

GSA TODAY

 THE GEOLOGICAL SOCIETY
OF AMERICA®

VOL. 30, NO. 2 | FEBRUARY 2020

The Future for Geoscience in the Context of Emerging Climate Disruption



SCIENCE EDITOR

OPENINGS
2021
FOR

GSA is soliciting applications for three science co-editors for the journal *Geology*. The **four-year terms begin 1 January 2021**. Duties include: ensuring stringent peer review and expeditious processing of manuscripts; making final acceptance or rejection decisions after considering reviewer recommendations; and, along with your co-editors, setting the editorial tone of *Geology* and maintaining excellent content through publication of a diverse range of papers. *Geology* editors should expect to handle 200–250 manuscripts each year, with ~35 active manuscripts on any given day.

3 POSITIONS AVAILABLE

GEOLOGY Research interests that complement those of the continuing editors include, but are not limited to: geochemistry, geomorphology, petrology, tectonics, tectonophysics, structural geology, seismology, volcanology, Earth surface processes, planetary geology, Quaternary studies, hydrogeology, and economic geology.

Note: Because of the volume of papers received by *Geology* and the breadth of the topics covered, editors must be willing to handle papers outside of their main disciplines.

GEOLOGY

TO APPLY

Submit the following to Jeanette Hammann, jhammann@geosociety.org:

- ▶ A **letter** detailing how your experience (including editorial experience) qualifies you for a science editor position, and
- ▶ A **curriculum vitae**

The GSA Publications Committee will review applications at its spring 2020 meeting. The Committee won't consider incomplete applications.

Editors work out of their current locations at work or at home. The positions are considered voluntary, but GSA provides an annual stipend and funds for office expenses. **DEADLINE:** First consideration will be given to nominations or applications received by **15 March 2020**.

A SUCCESSFUL EDITOR WILL HAVE:

- ▶ a broad interest and experience in geosciences, including familiarity with new trends;
- ▶ experience as an editor or associate editor for a geoscience journal (experience with a GSA publication is preferred but not required);
- ▶ international recognition and familiarity with many geoscientists and their work;
- ▶ a progressive attitude and a willingness to take risks and encourage innovation;
- ▶ ability to make timely decisions; and
- ▶ a sense of perspective and humor.

GSA TODAY

GSA TODAY (ISSN 1052-5173 USPS 0456-530) prints news and information for more than 22,000 GSA member readers and subscribing libraries, with 11 monthly issues (March-April is a combined issue). *GSA TODAY* is published by The Geological Society of America® Inc. (GSA) with offices at 3300 Penrose Place, Boulder, Colorado, USA, and a mailing address of P.O. Box 9140, Boulder, CO 80301-9140, USA. GSA provides this and other forums for the presentation of diverse opinions and positions by scientists worldwide, regardless of race, citizenship, gender, sexual orientation, religion, or political viewpoint. Opinions presented in this publication do not reflect official positions of the Society.

© 2020 The Geological Society of America Inc. All rights reserved. Copyright not claimed on content prepared wholly by U.S. government employees within the scope of their employment. Individual scientists are hereby granted permission, without fees or request to GSA, to use a single figure, table, and/or brief paragraph of text in subsequent work and to make/print unlimited copies of items in *GSA TODAY* for noncommercial use in classrooms to further education and science. In addition, an author has the right to use his or her article or a portion of the article in a thesis or dissertation without requesting permission from GSA, provided the bibliographic citation and the GSA copyright credit line are given on the appropriate pages. For any other use, contact editing@geosociety.org.

Subscriptions: GSA members: Contact GSA Sales & Service, +1-888-443-4472; +1-303-357-1000 option 3; gsa-service@geosociety.org for information and/or to place a claim for non-receipt or damaged copies. **Nonmembers and institutions:** *GSA TODAY* is US\$105/yr; to subscribe, or for claims for non-receipt and damaged copies, contact gsa-service@geosociety.org. Claims are honored for one year; please allow sufficient delivery time for overseas copies. Periodicals postage paid at Boulder, Colorado, USA, and at additional mailing offices. Postmaster: Send address changes to GSA Sales & Service, P.O. Box 9140, Boulder, CO 80301-9140.

GSA TODAY STAFF

Executive Director and Publisher: Vicki S. McConnell

Science Editors: **Mihai N. Ducea**, University of Arizona, Dept. of Geosciences, Gould-Simpson Building, 1040 E 4th Street, Tucson, Arizona 85721, USA, ducea@email.arizona.edu; **Peter Copeland**, University of Houston, Department of Earth and Atmospheric Sciences, Science & Research Building 1, 3507 Cullen Blvd., Room 314, Houston, Texas 77204-5008, USA, copeland@uh.edu.

Member Communications Manager: Matt Hudson, mhudson@geosociety.org

Managing Editor: Kristen "Kea" Giles, kgiles@geosociety.org, gsatoday@geosociety.org

Graphics Production: Emily Levine, elevine@geosociety.org

Advertising Manager: Ann Crawford, +1-800-472-1988 ext. 1053; +1-303-357-1053; Fax: +1-303-357-1070; advertising@geosociety.org

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

Printed in the USA using pure soy inks.

4 **2019 GSA Presidential Address: The Future for Geoscience in the Context of Emerging Climate Disruption**
Donald I. Siegel



Cover: Clockwise from top left: Array of photovoltaic panels and sun, Mojave Desert, USA. California oil pump jack near Taft, California, USA. Windmills at Altamont Pass, California, USA. Aerial view of geothermal power plant, The Geysers geothermal field, California, USA. Photos by Marli Miller, University of Oregon. See related article, p. 4–5.

- 6 **Commentary: Decoupling Process from Form in Landscape Evolution Studies**
- 8 **Thompson Field Forum Report: Age and Carving of Grand Canyon: Toward a Resolution of 150 Years of Debate**
- 12 **GSA/ExxonMobil Field Awards**
- 13 **GSA J. David Lowell Field Camp Scholarships**
- 13 **2020 Undergraduate Student Research Grants**
- 13 **Travel Awards to the 2020 Southeastern-Northeastern Joint Section Meeting**
- 14 **Give Us Your Best Shots: 2021 GSA Calendar Photo Search**
- 15 **2019 Outstanding Earth Science Teacher Awards**
- 16 **Second Announcement: Rocky Mountain Section Meeting**
- 19 **2020 GSA Section Meetings**
- 20 **Second Announcement: Cordilleran Section Meeting**
- 24 **Second Announcement: North-Central Section Meeting**
- 29 **GeoCareers Programs at the 2020 Section Meetings**
- 30 **Call for Nominations: GSA Scientific Division Awards**
- 36 **Geoscience Jobs & Opportunities**
- 38 **GSA Foundation Update**



The Future for Geoscience in the Context of Emerging Climate Disruption



Donald I. Siegel

Donald I. Siegel, Syracuse University, Syracuse, New York, USA; president@geosociety.org

I speak to climate disruption, the result of the most sweeping tragedy of the commons, when nations use a resource owned by none, in this case the atmosphere (Hardin, 1968), and then individually degrade it to achieve individual advantage. The tragedy of the commons originally referred to common

pastures where farmers would graze their animal stock. When each farmer incrementally added more animals—thinking nothing bad would happen—the pasture failed. Much as humanity has incrementally added greenhouse gases to our collective atmosphere.

Sadly, I see no evidence that most nations releasing greenhouse gases will make the necessary economic and political decisions to prevent at least a two-degree increase in average tropospheric temperature—a temperature beyond which severe climate disruption will almost certainly affect our way of life and the survival of many, if not most, current ecosystems (e.g., Knutti et al., 2016). Large swaths of our planet will suffer hell or high water or both.

Hypothetically, of course, humanity could scale up and generate sufficient green energy by covering hundreds of thousands of square miles in the world's major deserts with solar panels and then retooling up our electric grids. Landscapes would be created filled with solar panels and turbines as far as the eye could see, like cornfields in Iowa. Here in the United States, we'd cover an area equivalent to at least two states and globally, the area of a medium-sized country. You just have to look at the figure at <https://ourworldindata.org/energy-production-and-changing-energy-sources> to see how far we have to go. Historically, it takes about three decades for a new energy to replace even 20% of what was used prior. How can we possibly go renewable globally (the operative word to make a difference) given this historical reality?

In addition, humanity will also have to develop orders-of-magnitude more electrical storage capacity and find and mine up to ten times more rare elements than we now get from open pits or playa lakes to do the green energy. Humanity already has mined out the easy elements to find. Where will the rest come from?

We also may have to remove greenhouse gas from the atmosphere too. Think of this—another huge energy demand on top of the rest!

It's mind-boggling to me that this can be done in the next few decades.

There are other options to go green beyond solar and wind. We could build out large numbers of twenty-first-century modular modern nuclear power plants, perhaps fueled by thorium. Much safer nuclear than before constitutes a reality now. The technology of the three reactors (out of about 450 reactors) worldwide that critically failed because of gross human error or mega-earthquakes has long gone.

We could also add hydrogen-based energy to our energy portfolio, or miraculously discover a brand-new energy source that can be tied to the current grid. But given the time to do this, I find the odds are long to globally accomplish this task.

Why? Because of the toxic mix of modern nationalism, environmentalism unwilling to accept technological changes in energy and food production, a western public unwilling to understand absolute risk or accept economic inconvenience, and poor nations who logically want to have good health and opportunities like us.

Does anyone really think that hydrocarbons and coal will globally disappear as fuels? That poorer nations with these resources will not exploit them to help their economies? Does anyone think when Venezuela once again becomes a viable country it will not exploit the biggest economic resource it has—Maracaibo Basin crude? Or, that other nations will not buy what we here in America don't use and at lower prices?

My consulting partner Ed Hinchey (also a GSA member) tells me that using fossil fuels constitutes a zero-sum game. Globally, oil and gas may very well be used to the very last drop, like coffee in the Maxwell House advertisement. I sadly have to agree with him. The future energy demand remains that great, and fossil fuels are the densest energy source next to nuclear.

Please understand, I am not suggesting we abandon “going green.” I repeat. I am not suggesting that we abandon going green with solar and wind. Far from it. Humanity globally needs to build out solar and wind to the extent that identified natural resources, economics, and politics allow us to do it. Globally. That is the problem. Globally. How can that be done fast and efficiently today to replace fossil fuels? And be politically and economically acceptable.

I have to conclude that until climate disruption seriously affects large swaths of economically well-to-do populations, little will be done at the scale needed to make a global difference—I repeat—at the scale needed. The global scale (I am purposely being redundant). It will not work at the village scale. Villages and towns can't solve the problem because most of the world's population lives in giant megacities that need continual baseline uninterrupted power.

Adapting to environmental disruption and trying to go green as best we can will be humanity's best hope for our future. By adaptation I mean developing new science and engineering technology designed to build extensive wetlands, dikes, and other ways to attenuate floods; new regional water delivery systems and desalination plants; genetic advances designed to grow plants under stressful climatic conditions; and extensive exploration for rare elements and then extracting them with attendant additional environmental cost—perhaps even from the ocean floor.

I also see experiments in the near future on how to best place aerosols into the high atmosphere to reflect sunlight. The National Academy of Sciences (NRC, 2015) suggested we should begin these experiments sooner than later because geoengineering the atmosphere will be humanity's last resort. Technically geoengineering the

atmosphere seems remarkably easy and inexpensive, but the uncertainty of what regionally will happen with the climate will remain large without small-scale experimentation first.

