lectures from members of many subcommissions of the International Commission on Stratigraphy. The meeting is formally hosted by the International Subcommission on Timescale Calibration, and students and early-career scientists are strongly encouraged to apply to attend. Priority for attendance and financial support will be given to rising early-career scholars. We welcome applications from practitioners of any discipline or sub-discipline within geoscience for whom the GTS is a critical component. Accepted participants will be notified following review by the conveners.

Application & Key Dates

Participation in Penrose Conferences is intentionally limited to foster deep scientific discussion and collaboration.

- **Applications Open:** 8 December 2025
- **Application Deadline:** 30 January 2025
- **Acceptance Letters Sent & Registration Opens:** 14 February 2026
- **Abstract and Registration Deadline:** 6 March 2026
- **Cancellation Deadline:** 30 April 2026
- **Conference Dates:** 30 May–5 June 2026

More Information & Application

Scan the QR code below to visit the event webpage for full details and application access.

How to Build Complex Life: Understanding Ediacaran–Cambrian Environmental Change and the Emergence of Animals

25 May–2 June 2026
University of Namibia Southern Campus, Keetmanshoop, Namibia

Conveners

- Emmy Smith (Johns Hopkins University)
- Catherine Rose (University of St Andrews)
- Francis Macdonald (University of California, Berkeley)

Sponsors

- Geological Society of America
- U.S. National Science Foundation
- Agouron Institute

Description and Objectives

Since Darwin (1859) first observed the seemingly abrupt appearance of fossils in Cambrian strata, the cause and tempo of the 'Cambrian Explosion' has remained among the most compelling research topics in Geobiology. Many questions surrounding the Ediacaran-Cambrian Transition (ECT) remain unresolved: What were Earth's first macroscopic life forms, how did they live, and why did they go extinct at the base of the Cambrian Period? What is the significance of large carbon isotope excursions at the ECT for both the carbon and oxygen cycles? What is the source of anomalous Ediacaran paleomagnetic data? How rapid was the Cambrian radiation of animals? Much of the data addressing these questions comes from field sites in southern Namibia, the location of the proposed paired conference and Thompson Field Forum. This event will bring together an international and interdisciplinary community of ECT researchers to discuss key questions and visit outcrop and recent International Continental scientific Drilling Program (ICDP) cores through Geological Research through Integrated Neoproterozoic Drilling (GRIND-ECT), offering a timely opportunity to discuss, interrogate, and build upon research accomplished during the past five years.

Applications and Registration

GSA and the conveners encourage applications from researchers working across geochronology, geochemistry, paleontology, stratigraphy, paleomagnetism, and related fields. We particularly welcome applications from early career scientists and individuals from groups historically underrepresented in the geosciences. Selection will aim to achieve a balance of disciplinary perspectives, geographic backgrounds, and career stages, while preserving the small-group character of a Thompson Field Forum.

Applicants will be asked to submit a brief statement outlining their research interests and how their work relates to the meeting's themes. Full abstracts will be requested after acceptance. Participants will be responsible for their own travel to and from Namibia. The registration fee will cover lodging, meals, meeting facilities, field transportation, and logistical support. Limited financial assistance may be available to help offset costs for students and early career researchers.

Key Dates

- **Applications Open:** 8 December 2025
- **Application Deadline:** 30 January 2026
- **Acceptance Letters Sent & Registration Opens:** 20 February 2026
- **Registration Deadline:** 6 March 2026
- **Cancellation Deadline:** 3 April 2026
- **Conference Dates:** 25 May–2 June 2026

More Information & Application

Scan the QR code below to visit the event webpage for full details and application access.

The Ways We Give to GSA: Ellen Wohl's Geology Journeys and Legacies

Ellen Wohl has always been an explorer. She grew up immersed in nature, encouraged by her high school science teacher father and school librarian mother to investigate and analyze the ecosystems that surrounded her.

From a young age, she knew she wanted to keep learning about natural science. After earning degrees in geology from Arizona State and the University of Arizona, she joined the faculty at Colorado State University. This has been her academic home over a long and distinguished career as an expert in fluvial morphology.

The Geological Society of America (GSA) has been part of Ellen's journey since her student days. While completing her education, Ellen won a Fulbright-Hayes Grant to conduct research in Northern Australia. While prestigious, this award did not cover all costs. Ellen was awarded a GSA Research Grant for the same period, which provided affirmation along with vital funding. She notes, "psychologically and financially, that support is really critical."

The impact of this early award has stayed with Ellen—and inspired her to endow funds for future generations of geoscience students. She instigated and funded, in whole or part, GSA's Marie Morisawa Award, Troy L. Péwé Award, Victor R. Baker Graduate Student Research Grant Award, and Stanley A. Schumm Research Grant Fund. These GSA funds have supported numerous students and their research over the past years, and they will continue to do so in perpetuity.

Ellen's approach exemplifies the long-term impact of endowed giving. $100,000 invested in an endowment today, presuming historical return rates and an annual payout rate of 4.5%, will, over 50 years—the blink of an eye in geologic time—provide more than $350,000 in program support while growing to $438,000 in principal. Endowed funds are truly the gift that keeps on giving to more students, scholars, and investigators—and spur new discoveries that drive the future of geoscience.

Ellen Wohl.

Upon receiving a recent bequest from her mother, Ellen decided to give back yet again. She established the Richard and Annette Wohl Fund to provide research support to a graduate student whose proposal demonstrates an environmental sustainability connection to their proposed investigation.

Unlike the other funds, it is not named for a geoscientist. It is named for Ellen's parents: the intrepid explorers who nurtured her curiosity and encouraged her appreciation of ecology. "They raised me to ask questions, investigate the outdoors, and do all the things natural scientists do," Ellen says. GSA and the GSA Foundation are honored that Ellen chose to memorialize her parents in this way.

Ellen's parents also inspired her to build bridges between scientists and the curious general public. Thanks in part to their mentorship, she became skilled at sharing her expertise with lay audiences. This led to a flourishing career as an author on top of her work as a scholar and researcher.

Ellen's most recent book, Following the Bend: How to Read a River and Understand Its Nature, was published by Princeton University Press in September 2025. Following the Bend explains river ecosystems for lay readers. Where is the river flowing to or from, and why? Why is its water clear or turbid? Which fish and aquatic life make rivers their habitats, and what do they need to thrive? This book is attracting substantial attention and accolades. Ellen was recently invited to discuss it on the "Talk Nerdy" and "Listening to America" podcasts.

Ellen's journey shows how geoscience impacts all our lives. You too can further the excellence and impact of GSA for generations to come. Please scan the QR code below to donate now, or contact GSA Foundation Executive Director Sean O'Brien, PhD, at sobrien@geosociety.org. The GSA Foundation would love to help you learn how you, like Ellen, can create a legacy for the future of geoscience.

You can also contact Sean or Becky Priest Santavicca at bsantavicca@geosociety.org if you would like to learn more about the GSA Foundation's upcoming rendezvous trips to Death Valley (29 March–3 April 2026) or Bryce Canyon (6–11 September 2026).

Ellen's parents, Richard and Annette Wohl. Photo from Ellen Wohl.

All donations make a difference. Please scan the QR code to make a gift now, or contact GSA Foundation Executive Director Sean O'Brien, PhD, at sobrien@geosociety.org to learn about more ways to give. Gifts to the GSA Foundation are fully tax-deductible under U.S. law.

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