To this end, I suggest that GSA's Environmental & Engineering Geology Division, Energy Geology Division, Geology and Society Division, and Hydrogeology Division, at the very least, could put GSA in a leadership position with respect to developing climate adaptation strategies. They could begin to offer sessions on it at meetings or organize Penrose Conferences. I urge them and other GSA Divisions to consider taking on this challenge individually or collectively.

If GSA does not, I guarantee that other societies and disciplines will quickly rise to the challenge, possibly to poorer success. I especially urge geoscientists beginning their careers and those in mid-career to reflect how they could participate in future adaptation ventures—even if they don't like the idea, don't want to hear about it, or think nobody can predict the future. Maybe.

But I hereby predict that climate disruption will continue to worsen in the next 20 years, well beyond the two-degree centigrade threshold. I am 72 years old. The last twenty years roared past me—like a finger snapping. Thirty years from now, those of you in your twenties will be in mid-career. Snap. Those of you approaching retirement will be... well, I'll let that one slide.

To those of you who disagree with me, I welcome emails or messages to me on Facebook, Twitter, Instagram, LinkedIn, even stamped letters that scientifically counter what I say. But please base your comments on the combination of observable scientific, social, and political facts and trends—not wishes and hopes that doing the right thing by incrementally going green, changing how people in the west consume, or miraculous discoveries will solve the problem. There remains too little time for hoping, wishing,

incremental change, and placing bets on miraculous discoveries or large masses of people choosing large-scale sacrifice for the betterment of humanity and the environmental worldwide. History tells me these will not happen.

To end my talk, I propose a set of environmental freedoms, extensions of the four freedoms that President Franklin Roosevelt gave to America during World War II, another time of existential threat to our way of life.

First, I propose the freedom from recurrent extreme climate-driven disasters—not all climatic harm—just extreme harm.

Second, I propose the freedom from worrying we won't have reasonably clean and safe water, air, and food. Reasonably. Not perfectly.

Third, I propose the freedom from losing environments we cherish. Not everywhere, but in places we collectively choose. I frankly wonder if this freedom can be met—even theoretically—given the rising pace of ecological disruption from climate change.

Finally, I propose the freedom from worrying that the necessary additional environmental harm and economic sacrifice needed to achieve the first three freedoms will not be made in vain.

Four environmental freedoms for our future. From my lips—perhaps to our politicians' ears.

Thank you very much.

REFERENCES CITED

Hardin, G., 1968, The tragedy of the commons: *Science*, v. 162, p. 1243–1248, <https://doi.org/10.1126/science.162.3859.1243>.
Knutti, R., Rogelj, J., Sedláček, J., and Fischer, E.M., 2016, A scientific critique of the two-degree climate change target: *Nature Geoscience*, v. 9, p. 13, <https://doi.org/10.1038/ngeo2595>.
NRC, 2015, *Climate intervention: Reflecting sunlight to cool Earth*: National Academies Press, Washington, D.C., 250 p., <https://doi.org/10.17226/18988>.

YOUR SCIENCE HERE

Get your science out in front of thousands of readers, with open access bringing in more readers all the time.

GSA Today publishes peer-reviewed science, with no page charges or fees for color figures. Plus, your science article will be featured on the front cover.

Go to <https://www.geosociety.org/gsatoday> to read more than 29 years of science and Groundwork articles, plus other features and commentary.

All articles are published online ahead of print with an average six-week turnaround from acceptance to publication.



Upload to our peer-review system at <https://gsatoday.msubmit.net>.

Decoupling Process from Form in Landscape Evolution Studies

D.W. Hedding, Dept. of Geography, University of South Africa, Florida 1710, South Africa, heddiddw@unisa.ac.za

According to Cruden (2003), the term “landslide” was first recorded in 1838 by J.D. Dana. Varnes (1958) used “landslide” in the title of his well-known paper but subsequently abandoned the term in favor of “slope” in the updated iteration (see Varnes, 1978). Varnes (1978, p. 11) states that the reason for the change is that “improvements in technical communication require a deliberate and sustained effort to increase the precision associated with the meaning of words, and therefore the term slide will not be used to refer to movements that do not include sliding.” Later, Cruden (1991, p. 28) suggested that a landslide is “the movement of a mass of rock, earth or debris down a slope” and is intended for informal, non-technical use. Several other definitions have been suggested; however, Shanmugam (2015) notes that the term “landslide” lacks conceptual clarity. Nevertheless, the term “landslide” remains entrenched in the literature and, with each scientific discipline using its own nomenclatural scheme, it means different things to different groups (Shanmugam, 2015).

In the study of landscape evolution, the transfer of considerable volumes of material downslope under the influence of gravity plays a significant role in shaping landscapes (Cendrero and Dramis, 1996). As such, various papers assess the role and significance of slope processes and resultant mass movements in landscape evolution, typically within the context of quantifying erosion rates (Roda-Boluda et al., 2019) and/or the roles of tectonic and climatic factors in weathering (Emberson et al., 2016). Often the terms “landsliding” or “bedrock landsliding” are used to describe the process by which material moves downslope (Egholm et al., 2013; Roering et al., 2001, 2005). However, their usage demonstrates a poor appreciation of the difference between process and form in geomorphology since these terms are intrinsically linked to landslides that are a discrete geomorphological landform and not to the range of process(es) that are responsible for the movement of material downslope in landscape evolution. In addition, form-convergence (equifinality) suggests that morphologically similar landforms can be generated by different processes, on their own or in combination, which complicates the correct identification of the process-origin of landforms (Hedding, 2016; Hedding et al., 2018). Still, the term “landsliding” is often described as the process responsible for the movement of material downslope and has received a level of credence (see Roering et al., 2001) through repetition and subsequent acceptance in the literature, rather than recognition of the actual process-form relationships. Notwithstanding the poor phrasing, the term “landsliding” is sometimes used as a synonym for “mass wasting.” However, the movement of material downslope in landscape evolution can be generated through a suite of mass wasting (movement) processes resulting in landforms (e.g., catastrophic mudflows and rockfalls) and not solely from movement of material along a plane of weakness resulting in various types of landslides. In particular, the relative contribution of material through rockfall activity may be critical, specifically in seismically active regions where topographic amplification of seismic waves along ridgelines, which are not supported laterally, can produce significant

volumes of debris. Thus, conflation of process and form in terminology used across the disciplines encompassed by the geosciences (e.g., geology, geochemistry, geomorphology, and sedimentology) may lead to a limited understanding of the processes responsible for landscape evolution and denudation, particularly where English may be the second language of the researcher and a literal or direct interpretation is utilized. To resolve the potential confusion, the term “landsliding” should be abandoned and replaced with the term “mass wasting,” an established term in geomorphology, to decouple process(es) from form(s) in research on landscape evolution and in other geosciences. Mass wasting is an encompassing term that refers specifically to the processes responsible for the movement of material downslope. In addition, “deep-seated mass wasting” should be used to replace “bedrock-landsliding” in the lexicon of landscape evolution. To avoid further confusion, it is pertinent to highlight that “mass movements” is a term used to describe the resultant landforms generated through the processes of mass wasting.

REFERENCES CITED

- Cendrero, A., and Dramis, F., 1996, The contribution of landslides to landscape evolution in Europe: *Geomorphology*, v. 15, p. 191–211, [https://doi.org/10.1016/0169-555X\(95\)00070-L](https://doi.org/10.1016/0169-555X(95)00070-L).
- Cruden, D.M., 1991, A simple definition of a landslide: *Bulletin of the International Association of Engineering Geology*, v. 43, p. 27–29, <https://doi.org/10.1007/BF02590167>.
- Cruden, D.M., 2003, The first classification of landslides?: *Environmental & Engineering Geoscience*, v. 9, p. 197–200, <https://doi.org/10.2113/9.3.197>.
- Egholm, D.L., Knudsen, M.F., and Sandiford, M., 2013, Lifespan of mountain ranges scaled by feedbacks between landsliding and erosion by rivers: *Nature*, v. 498, p. 475, <https://doi.org/10.1038/nature12218>.
- Emberson, R., Hovius, N., Galy, A., and Marc, O., 2016, Chemical weathering in active mountain belts controlled by stochastic bedrock landsliding: *Nature Geoscience*, v. 9, p. 42–45, <https://doi.org/10.1038/ngeo2600>.
- Hedding, D.W., 2016, Pronival ramparts: Origin and development of terminology: *Erdkunde*, v. 70, p. 141–151, <https://doi.org/10.3112/erdkunde.2016.02.03>.
- Hedding, D.W., Brook, M.S., and Winkler, S., 2018, Old landscape, new eyes: Revisiting geomorphological research in the Southern Alps of New Zealand: *New Zealand Geographer*, v. 74, p. 109–112, <https://doi.org/10.1111/nzg.12189>.
- Roda-Boluda, D.C., D’Arcy, M., Whittaker, A.C., Gheorghiu, D.M., and Rodés, A., 2019, ¹⁰Be erosion rates controlled by transient response to normal faulting through incision and landsliding: *Earth and Planetary Science Letters*, v. 507, p. 140–153, <https://doi.org/10.1016/j.epsl.2018.11.032>.
- Roering, J.J., Kirchner, J.W., Sklar, L.S., and Dietrich, W.E., 2001, Hillslope evolution by nonlinear creep and landsliding: An experimental study: *Geology*, v. 29, p. 143–146, [https://doi.org/10.1130/0091-7613\(2001\)029<0143:HEBNCA>2.0.CO;2](https://doi.org/10.1130/0091-7613(2001)029<0143:HEBNCA>2.0.CO;2).
- Roering, J.J., Kirchner, J.W., and Dietrich, W.E., 2005, Characterizing structural and lithologic controls on deep-seated landsliding: Implications for topographic relief and landscape evolution in the Oregon Coast Range, USA: *Geological Society of America Bulletin*, v. 117, no. 5–6, p. 654–668, <https://doi.org/10.1130/B25567.1>.
- Shanmugam, G., 2015, The landslide problem: *Journal of Palaeogeography*, v. 4, no. 2, p. 109–166, <https://doi.org/10.3724/SP.J.1261.2015.00071>.
- Varnes, D.J., 1958, Landslide types and processes, in Eckel, E.B., ed., *Landslide and Engineering Practice: Highway Research Board Special Report*, v. 29, p. 20–47.
- Varnes, D.J., 1978, Slope movement types and processes, in Schuster, R.L., and Krizek, R.J., eds., *Landslides: Analysis and Control: Washington, D.C., National Academies of Science, Special Report 176*, p. 11–33.

MANUSCRIPT RECEIVED 19 SEPT. 2019

REVISED MANUSCRIPT RECEIVED 11 NOV. 2019

MANUSCRIPT ACCEPTED 16 NOV. 2019



MS2/MS3 Magnetic Susceptibility Measuring Equipment

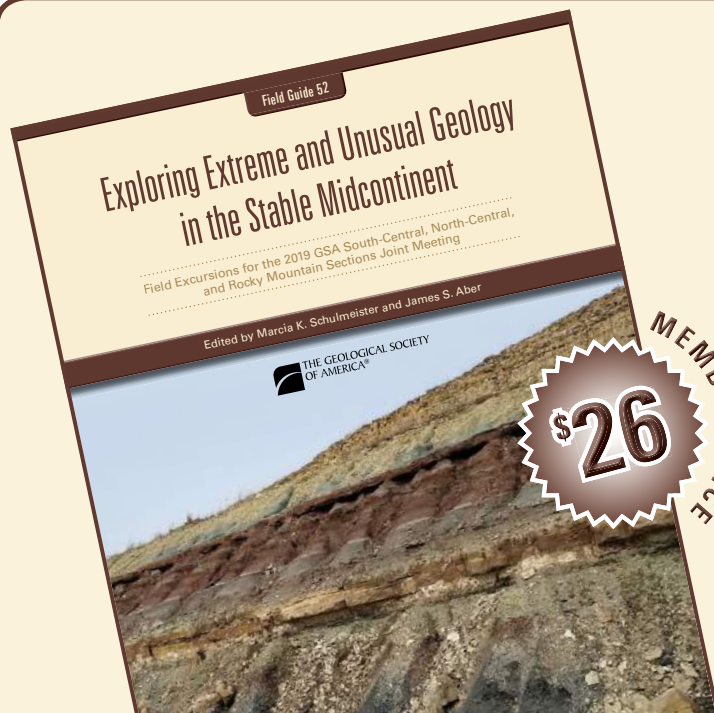
- Resolution to 2×10^{-6} SI
- Laboratory sensor with dual frequency facility
- Core logging and scanning sensors
- Field survey equipment



US distributor: ASC Scientific
E: sales@ascscientific.com | W: www.ascscientific.com



FIELD GUIDE 52



Exploring Extreme and Unusual Geology in the Stable Midcontinent: Field Excursions for the 2019 GSA South-Central, North-Central, and Rocky Mountain Sections Joint Meeting

Edited by Marcia K. Schulmeister and James S. Aber

The flat-lying sedimentary strata of the North American midcontinent are typically thought of as uniform and predictable. However, mid-continent geology contains a record of exciting geologic events and processes. The papers in this volume examine four geologic phenomena associated with the continental interior: Pennsylvanian and Permian cyclothems, the origin of a massive Permian salt deposit, Cretaceous kimberlite intrusions, and Quaternary glacial geology. The guides cover processes and events that are unique to the geology of Kansas and highlight important economic and rich historical influences of these geologic features.

\$26
MEMBER PRICE

FLD052, 70 p., ISBN 9780813700526
list price \$38.00 | member price \$26.00



THE GEOLOGICAL SOCIETY OF AMERICA®

BUY ONLINE ▶ <http://rock.geosociety.org/store/>

toll-free 1.888.443.4472 | +1.303.357.1000, option 3 | gsaservice@geosociety.org

Age and Carving of Grand Canyon: Toward a Resolution of 150 Years of Debate

14–21 September 2019 | Grand Canyon, Arizona, USA

CONVENERS

Karl E. Karlstrom, *University of New Mexico, Albuquerque, New Mexico 87131, USA; kek1@unm.edu*

Laura J. Crossey, *University of New Mexico, Albuquerque, New Mexico 87131, USA*

Eugene Humphreys, *University of Oregon, Eugene, Oregon 97403, USA*

David Shuster, *University California Berkeley, Berkeley, California 94720, USA*

Kelin Whipple, *Arizona State University, Tempe, Arizona 85287, USA*

Ryan Crow, *U.S. Geological Survey, 2255 N. Gemini Road, Flagstaff, Arizona 86001, USA*

PARTICIPANTS

Andres Aslan (AA); Thorsten Becker (TB); Whitney Behr (WB); Jeanne Calhoun (JC); Kristen Cook (KC); Laurie Crossey (LC); Ryan Crow (RC); Andy Darling (AD); Rebecca Dorsey (RD); Madison Douglas (MD); Claudio Faccenna (CF); Anke Friedrich (AF); Arjun Heimsath (AH); Gene Humphreys (GH); Karl Karlstrom (KK); Eric Kirby (EK); Alan Levander (AL); M. Qasim Mahmood (MQM); Juliet McKenna (JM); Peter Reiners (PR); Marisa Repasch (MR); David Rowley (DR); Leah Sabbeth (LS); Taylor Schildgen (TS); David Shuster (DS); Peter van der Beek (PvdB); Brian Wernicke (BW); Kelin Whipple (KW).*

This GSA Thompson Field Forum involved 28 researchers and young scientists who discussed the evidence for the age, geomorphic evolution, and incision history of Grand Canyon. The field forum was centered around an eight-day, 280-mile field conference by raft through the Grand Canyon. Each of the participants gave a field seminar presentation.

Water in Grand Canyon's dissected aquifer system includes the Colorado River plus indigenous groundwaters that emerge as springs. John Wesley Powell, in an 1893 address to irrigation advocates in Los Angeles, foresaw: "... a heritage of conflict and litigation over water rights for there is not enough water to supply the land." As we face a hotter and drier future, our task is to figure out how to make do with less water and more people while preserving our quality of life, lands, groundwater resources, and groundwater-dependent ecosystems (JM). Grand Canyon's incised

aquifer system shows mixing of meteoric, karst, and CO₂-rich "lower world" waters, and complex water pathways (LC). Grand Canyon National Park, in its 100th anniversary and beyond, is working to establish a better baseline for understanding water quantity and quality as well as complex groundwater flow paths in order to continue to provide water for the park's more than six-million annual visitors (JC).

Regional uplift of the Rocky Mountain–Colorado Plateau region took place in three episodes (Laramide, mid-Tertiary, and past 10 Ma), each related to a phase of carving of paleocanyons, but the relative uplift amounts have yet to be well quantified; ~thirds for each is one estimate (KK, GH). These lithospheric modifications started with flat slab subduction of the buoyant conjugate of the Shatsky Rise (GH). Middle Tertiary removal of the slab initiated the ignimbrite flare-up volcanism with uplift and heating consequences that still need to be deconvolved (PR). Young and ongoing uplift of the Rockies relative to the Colorado Plateau (EK, AA) and of western Colorado Plateau relative to sea level (KK, RC) may be driven by mantle convection at global scales (DR) but is probably dominated by changes in lithospheric density structure (GH), for example, by lithosphere delamination and asthenospheric return flow (AL) that is driving inboard migration of basaltic volcanism (RC). Mantle xenoliths were seen near Lava Falls that show deformation features and give pressure and temperature information about mantle tectonism (WB).

Geodynamics of uplift involved both isostatic and dynamic forces. We used the term "dynamic topography" for the components of topography not explained by crustal isostasy (DR). The western U.S. upper mantle contains very large gradients in seismic velocity that likely reflect marked buoyancy variations that affect topography. Estimates of dynamic topography for the region in recent papers range from several kilometers (TB) to near zero. Empirical estimates of differential uplift over the past 5–10 Ma of ~1 km are based on differential incision studies of rivers, which is observed where rivers cross sharp mantle velocity gradients (KK, RC, AA, EK).

Age of the Colorado River: The oldest known deposits of a major river draining the western Rockies are the 11 Ma gravels below the Grand Mesa basalt (AA). Downward integration of the system is suggested by onset of rapid cooling near Rifle, Colorado,



Group picture at the Little Colorado River. Photo by Laurie Crossey. Front row, from left: Marisa Repasch; M. Qasim Mahmood; Taylor Schildgen; Andy Darling; Arjun Heimsath; Karl Karlstrom; Laurie Crossey; Peter Reiners; Juliet McKenna. Standing, from left: Thorsten Becker; Kristen Cook; Kelin Whipple; Jeanne Calhoun; Whitney Behr; Eric Kirby; Andres Aslan; David Rowley; Gene Humphreys; Alan Levander; Peter van der Beek; Madison Douglas; David Shuster; Ryan Crow; Leah Sabbeth; Anke Friedrich; Brian Wernicke; Becky Dorsey; and Claudio Faccenna.

(MWX well) at 6–8 Ma, before the Colorado River was integrated through Grand Canyon (EK). The Green River was integrated with the Colorado between 8 and 2 Ma, but the lack of terraces older than 2–3 Ma and steady incision documented by detrital sanidine dating data suggest a young 2–3 Ma Green River integration (AA). New detrital sanidine dating combined with magnetostratigraphy show that the oldest Colorado River sediment was first delivered to the Gulf of California between 4.8 and 4.63 Ma (RC). Recent studies provide new evidence for a multistage history of punctuated sediment discharge and complex marine-river interactions during integration of the Colorado River to the ocean (RD).

Thermochronology allows us to reconstruct past, now-eroded, landscapes. Lees Ferry and Marble Canyon rocks were $>60\text{ }^{\circ}\text{C}$ until after 5 Ma, indicating that this area was beneath $\sim 2\text{ km}$ of Jurassic and Cretaceous strata (Vermillion cliffs) and hence was not carved until the past 5 Ma (KK). All thermochronology models for the eastern Grand Canyon segment show rim- and river-level samples at $50\text{--}80\text{ }^{\circ}\text{C}$ until 25–15 Ma, indicating this segment of Grand Canyon was also not carved in its present location and depth. Rim- and river-level samples that are now separated vertically by 1.5 km show different rim ($\sim 55\text{ }^{\circ}\text{C}$) and river ($\sim 85\text{ }^{\circ}\text{C}$) temperatures until their temperatures converged 25–15 Ma, indicating that an East Kaibab paleocanyon was carved across the Kaibab uplift at this time (KK). Best time-temperature histories need to account for the long radiation damage history and that lattice damage by alpha particle decay has different annealing characteristics than fissioning of radioactive nuclei (DS).

Age of Grand Canyon: Endmember “Young Canyon” models (all post-6 Ma) and “Old Canyon” models (70–50 Ma) were not strongly supported on the trip. A “paleocanyon solution” is that integration of the Colorado River at 5–6 Ma deepened older paleocanyon segments as it carved Grand Canyon (KK). Marble

Canyon is a young (post-5 Ma) canyon segment based on thermochronology. Eastern Grand Canyon may have been partially carved 25–15 Ma by a paleo-Little Colorado River. Muav Gorge “looks young” like Marble Canyon but has little incision rate data. A 65–50 Ma north-flowing Hualapai paleoriver (Music Mountain Formation) and Hindu paleovalley have been long recognized; these may have followed the Hurricane fault segment. Westernmost Grand Canyon has recent thermochronologic data that are most consistent with it being carved below the Esplanade surface in the past 5 Ma (DS, KK). A Wheeler Ridge ca. 20 Ma paleocanyon and a ca. 20 Ma paleoriver that supplied clasts from Grand Canyon’s Shinumo Sandstone to the Sespe Formation of California were presented and debated (BW, LS).

Bedrock incision rates in the northern Colorado River basin have been 100–160 m/Ma over the past 10 Ma and somewhat faster (200–300 m/Ma) over the past 0.3 to 1 Ma. Short-term (100 ka) incision rates are variable, reflecting complexities of fluvial processes at glacial-interglacial scales. Incision rates in Grand Canyon show semi-steady incision at 160 m/Ma over the past 1.2 Ma in the east; 100–110 m/Ma over 1.2 Ma in central Grand Canyon; and 90–100 m/Ma over 3–4 Ma in the west (RC). Steady incision in a given reach at the million-year timescale suggests steady forcings, the absence of major knickpoint passage, and a tectonic uplift driver (RC, KK, AA, EK). Differences reach-to-reach have been interpreted by some researchers to reflect active differential uplift (RC, KK, AA, EK), although geomorphic dampening from landslides, such as the three-million-year history of landsliding near Surprise Valley (KK), may have dampened bedrock incision in central Grand Canyon. Seventeen lava damming events from ca. 800 to 100 ka are recorded in western Grand Canyon; these dams quickly failed by overtopping, then the system returned to semi-steady bedrock incision rates (RC).

Incision history may be affected by ongoing uplift, but this is debated. Absent strong spatial gradients in rock strength or rock uplift rate relative to base level, rivers evolve toward smoothly concave-up profiles. In contrast, major slope-break knickpoints or convexities in the river profile existing on the Colorado River at Lees Ferry and on the Little Colorado River near Cameron give rise to “double concave” river profiles. These knickpoints coincide with the top of the Kaibab Limestone surface, suggesting a controlling influence of rock strength. These and other profile convexities are at least partly controlled by rock strength (KW, KC) and may be “hung up” in harder rocks, complicating interpretation (AD, KC). Projection of the restored level of the pre-6 Ma Little Colorado paleoriver profile through the proposed East Kaibab paleocanyon suggests that the Esplanade bedrock bench of western Grand Canyon could have been cut at this time (KW), although a new date of 3.3 Ma of basalt on Whitmore Hill that rests on Hermit Shale shows that the entire Esplanade surface had not yet been exposed at this time (KK).

Landscape evolution of the region has been influenced by pronounced differences in rock erodibility (rock strength) that give rise to the characteristic cliff and bench morphology of canyon walls and the Grand Staircase. Erosion rates can be quantified by measuring the concentration of cosmogenic ^{10}Be in sands deposited by river tributaries (AH). These data show significant scatter but with averages in eastern and central Grand Canyon generally similar to independently measured incision rates (KW). In western Grand Canyon, tributary profiles are suggestive of sustained quasi-steady river incision since integration (AD). However, it is also possible that incision on these tributaries has ceased, but their form is preserved by an armoring of large boulders that inhibits further incision and topographic relaxation, potentially consistent with a longer history of western Grand Canyon (MD). Contrary to

this idea, cliff and tributary river profiles along the <17 Ma Grand Wash Cliffs are considerably less steep than those in western Grand Canyon despite similar geology and climate, implying that the final ~1 km of relief generation in westernmost Grand Canyon is <10 Ma (AD).

Regional and global analogs were also discussed. Mantle-driven uplift at a rising plume head can be modeled to leave predictable stratigraphic patterns in the sedimentary record of many continents (AF). The Rio Grande, on the other side of the continental divide, extended its length in a downward direction about six million years ago at the same time Grand Canyon was becoming integrated, which may implicate climatic changes near the end of the Miocene (MR). River incision and profile analysis in the central Anatolian region of the eastern Mediterranean supports very young tectonic uplift caused by slab breakoff (TS). Himalayan and Andean rivers show double-concave profiles with major knickzones, a delay between uplift and incision in knickzones, fault-control on knickzones, and tectonic rather than climate controls on incision (PvdB). Along the Nile River, the change in base level during the Messinian drawdown, and the uplifting Ethiopian Plateau headwaters provide possible direct comparisons to Colorado Plateau evolution with similar multi-stage uplift and potential ongoing mantle-driven dynamic uplift (CF).

Geoscience outreach is needed to improve global science literacy. Challenges include language barriers, validating tested from pseudoscience, citing and crediting sources, and outreach to developing countries. The “Learning Geology” Facebook page (headed by MQM) reaches 137,000 geoscience learners internationally and provides an ongoing successful example of geoscience outreach through social media. Informal science education at Grand Canyon in partnership with Grand Canyon National Park offers continued opportunities.

Take the lead in applied geosciences

With Penn's **Master of Science in Applied Geosciences**, you stay ahead of the curve in remediation practices.

Advance your career and learn from industry leaders about:

- Geologic field methods
- Stormwater systems
- Project management
- HAZWOPER certification
- New technologies and techniques

Apply by April 1 for a fall 2020 start.

WWW.UPENN.EDU/MSAG



 THE GEOLOGICAL SOCIETY OF AMERICA®

Online Store

WE OFFER

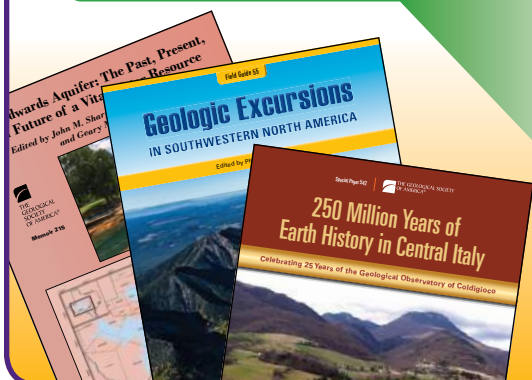
- ▶ Publications (Special Papers, Memoirs, Field Guides, Maps and Charts, and more)
- ▶ Specialty books from other publishers
- ▶ Rite-in-the-Rain products
- ▶ Teaching materials for K-12 and beyond
- ▶ EarthCache items (Geocoins, pins, t-shirts, etc.)

FEATURES

- ▶ E-versions of books not available in print (including DNAG)
- ▶ Details on and notification, if requested, about upcoming books
- ▶ Category for books \$10 or less

SHOP NOW

- ▶ Explore the GSA Store: <https://rock.geosociety.org/store/>
- ▶ Checkout credentials (username and password) are the same as those you use to access the **GSA Member Community** (<https://community.geosociety.org/home/>).
- ▶ Create an account if needed. Go to <https://www.geosociety.org/createaccount>.



rock.geosociety.org/store/

GSA/ExxonMobil Field Awards



GSA/ExxonMobil Bighorn Basin Field Award

Who should apply? Undergraduate and graduate students and faculty

Deadline: 27 March

Camp dates: 19–26 July 2020

This award offers 20 undergraduate and graduate students and five faculty members a high-quality educational experience in the spectacular Bighorn Basin of north-central Wyoming, USA. This one-week field seminar is free to accepted participants, and all transportation, meals, and living expenses are covered.

Supported by



GSA/ExxonMobil Field Camp Excellence Award

Who should apply? Anyone, but the award must be used toward field camp operations

Deadline: 27 March

This US\$10,000 award is given to a geology field camp that clearly focuses on the fundamentals of geologic mapping and field methods. It is based on safety awareness, diversity, and technical excellence. One field camp instructor/director will receive the award to assist with his or her summer field season.

To apply, go to https://www.geosociety.org/GSA/Education_Careers/Field_Experiences/GSA/fieldexp/home.aspx. Students and recent graduates must submit an online application form, two letters of recommendation, and a cover letter.

Questions? Contact Jennifer Nocerino, jnocerino@geosociety.org, or +1-303-357-1036.

The Geological Society of America®

GEOCAREERS

Check the GeoCareers website for upcoming webinars on energy, hydrology, and government, and view recordings of past webinars on petroleum, minerals, and environmental consulting at <https://www.geosociety.org/careers>.

Announcing

Guide to the
**Geology
& Natural History**
of the **Blue Ridge
Mountains**

by **Edgar W. Spencer**



Also named a
CHOICE
"OUTSTANDING
ACADEMIC
TITLE"
by the American
Library Assoc.

**2019
WINNER**
"BEST GUIDEBOOK"
(POPULAR AWARD)
Geoscience
Information
Society

Distributed by University of Virginia Press - Longleaf Services, Inc. - 800-848-6224
www.longleafservices.org | 396 pages | 6" x 9" | Paperback - ISBN: 978-0-9837471-6-1

GSA J. David Lowell Field Camp Scholarships

The importance of field schools to practicing geologists is unquestionable, yet the opportunities to experience field geology are dwindling. J. David Lowell Field Camp Scholarships give undergraduate students the opportunity to experience the wonder of the geosciences and learn something new about the world. These scholarships will provide US\$2,000 to undergraduate students so they can attend the summer field camp of their choice. Awards will be based on diversity, economic/financial need, and merit.

Students and recent graduates must submit an online application form, two letters of recommendation, and a cover letter by 27 March. Go to https://www.geosociety.org/GSA/Education_Careers/Field_Experiences/GSA/fieldexp/home.aspx to apply. Questions? Contact Jennifer Nocerino, jnocerino@geosociety.org, +1-303-357-1036.

Supported by



GSA FOUNDATION



"I am very thankful for the support of GSA, which helped make it possible for me to partake in this educational adventure. My skills in geologic mapping and interpretation were brought to a new level, and I leave with many fond memories I will enjoy for years to come."

—Cody Keith, 2019 GSA Field Camp Scholar Award Winner



2020 Undergraduate Student Research Grants

Take advantage of this opportunity: Five of GSA's Geographic Sections offer undergraduate research grants. Deadlines vary by Section, ranging from 1 March to 1 April.

<https://www.geosociety.org/undergradgrants>

Travel Awards to 2020 Southeastern-Northeastern Joint Section Meeting

Application deadline: 5 Feb.

Students nationwide who work full-time, care for dependents, or are considered non-traditional are eligible to apply for a travel award to attend the Southeastern and Northeastern Joint Section Meeting, 20–22 March, in Reston, Virginia, USA. Funding will cover meeting registration, lodging, transportation, food, and dependent care. Send questions to Tahlia Bear, tbear@geosociety.org. Learn more at <https://www.geosociety.org/gsa/about/sections/GSA/Sections/se/students.aspx#travel> for the Southeastern Section and <https://www.geosociety.org/gsa/about/sections/gsa/Sections/ne/home.aspx> for the Northeastern Section.





Give us your best shots!

2021 GSA CALENDAR PHOTO SEARCH

Each year, we enjoy seeing how you connect with the natural world through your camera lens. If you have a remarkable or noteworthy geologic image that's sure to wow us, enter the 2021 GSA Calendar Photo Search. Send up to three of your best images in landscape orientation, using the following categories as a guide:

ICONIC LANDSCAPES

Striking or notable geologic landscapes and features.

ABSTRACT IMAGES

The patterns of geology at any scale, photomicrographs to satellite images.

GEOLOGIC PROCESSES PAST AND PRESENT

Process or feature resulting from a specific process. For example: An erupting volcano or volcanic rocks that represent ancient eruptions.

HOW TO ENTER

Email the following to editing@geosociety.org with the subject line "Calendar Submission":

- Your name, email, and mailing address.
- A caption describing the image(s), plus a photo credit, including a one-sentence bio. Feel free to include information on how you captured the image.
- Up to three images in landscape orientation, in .jpg format, and no larger than 1 MB each (if your image is chosen, we'll ask for a high-resolution file).
- Name your file using your initial and last name (e.g., FBascom_image1.jpg).

Deadline: 19 March 2020

Go to <https://www.geosociety.org/GSA/Publications/GSA/Pubs/Photos.aspx> for more information.

If you have some amazing shots in a vertical orientation, please send them to gsatoday@geosociety.org for consideration for publication in *GSA Today*.



2019 Outstanding Earth Science Teacher Awards

The National Association of Geoscience Teachers (NAGT) has announced the 2019 Outstanding Earth Science Teacher (OEST) Awards. This annual award recognizes excellence in earth-science teaching at the pre-college level. GSA awards the section recipients US\$500 in travel money to attend a GSA meeting or US\$500 for classroom supplies, and complimentary membership in GSA for three years. State winners receive a one-year complimentary GSA membership. Read about the awardees at https://nagt.org/nagt/awards/oest/2019_oest.html.

SECTION WINNERS

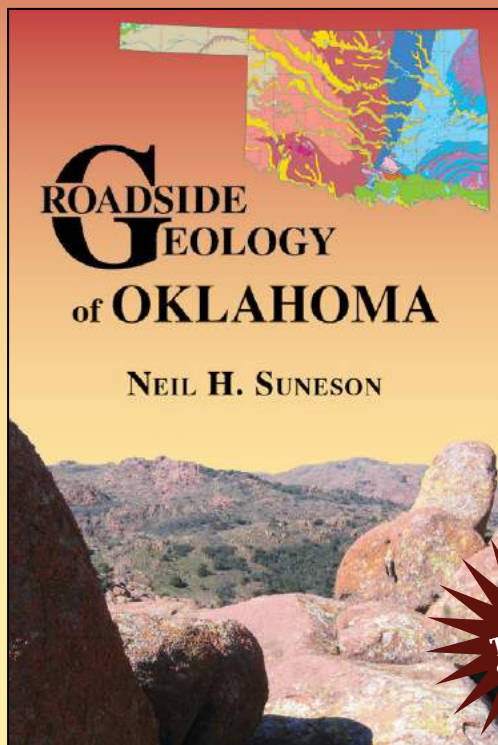
Central Section: Michael J. Smith
Eastern Section: Christopher Bowring
Far Western Section: Sergio de Alba
New England Section: Susan Meabh Kelly
Pacific Northwest Section: Renee Drummond
Southeastern Section: Andrea Starks
Southwest Section: Hank Shoop
Texas Section: Isabel Anaya

STATE WINNERS

Alabama: Ricky Conte
Alaska: Renee Drummond
California: Kevin Lesback
Connecticut: Lindsay Waack
Florida: Maggie Paxson
Georgia: Deborah Lynn Sheppard
Indiana: John Hesser
Michigan: Sarah Geborkoff
Minnesota: Jill Holz
Mississippi: Brooke Dodd

New Jersey: Matthew Fichter
New York: Christine Scavone
North Carolina: Marta Toran
Ohio: Michael Koenig
Oregon: Jim Hartmann
Pennsylvania: Andrea Mangold
South Carolina: Kimberley Norris-Jones
Tennessee: Andrea Starks
Virginia: Christopher Bowring
Washington: Alice Ryan
West Virginia: Angela McKeen

Take this book along for a ride as you roll across the red plains east to the Ozark Plateau, west to the Panhandle, or south to the Ouachita, Arbuckle, and Wichita Mountains.



ROADSIDE GEOLOGY OF OKLAHOMA

NEIL H. SUNESON

Dinosaur tracks preserved in sandstone, knobs of granite rising from the plains, and springs cascading down limestone cliffs are just a few of the fascinating geologic features discussed in *Roadside Geology of Oklahoma*, a guide to more than 35 roads that crisscross the state. Geologist Neil Suneson tells you what to look for along the roads, points you to nearby parks with interesting rocks and crystals, and recounts the history of radium mineral baths, coal mines, fossil excavations, and petroleum drilling, not to mention the rush for nonexistent gold in the Wichita Mountains.

400 pages • 6 x 9 • full color • 220 color photographs
 100 color maps and illustrations • glossary • references • index
 paper \$26.00 • Item 204 • ISBN 978-0-87842-697-3



MP Mountain Press
 PUBLISHING COMPANY

P.O. Box 2399 • Missoula, MT 59806 • 406-728-1900
 800-234-5308 • info@mtnpublish.com
www.mountain-press.com

SECOND ANNOUNCEMENT

Rocky Mountain Section

72nd Annual Meeting of the Rocky Mountain Section, GSA

Utah Valley Convention Center

Provo, Utah, USA

4–5 May 2020

www.geosociety.org/rm-mtg



Mount Timpanogos. Photo by Hike395 via Wikimedia Commons.

LOCATION

The 2020 meeting of the GSA Rocky Mountain Section will be hosted by the Department of Earth Science at Utah Valley University and held at the Utah Valley Convention Center in downtown Provo, Utah, USA. Provo Center Street, site of the convention center, is a pedestrian-friendly, four-block cluster of restaurants, shops, and bars. Provo is less than an hour from the Salt Lake City International Airport and has been ranked by *Outside* magazine as one of the best places to live in the United States. Downtown Provo is just a couple of miles from the nearest Wasatch Range trailheads at Slate Canyon and Rock Canyon, and less than a 25-minute drive from the spectacular Sundance Mountain Resort. Provo is about 45 miles from the historic mining town of Park City and the high alpine resorts of Snowbird and Alta. You can combine your visit to the 2020 Rocky Mountain meeting with a spectacular vacation by setting out on a road trip to Arches and Canyonlands National Parks (just over three hours away), Zion National Park (about four hours), or Yellowstone and Grand Teton National Parks (about five hours).

REGISTRATION

Early registration deadline: 30 Mar.

Cancellation deadline: 6 Apr.

For further information or if you need special accommodations, please contact the general chair, Daniel Horns, hornsa@uvu.edu.

REGISTRATION FEES (all fees are in U.S. dollars)

	Early		Standard	
	Full Mtg.	One Day	Full Mtg.	One day
Professional Member	\$180	\$130	\$210	\$160
Professional Member 70+	\$95	\$65	\$110	\$75
Professional Nonmember	\$230	\$180	\$260	\$200
Early Career Professional Member	\$130	\$90	\$150	\$100
Student Member	\$65	\$50	\$90	\$75
Student Nonmember	\$90	\$60	\$125	\$75
K–12 Professional	\$45	\$25	\$55	\$30
Guest or Spouse	\$35	n/a	\$55	n/a
Field Trip/Short Course Only	\$40	n/a	\$65	n/a

ACCOMMODATIONS

A block of rooms has been reserved at the Provo Marriott Hotel & Conference Center, 101 West 100 North, Provo, Utah 84601, USA, located in the heart of vibrant Provo. The meeting rate is US\$134 per night plus tax. The hotel offers many amenities (restaurants, bar, pool, Wi-Fi), and the convention center is just steps away. Reservations can be made by calling +1-800-228-9290, or register online at <https://www.geosociety.org/rm-mtg>. Please be sure to identify yourself with the 2020 Annual Meeting of the Rocky Mountain Section to ensure you receive the contracted rate. Complimentary parking is available at the hotel.

TECHNICAL PROGRAM

Please direct questions to the Technical Program co-chairs: Nathan Toké, Nathan.toke@uvu.edu, and Michael Bunds, bundsmi@uvu.edu.

Theme Sessions

- T1. **Extensional Tectonics in the Rocky Mountain Region from the Precambrian to the Quaternary.** Jason W. Ricketts, The Univ. of Texas at El Paso, jricketts@utep.edu.
- T2. **Geohazards of the Rocky Mountain West and Beyond.** Emily Kleber, Utah Geological Survey, ekleber@utah.gov.
- T3. **Innovative Methods for Analyses of Fault Hazards Studies.** James Evans, Utah State Univ., james.evans@usu.edu.
- T4. **Reconstructing a Lost World: The Paleoclimate, Paleobiology, and Geology of the Late Cretaceous Southern Utah Plateau Region.** Landon Burgener, North Carolina State Univ., lkburgen@ncsu.edu.
- T5. **Use It or Lose It: Developing Paleontological Interpretive Sites for Education and Resource Protection.** James Kirkland, Utah Geological Survey, jameskirkland@utah.gov.
- T6. **Advances in Rocky Mountain Region Paleontology.** Brooke Long-Fox, South Dakota School of Mines and Technology, brooke.long@mines.sdsmt.edu.

- T7. **Geologic Maps—The Foundation of Research and Exploration.** Grant Willis, Utah Geological Survey, grantwillis@utah.gov.
- T8. **Mining in the Rocky Mountain Region and Beyond: Risks and Opportunities.** Steven H. Emerman, Malach Consulting, SHEmerman@gmail.com.
- T9. **Innovative Technologies to Improve Mine Site Characterization: Extracting Value from Your Drone Data.** Mitch Rawitch, SiteSee, mrawitch@ramboll.com; Kara Haas, SiteSee, khaas@ramboll.com.
- T10. **Geology of the San Rafael Swell, East-Central Utah.** Thomas C. Chidsey, Utah Geological Survey, tomchidsey@utah.gov.
- T11. **Federal and State Geologists of the Rocky Mountain Section: Who Are They, What Are They Working on, and How Can Everyone Collaborate? (Posters)** Cianna Wyshnytzky, USDA–Natural Resources Conservation Service, cianna.wyshnytzky@usda.gov.
- T12. **Advances and Applications of River Science in the West.** Sharon Bywater-Reyes, Univ. of Northern Colorado, sharon.bywaterreyes@unco.edu.
- T13. **Geomorphic and Paleoclimate Records from the Intermountain West.** Tammy Rittenour, Utah State Univ., tammy.rittenour@usu.edu.
- T14. **Bonneville Basin: Geology of Pleistocene and Holocene Lakes.** Adam P. McKean, Utah Geological Survey, adamckean@utah.gov.
- T15. **Hydrology of the Western United States (Posters).** Daren Nelson, Utah Valley Univ., nelsonda@uvu.edu.
- T16. **Effective and Innovative Teaching and Curricula in the College Geoscience Classroom.** Doug Czajka, Utah Valley Univ., dczajka@uvu.edu.
- T17. **Undergraduate Research (Posters).** Daniel Horns, Utah Valley Univ., hornsda@uvu.edu.
- T18. **Beyond Geologic Maps—GIS in the Geosciences (Posters).** Julie Willis, Brigham Young Univ.–Idaho, willisj@byui.edu.

FIELD TRIPS

Please direct questions to the Field Trip co-chairs: Michael Stearns, mstearns@uvu.edu, and Patricia Garcia, pgarcia@uvu.edu.

Pre-Meeting

- FT1. **Tracking Dinosaurs in Canyon County (Moab).** Fri., 1 May, 8 a.m.–Sun., 3 May, 7 p.m. Cost: US\$380. Limit: 10. Leaders: ReBecca Hunt-Foster; Brent H. Breithaupt; Nefra A. Matthews; Hugh McDonald; Martin Lockley.

- FT2. **Tectonic Evolution of the Sevier and Laramide Belts in Northern Utah.** Sat., 2 May, 7:30 a.m.–Sun., 3 May, 6:30 p.m. Cost: US\$190. Limit: 25. Leaders: Adolph Yonkee; Doug Sprinkel; Liz Balgord.

- FT3. **Lake Bonneville and Great Salt Lake** (a field trip to locations within the vicinity of Provo and Salt Lake City). Sun., 3 May, 7:30 a.m.–5 p.m. Cost: US\$75. Limit: 40. Leader: Charles G. Oviatt.

Post-Meeting

- FT4. **Dinosaur National Monument and Other Mesozoic Sites of Northeastern Utah.** Wed., 6 May, 8:30 a.m.–Thurs., 7 May, 7 p.m. Cost: US\$230. Limit: 18. Leaders: ReBecca Hunt-Foster; Ben Burger; Jim Kirkland; Ken Carpenter; Brooks Britt; Doug Sprinkle.
- FT5. **The Integrated Ten-Million-Year History of the Little Cottonwood–Alta Stock System from Pluton to Aureole.** Wed., 6 May. Cost: US\$115. Limit: 33. Leaders: Michael A. Stearns; John R. Bowman; John M. Bartley; Carl Beno.
- FT6. **Geology of Bryce Canyon and Zion National Parks.** Wed., 6 May–Fri., 8 May. Cost: US\$450. Cost for those wanting single rooms: US\$615. Dinners not included. Limit: 40. Leaders: Grant C. Willis; Adam McKean.
- FT7. **The Gigantic Markagunt and Sevier Gravity Slides Resulting from Mid-Cenozoic Catastrophic Mega-Scale Failure of the Marysvale.** Wed., 6 May, 7:30 a.m.–Fri., 8 May, 5 p.m. Cost: US\$345 per person, double occupancy. Limit: 24 participants. Leaders: Robert F. Biek; David B. Hacker; Peter D. Rowley. *Thanks to generous support from the Utah Geological Association, we can offer a reduced registration fee of approximately half off to a limited number of students; the difference in cost will be reimbursed once we have a final student count.*

OPPORTUNITIES FOR STUDENTS AND EARLY CAREER PROFESSIONALS

Roy J. Shlemon Mentor Program in Applied Geoscience.

Mon., 4 May, noon–1:30 p.m., Utah Valley Convention Center Soldier Creek Room. GSA student members will have the opportunity to discuss career prospects and challenges with applied geoscientists from various sectors over a FREE lunch. Space is limited; this event is first-come, first-served.

John Mann Mentors in Applied Hydrogeology Program.

Tues., 5 May, noon–1:30 p.m., Utah Valley Convention Center Soldier Creek Room. GSA student members interested in applied hydrogeology or hydrology as a career will have the opportunity to network with professionals in these fields over a FREE lunch. Space is limited; this event is first-come, first-served.

Geoscience Career Workshop Part 1: Career Planning and Informational Interviewing. Mon., 4 May, 9–10 a.m., Utah Valley Convention Center Soldier Creek Room. Your job-hunting process should begin with career planning, not when you apply for

jobs. This workshop will help you begin this process and will introduce you to informational interviewing. This section is highly recommended for freshmen, sophomores, and juniors. The earlier you start your career planning the better.

Geoscience Career Workshop Part 2: Geoscience Career Exploration. Mon., 4 May, 10–11 a.m., Utah Valley Convention Center Soldier Creek Room. What do geologists in various sectors earn? What do they do? What are the pros and cons to working in academia, government, and industry? Workshop presenters and professionals in the field will address these issues.

Geoscience Career Workshop Part 3: Cover Letters, Résumés, and CVs. Tues., 5 May, 9–10 a.m., Utah Valley Convention Center Soldier Creek Room. How do you prepare a cover letter? Does your résumé need a good edit? Whether you are currently in the market for a job or not, learn how to prepare the best résumé possible. You will review numerous examples to help you learn important résumé dos and don'ts.

Learn more about all these opportunities at <https://www.geosociety.org/mentors>.

PROFESSIONALS

Interested in sharing information about your applied geoscience or hydrology career with students? Being a mentor is a rewarding experience. To learn more about serving as a mentor, contact Jennifer Nocerino, jnocerino@geosociety.org.

The Rocky Mountain Section Meeting also offers an excellent opportunity to earn CEUs toward your continuing education requirements for your employer, K–12 school, or professional registration. Please check the meeting website after the meeting to download your CEU certificate.

ORGANIZING COMMITTEE

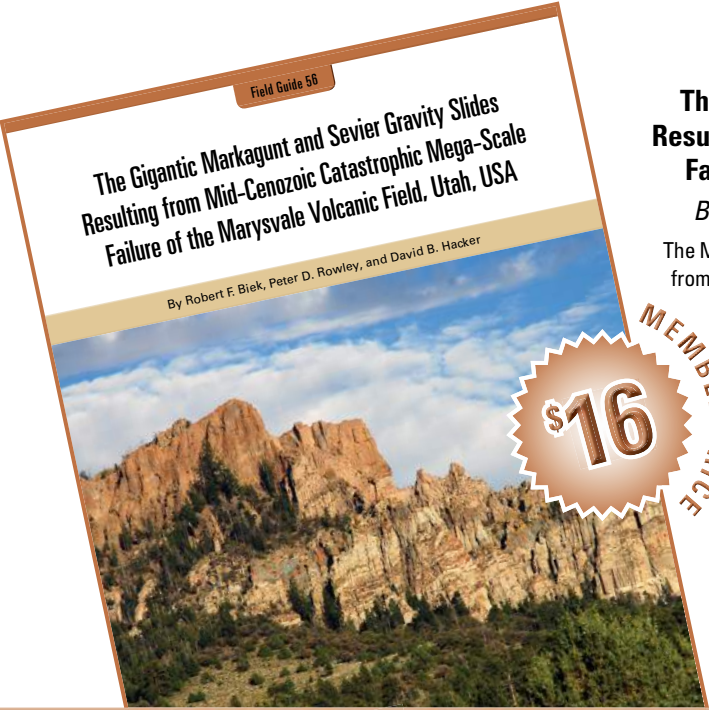
Meeting Chair: Daniel Horns, hornsd@uvu.edu

Technical Program Co-Chairs: Nathan Toké, Nathan.toke@uvu.edu; Michael Bunds, bundsmi@uvu.edu

Field Trip Co-Chairs: Michael Stearns, mstearns@uvu.edu; Patricia Garcia, pgarcia@uvu.edu

Exhibits Chair: Daniel Horns, hornsd@uvu.edu

FIELD GUIDE 56



The Gigantic Markagunt and Sevier Gravity Slides Resulting from Mid-Cenozoic Catastrophic Mega-Scale Failure of the Marysvale Volcanic Field, Utah, USA

By Robert F. Biek, Peter D. Rowley, and David B. Hacker

\$16

MEMBER PRICE

The Gigantic Markagunt and Sevier Gravity Slides Resulting from Mid-Cenozoic Catastrophic Mega-Scale Failure of the Marysvale Volcanic Field, Utah, USA

By Robert F. Biek, Peter D. Rowley, and David B. Hacker

The Markagunt and Sevier gravity slides are gigantic landslides that resulted from gravitationally induced catastrophic failure of the southern flank of the Oligocene to Miocene Marysvale volcanic field. Each is nearly 100 km long with runouts over the former land surface >35 km; together they span 7000 km² and rank among Earth's largest terrestrial landslides. Basal cataclastic layers, injectites, pseudotachylyte, deformed clasts, and a variety of kinematic indicators demonstrate catastrophic emplacement, which was preceded by slow gravitational spreading of the volcanic field. This volume offers a history of their discovery, our current understanding of the gravity slides, and a guide to particularly instructive exposures for which the authors document their conclusions about the size, age, and significant structural features of these newly discovered features.

FLD056, 121 p., ISBN 9780813700564

list price \$23.00 | **member price \$16.00**



THE GEOLOGICAL SOCIETY
OF AMERICA®

BUY ONLINE ▶ <https://rock.geosociety.org/store/>

toll-free 1.800.472.1988 | +1.303.357.1000, option 3 | gsaservice@geosociety.org

2020 GSA Section Meetings



South-Central

9–10 March
Ft. Worth Convention Center
Fort Worth, Texas, USA
Chairs: Omar Harvey, omar.harvey@tcu.edu; Arne Winguth, awinguth@uta.edu
www.geosociety.org/sc-mtg

Fort Worth Stockyards. Photo by Visit Fort Worth.



Joint Southeastern–Northeastern

20–22 March
Hyatt Regency Reston
Reston, Virginia, USA
Chairs: Arthur Merschat, amerschat@usgs.gov; Patrick Burkhart, patrick.burkhart@sru.edu
www.geosociety.org/se-mtg

Great Falls Park. Photo by Visit Fairfax.



Rocky Mountain

4–5 May
Utah Valley Convention Center
Provo, Utah, USA
Chair: Daniel Horns, hornsd@uvu.edu
www.geosociety.org/rm-mtg

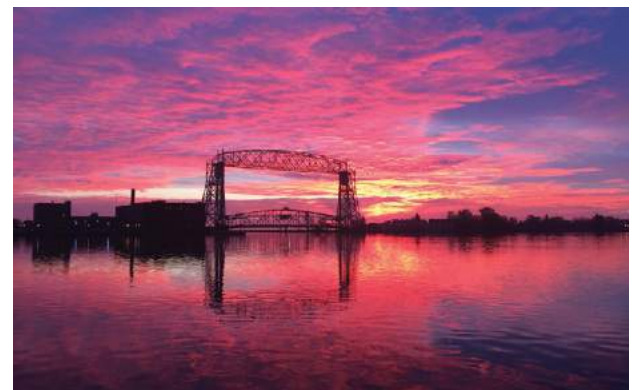
Mount Timpanogos. Photo by Hike395 via Wikimedia Commons.



Cordilleran

12–14 May
The Westin Pasadena
Pasadena, California, USA
Chair: Doug Yule, doug.yule@csun.edu
www.geosociety.org/cd-mtg

City Hall. Photo by Pasadena Convention & Visitors Bureau.



North-Central

18–19 May
Duluth Entertainment Convention Center
Duluth, Minnesota, USA
Chair: Karen Gran, kgran@d.umn.edu
www.geosociety.org/nc-mtg

Aerial Lift Bridge at sunrise. Photo by Visit Duluth.

SECOND ANNOUNCEMENT

Cordilleran Section

116th Annual Meeting of the Cordilleran Section, GSA

The Westin Pasadena

Pasadena, California, USA

12–14 May 2020

www.geosociety.org/cd-mtg



City Hall. Photo by Pasadena Convention & Visitors Bureau.

LOCATION

Pasadena, California, USA—the Crown City—is one of California's iconic cities and is centered in a region defined by its geology. The landscape surrounding Pasadena reflects many past phases of geologic activity, all the while it continues to change through the slow motion of faults, the movement of water, the cycle of wind and fire and landslides, and many other processes. Its location affords access to world-famous faults, rugged mountains with an almost two-billion-year geologic history, well-known sedimentary basins with vast petroleum reserves, and legendary earthquakes, landslides, and other geologic hazards. Building on the extraordinary geological features of the surrounding region, we have devised a diverse program reflecting fundamental and applied aspects across earth-science disciplines.

REGISTRATION

Early registration deadline: 6 Apr.

Cancellation deadline: 13 Apr.

For further information or if you need special accommodations, please contact the meeting general chair, Doug Yule, doug.yule@csun.edu.

REGISTRATION FEES (all fees are in U.S. dollars)

	Early		Standard	
	Full Mtg.	One Day	Full Mtg.	One day
Professional Member	\$305	\$225	\$335	\$270
Professional Member 70+	\$205	\$140	\$230	\$170
Professional Nonmember	\$355	\$245	\$390	\$295
Early Career Professional Member	\$205	\$140	\$230	\$170
Student Member	\$125	\$85	\$140	\$105
Student Nonmember	\$150	\$100	\$165	\$120
K–12 Professional	\$125	\$85	\$140	\$105
Guest or Spouse	\$135	n/a	\$135	n/a
Field Trip/Short Course Only	\$65	n/a	\$90	n/a

ACCOMMODATIONS

Deadline for group rate: 20 Apr.

A block of rooms has been reserved at The Westin Pasadena, 191 N. Los Robles Ave., Pasadena, CA 91101, USA, which is where the conference will be held. The meeting room rate is US\$179 per night plus tax. Make reservations by calling toll free,

+1-866-837-4181, or call the hotel directly at +1-626-304-1403.

When booking, please refer to our group as the Cordilleran Section of the Geological Society of America.

CALL FOR PAPERS

Abstract deadline: 11 Feb.

Submit abstracts online at <https://www.geosociety.org/cd-mtg>.

Submission fee: US\$18 for students and US\$30 for all others.

If you have questions about online submission, please contact Heather Clark, +1-303-357-1018, hclark@geosociety.org.

In addition to the following Theme Sessions, we are soliciting abstracts for general discipline sessions. For additional information, contact the Technical Session chair, Robinson Cecil, robinson.cecil@csun.edu.

Theme Sessions

- T1. The Changing Face of Paleontology: In Honor of the Career Contribution of Dr. Richard L. Squires.** Linda A. Ritterbush, California Lutheran Univ., ritterbu@callutheran.edu; Mary McGann, U.S. Geological Survey, mmcgann@usgs.gov.
- T2. La Brea Tar Pits: Old Bones and New Insights.** Donald R. Prothero, Cal Poly Pomona, donaldprothero@att.net.
- T3. Finding Fault: Slip Rates across the Southern California Plate Boundary.** Richard Heermance, California State Univ. Northridge, richard.heermance@csun.edu; Kate Scharer, U.S. Geological Survey, kscharer@usgs.gov.
- T4. The Kinematics, Dynamics, and Surface Expression of Faults in Eastern California—Improving Hazard Forecasts and Long-Term Slip Histories.** Elizabeth Haddon, U.S. Geological Survey, ehaddon@usgs.gov; Scott Bennett, U.S. Geological Survey, sekbennett@usgs.gov; Janis Hernandez, California Geological Survey, janis.hernandez@conservation.ca.gov; Katherine Kendrick, U.S. Geological Survey, kendrick@usgs.gov; Dave Miller, U.S. Geological Survey, dmiller@usgs.gov.
- T5. Paleoseismicity Records of the North American Cordillera.** Sinan Akciz, California State Univ. Fullerton, sakciz@fullerton.edu; Janis Hernandez, California Geological Survey, Janis.Hernandez@conservation.ca.gov; Brian Olson, California Geological Survey, Brian.Olson@conservation.ca.gov.

- T6. **New Constraints on the Evolution of the Southern California Bight: Understanding Diffuse Plate Boundaries across Multiple Scales from Laboratory and Numerical Models to Field Observations.** Drake Singleton, San Diego State Univ. and Scripps Institution of Oceanography, dsinglet@ucsd.edu; Boe Derosier, Scripps Institution of Oceanography, bderosie@ucsd.edu.
- T7. **Integrated Subduction Zone Systems: Advances in Understanding Landscape Evolution, Deformation, and Tectonics.** Melanie Michalak, Humboldt State Univ., melanie.michalak@humboldt.edu; Francis Sousa, Oregon State Univ., francis.sousa@oregonstate.edu; Rebecca Dorsey, Univ. of Oregon, rdorsey@uoregon.edu.
- T8. **Exhumation and Uplift of the Sierra Nevada and Tehachapi Mountains.** Ann Blythe, Occidental College, ablythe@oxy.edu; Jeffrey Lee, Central Washington Univ., jeff@geology.cwu.edu.
- T9. **The Enigmatic Late Cretaceous–Paleogene Tectonic Evolution of the Southwestern USA.** Richard V. Heermance, California State Univ. Northridge, richard.heermance@csun.edu; Scott Johnston, Cal Poly San Luis Obispo, scjohnst@calpoly.edu; John Singleton, Colorado State Univ., John.Singleton@colostate.edu.
- T10. **Quaternary Volcanism in California.** Seth Burgess, U.S. Geological Survey, sburgess@usgs.gov; Jorge Vazquez, U.S. Geological Survey, jvazquez@usgs.gov; Andrew Calvert, U.S. Geological Survey, acalvert@usgs.gov.
- T11. **Impacts of Arc Activity on the Rheology of the Lithosphere across Convergent Margins.** Snir Attia, Univ. of Southern California, sattia@usc.edu; Katie Ardill, Univ. of Southern California, kardill@usc.edu; Tarryn Cawood, Univ. of Southern California, cawood@usc.edu; William Schmidt, Univ. of Southern California, wlschmid@usc.edu.
- T12. **Igneous Minerals as Capsules of Length and Time-Scale Information for Magma Processes in Magma Plumbing Systems.** *Cosponsored by GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division.* Vali Memeti, California State Univ. Fullerton, vmemeti@fullerton.edu; Cal Barnes, Texas Tech Univ., cal.barnes@ttu.edu.
- T13. **Magma Emplacement from Arcs to Outcrops: Patterns, Processes, and Rates across Multiple Scales.** Cullen Scheland, Univ. of Southern California, scheland@usc.edu; Scott Paterson, Univ. of Southern California, paterson@usc.edu.
- T14. **Magmatic Rates, Processes, and Spatiotemporal Evolution of Arc Activity.** Katie Ardill, Univ. of Southern California, kardill@usc.edu; Barbara Ratschbacher, California Institute of Technology, ratschba@gps.caltech.edu; Scott Paterson, Univ. of Southern California, paterson@usc.edu; Cullen Scheland, Univ. of Southern California, scheland@usc.edu; Ana Martinez-Ardila, Loma Linda Univ., anmartinez@llu.edu.
- T15. **Petrology, Geochemistry, and Structure of Cordilleran Batholiths through Space and Time.** *Cosponsored by GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division; GSA Structural Geology & Tectonics Division.* Madeline J. Lewis, California Institute of Technology, mjlewis@caltech.edu; Claire E. Bucholz, California Institute of Technology, cbucholz@caltech.edu; Jade Star Lackey, Pomona College, JadeStar.Lackey@pomona.edu; Juliet Ryan-Davis, California Institute of Technology, jrd@caltech.edu.
- T16. **Metamorphic Processes in Cordilleran Arc Systems.** Joshua Schwartz, California State Univ. Northridge, Joshua.schwartz@csun.edu; Jade Star Lackey, Pomona College, JadeStar.Lackey@pomona.edu.
- T17. **Sediment Stories: Utilizing Sediment to Understand and Document the Processes That Shape Earth's Surface.** Joe Carlin, California State Univ. Fullerton, jcarlin@fullerton.edu; Andrew Gray, Univ. of California Riverside, agray@ucr.edu.
- T18. **From Coasts to Deserts to Mountains: What Can the Past Tell Us about California's Future?** Matthew E. Kirby, California State Univ. Fullerton, mkirby@fullerton.edu; Elizabeth Fard, Univ. of California Los Angeles, ellyfard@gmail.com; Jessie George, Univ. of California Los Angeles, jmgeorge@ucla.edu; Jiwoo Han, Univ. of California Los Angeles, hjsing@ucla.edu; Kathleen Johnson, Univ. of California Irvine, kathleen.johnson@uci.edu; Glen Sproul dit MacDonald, Univ. of California Los Angeles, glen@geog.ucla.edu.
- T19. **Hydrology and Hydrogeology of Arid and Semi-Arid Regions.** M. Hassan Rezaie Boroon, California State Univ. Los Angeles, mrezaie@calstatela.edu.
- T20. **Hydrogeology (Posters).** Barry Hibbs, California State Univ. Los Angeles, bhibbs@calstatela.edu; M. Hassan Rezaie Boroon, California State Univ. Los Angeles, mrezaie@calstatela.edu.
- T21. **Geoscience in the Two-Year-College (2YC) Community: Sharing Successes, Growing Pains, and Lessons Learned.** Elizabeth Nagy, Pasadena City College, eanagy-shadman@pasadena.edu; Martha House, Pasadena City College, mahouse@pasadena.edu; Tania Anders, Mt. San Antonio College, tania.anders@mtsac.edu.
- T22. **Celebrating Indigenous Voices and Perspectives in Geoscience.** Diamond Tachera, Univ. of Hawai'i at Mānoa, diamondt@hawaii.edu; Brytne Okuhata, Univ. of Hawai'i at Mānoa, bokuhata@hawaii.edu; Jennifer Wong-Ala, Oregon State Univ., wongalaj@oregonstate.edu.
- T23. **Professional Pathways within the Geosciences.** Jennifer Wilson, Six Rivers Geosciences, jwilson@sixriversgeosciences.com.

T24. **Convergence of Earth, Data, and Behavior Science.**
Beth Weinman, Fresno State Univ., bweinman@csufresno.edu;
Cris Wilhite, Fresno State Univ., crissw@csufresno.edu.

T25. **Undergraduate Research (Posters).** *Cosponsored by the Council on Undergraduate Research (CUR)—Geological Sciences.* Jeff Marshall, Cal Poly Pomona, marshall@cpp.edu.

T26. **Geology and Geophysics of the Coso Geothermal Field and Source Area of the 2019 Ridgecrest Earthquake Sequence: A Tribute to the Career of Francis C. (“Frank”) Monastero.**
Allen F. Glazner, Univ. of North Carolina, afg@unc.edu;
J. Douglas Walker, Univ. of Kansas, jdwalker@ku.edu.

FIELD TRIPS

For additional information, please contact the Field Trip chairs: Richard Heermance, richard.heermance@csun.edu, and Joshua Schwartz, joshua.schwartz@csun.edu.

Pre-Meeting

FT1. **The Geology and Ambiguities of the Coyote Mountains, Western Salton Trough, Southern California.** Fri.–Mon., 8–11 May. Cost: US\$364 (includes two lunches, one dinner, snacks, three nights lodging, SUV transportation, and guidebook). Max. participants: 24. George Morgan, georgemorgan@cox.net; J.R. Morgan; John Prall; Jeff Hull.

FT2. **Structure, Metamorphism, and Geodynamic Significance of the Catalina Schist Terrane.** Sat.–Mon., 9–11 May. Cost: US\$296 (includes two breakfasts, two lunches, two dinners, two nights lodging, ferry, van, and bus transportation, and guidebook). Max. participants: 27. John Platt, Univ. of Southern California, jplatt@usc.edu; Marty Grove, Stanford Univ., mjgrove@stanford.edu; Tarryn Cawood, Univ. of Southern California, cawood@usc.edu.

FT3. **Tectonic and Magmatic Evolution of Salinian and Nacimiento Blocks, Central Coastal California.** *Cosponsored by GSA Structural Geology & Tectonics Division; GSA Geochronology Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division.* Sat.–Mon., 9–11 May. Cost: US\$255 (includes two breakfasts, two lunches, snacks, two nights lodging, van transportation, and guidebook). Max. participants: 31. Alan Chapman, Macalester College, chapman@macalester.edu; Scott Johnston, Cal Poly San Luis Obispo, scjohnst@calpoly.edu; John Singleton, Colorado State Univ., John.Singleton@colostate.edu; Owen Anfinson, Sonoma State Univ., anfinson@sonoma.edu; Jeremy Hourigan, Univ. of California Santa Cruz, hourigan@ucsc.edu.

FT4. **Recent Advancements in Geochronology, Geologic Mapping, and Landslide Characterization in Basement Rocks of the San Gabriel Mountains Block.** Sun.–Mon., 10–11 May. Cost: US\$93 (includes two lunches, van transportation, and guidebook). Max. participants: 26. Jonathan Nourse, Cal Poly Pomona, janourse@cpp.edu; Brian Swanson, California Geological Survey, Brian.Swanson@conservation.ca.gov; Nicolas Barth, Univ. of California Riverside,

nic.barth@ucr.edu; Joshua Schwartz, California State Univ. Northridge, joshua.j.schwartz@gmail.com.

FT5. **Montecito Debris Flow of 9 January 2018: Physical Processes and Social Implications.** *Cosponsored by University of California Santa Barbara Earth Research Institute.* Mon., 11 May. Cost: US\$93 (includes one lunch, van transportation, and guidebook). Max. participants: 32. Edward Keller, Univ. of California Santa Barbara, keller@ucsb.edu.

Post-Meeting

FT6. **Late Quaternary Offset on the Central Sierra Madre Fault and Timing of Terrace Formation along the San Gabriel Mountains Range Front.** Fri., 15 May. Cost: US\$83 (includes one lunch, van transportation, and guidebook). Max. participants: 33. Kate Scharer, U.S. Geological Survey, kscharer@usgs.gov; Reed Burgette, New Mexico State Univ., burgette@nmsu.edu; Scott Lindvall, Lettis Consultants International, lindvall@lettisci.com.

FT7. **Santa Cruz Island: Geology, History, and Future Opportunities.** Fri.–Mon., 15–18 May. Cost: US\$650 (includes three breakfasts, four lunches, three dinners, three nights lodging, ferry and 4WD transportation, National Park fees, and guidebook). Max. participants: 13. Thomas Davis, Geologic Maps Foundation, geologicmapsfoundation@gmail.com; Rick Behl, California State Univ. Long Beach, Richard.Behl@csulb.edu; Katie O’Sullivan, California State Univ. Bakersfield, kosullivan@csub.edu.

SHORT COURSES

For additional information, please contact the Short Course chair: Kathie Marsaglia, kathie.marsaglia@csun.edu.

SC1. **Use of Magmatic Structures for Unraveling the Evolution of Magmatic Systems: Combined Field, Structural, and Geochemical Techniques.** *Cosponsored by GSA Structural Geology & Tectonics Division; GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division.* Mon., 11 May, 8 a.m.–5 p.m. Fee: US\$25. Westin Pasadena. Scott Paterson, Univ. of Southern California, paterson@usc.edu; Katie Ardill, Univ. of Southern California, kardill@usc.edu; Cal Barnes, Texas Tech Univ., cal.barnes@ttu.edu; Vali Memeti, California State Univ. Fullerton, vmemeti@fullerton.edu.

SC2. **Using Thermal Infrared Spectral Imagery Data for Geological and Earth-Science Applications.** *Cosponsored by The Aerospace Corporation.* Mon., 11 May, 8 a.m.–noon. Fee: US\$25. Westin Pasadena. Rebecca (Amber) Witkosky, independent researcher, lithia35@gmail.com; David Tratt, The Aerospace Corporation, david.m.tratt@aero.org; Kerry Buckland, The Aerospace Corporation, kerry.n.buckland@aero.org; Patrick Johnson, The Aerospace Corporation, patrick.d.johnson@aero.org; Joann Stock, California Institute of Technology, jstock@gps.caltech.edu.

SC3. **Increase the Use of Data, Math, and Societal Relevance in Your Undergraduate or 9–12 Classroom.** *Cosponsored by*

Geodesy Tools for Societal Issues (GETSI) Project; National Association of Geoscience Teachers. Mon., 11 May, 8 a.m.–3 p.m. Fee: US\$20. Mt. San Antonio College. Workshop leaders will help facilitate carpools/vans to/from the workshop site. Becca Walker, Mt. San Antonio College, walkerbecca@gmail.com; Beth Pratt-Sitaula, UNAVCO, prattsitaula@unavco.org; Rachel Teasdale, California State Univ. Chico.

SC4. **Applied Forensic Geochemistry: Applications of Sr/Pb to Resolve Issues in Environmental Remediation.** Mon., 11 May, 1–5 p.m. Fee: US\$25. Westin Pasadena. Richard W. Hurst, California Lutheran Univ., rhurst@callutheran.edu.

OPPORTUNITIES FOR STUDENTS AND EARLY CAREER PROFESSIONALS

Roy J. Shlemon Mentor Program in Applied Geoscience.

GSA student members will have the opportunity to discuss career prospects and challenges with applied geoscientists from various sectors over a FREE lunch. Space is limited; this event is first-come, first-served.

John Mann Mentors in Applied Hydrogeology Program.

GSA student members interested in applied hydrogeology or hydrology as a career will have the opportunity to network with professionals in these fields over a FREE lunch. Space is limited; this event is first-come, first-served.

Geoscience Career Workshop Part 1: Career Planning and Informational Interviewing. Your job hunting process should begin with career planning, not when you apply to jobs. This workshop will

help you begin this process and will introduce you to informational interviewing. This section is highly recommended for freshmen, sophomores, and juniors. The earlier you start your career planning the better.

Geoscience Career Workshop Part 2: Geoscience Career Exploration. What do geologists in various sectors earn? What do they do? What are the pros and cons to working in academia, government, and industry? Workshop presenters and professionals in the field will address these issues.

Geoscience Career Workshop Part 3: Cover Letters, Résumés, and CVs. How do you prepare a cover letter? Does your résumé need a good edit? Whether you are currently in the market for a job or not, learn how to prepare the best résumé possible. You will review numerous résumés to help you to learn important résumé dos and don'ts.

Learn more about these opportunities at <https://www.geosociety.org/mentors>.

ORGANIZING COMMITTEE

Meeting General Chair: Doug Yule, doug.yule@csun.edu

Technical Program Chair: Robinson Cecil, robinson.cecil@csun.edu

Field Trip Chairs: Richard Heermance, richard.heermance@csun.edu; Joshua Schwartz, joshua.schwartz@csun.edu

Short Course Chair: Kathie Marsaglia, kathie.marsaglia@csun.edu

Student Volunteers, Exhibits: Elizabeth Nagy, eanagy-shadman@pasadena.edu

Sponsorship Chair: Doug Yule, doug.yule@csun.edu

Discover Recent, Rare, and Out-of-Print Books

Geology of Mineral Resources, Pegmatites, Paleontology, Fossil Specimens, Mineral Books and Specimens, Select Mines and Mining Locations, Ore Deposits, Mineral Exploration



<http://www.booksgeology.com>

WE PURCHASE BOOKS, SPECIMENS, AND ENTIRE COLLECTIONS

MS Book and Mineral Company
MSBOOKS@BOOKSGEOLOGY.COM
P.O. Box 6774, Lake Charles, LA 70606-6774 USA

Upgrade your career for success in the ENERGY INDUSTRY

ADVANCED GEOSCIENCES | DATA MANAGEMENT | BUSINESS



RICE NATURAL SCIENCES
Professional Science
Master's Program



profms.rice.edu

SECOND ANNOUNCEMENT

North-Central Section

54th Annual Meeting of the North-Central Section, GSA
Duluth Entertainment Convention Center
Duluth, Minnesota, USA
18–19 May 2020
www.geosociety.org/nc-mtg



Duluth 2020: Superior Rocks

LOCATION

We are excited to bring the GSA 2020 North-Central Section Annual Meeting up north to Duluth, Minnesota, USA. Perched on the western tip of Lake Superior, Duluth offers unparalleled beauty and natural amenities. The meeting will be held at the Duluth Entertainment Convention Center, within walking distance of the thriving Canal Park district and downtown Duluth. Field trip opportunities let you explore a range of geologic history: step back into the Precambrian to the Duluth complex or Mesabi Iron Range, trek up to the Gunflint Trail to see ejecta from the Sudbury impact, explore Quaternary history recorded in proglacial lake deposits, investigate modern processes ranging from landslides to peatlands to environmental remediation, or learn more about the depths of Lake Superior onboard the Research Vessel *Blue Heron*. Come north for a geologic adventure!

REGISTRATION

Early registration deadline: 13 Apr.

Cancellation deadline: 20 Apr.

REGISTRATION FEES (all fees are in U.S. dollars)

	Early		Standard	
	Full Mtg.	One Day	Full Mtg.	One day
Professional Member	\$195	\$160	\$240	\$190
Professional Member 70+	\$110	\$80	\$150	\$110
Professional Nonmember	\$245	\$185	\$295	\$195
Early Career Professional Member	\$130	\$90	\$180	\$130
Student Member	\$75	\$50	\$100	\$75
Student Nonmember	\$115	\$65	\$135	\$85
K–12 Professional	\$50	\$40	\$60	\$45
Guest or Spouse	\$50	n/a	\$60	n/a
Field Trip/Short Course Only	\$40	n/a	\$40	n/a

Tribal and community college professional members: Professional members from tribal and community colleges should register at the professional member rate but can apply to be reimbursed the difference between the professional member and early career member early two-day registration rate after the meeting (US\$65).

ACCOMMODATIONS

Hotel room registration deadline: 27 Apr.

A block of rooms has been reserved at the Canal Park Lodge (+1-218-279-6000), a few blocks from the Duluth Entertainment Convention Center (DECC), for US\$119/room, and at the Holiday Inn & Suites (+1-218-722-1202) in downtown Duluth for US\$114/room. The Holiday Inn is connected to the DECC via the downtown skyway system. Please call hotels directly and reference the group code of **NCGSA20** when reserving a room. Dormitory rooms are also available at the University of Minnesota Duluth (UMD) and can be reserved online at <https://forms.gle/95vF2LSh3kEszLVz9>. UMD is a 10-minute drive or 30-minute bus ride from the DECC.

CALL FOR PAPERS

Abstracts deadline: 18 Feb.

Submit online at <https://www.geosociety.org/nc-mtg>.

Submission fee: US\$18 for students and US\$30 for all others.

If you cannot submit an abstract online, please contact Heather Clark, +1-303-357-1018, hclark@geosociety.org.

TECHNICAL PROGRAM

- T1. Insights into Processes of Proterozoic Crustal Growth, Modification, and Stabilization in the North-Central U.S. Continental Interior.** Daniel Holm, Kent State Univ., dholm@kent.edu; David Malone, Illinois State; John Craddock, Macalester College.
- T2. Intrusive Rocks of the Midcontinent Rift.** Joshua Feinberg, Univ. of Minnesota Twin Cities, feinberg@umn.edu; Nicholas Swanson-Hysell, Univ. of California Berkeley; Mark Severson, Univ. of Minnesota Duluth Natural Resources Research Institute.
- T3. Precambrian Geology of the Lake Superior Region.** Robert Lodge, Univ. of Wisconsin–Eau Claire, lodgerw@uwec.edu; Mark Jirsa, Minnesota Geological Survey.
- T4. Petrology, Mineralogy, and High-Temperature Geochemistry.** Fred Davis, Univ. of Minnesota Duluth, fdavis@d.umn.edu.
- T5. Novel Approaches to Studying Earth's Earliest Terrestrial Ecosystems: From Biogeochemistry to Astrobiology.** Erik Gulbranson, Gustavus Adolphus College, erikgulbranson@

- gustavus.edu; Rebecca Dzombak, Univ. of Michigan; Nathan Sheldon, Univ. of Michigan.
- T6. **Deciphering the Record of Lake Superior Iron Formations.** Athena Eyster, Massachusetts Institute of Technology, aeyster@mit.edu; Latisha Brengman, Univ. of Minnesota Duluth; Chad Wittkop, Minnesota State Univ.
- T7. **Midcontinent Meteorite Impact Structures: Surficial and Subsurface Evidence of Deformation and Shock Metamorphism.** Ryan Clark, Iowa Geological Survey, ryan-j-clark@uiowa.edu; Kevin Ray Evans, Missouri State Univ.
- T8. **Structural Geology and Tectonics.** Melissa Lamb, Univ. of St. Thomas, malamb@stthomas.edu.
- T9. **Paleontology of the Upper Midwest: Glimpses into Five Seashores.** John Westgaard, Science Museum of Minnesota, jwestgaard@smm.org; Kenneth C. Gass, independent researcher; Alex Hastings, Science Museum of Minnesota; Douglas Hanks, Science Museum of Minnesota and Minnesota Discovery Center.
- T10. **Pre-Wisconsin Episode Records in the Midcontinent.** *Cosponsored by GSA Quaternary Geology & Geomorphology Division.* Peter Jacobs, Univ. of Wisconsin–Whitewater, jacobs@uw.edu; Henry Loope, Indiana Geological and Water Survey; Jose Luis Antinao Rojas, Indiana Geological and Water Survey; Andrew Phillips, Illinois State Geological Survey.
- T11. **Glaciation and Deglaciation along the Southern Margin of the Laurentide Ice Sheet: Bringing Multiple Tools to Bear.** *Cosponsored by GSA Quaternary Geology & Geomorphology Division.* Jennifer McDonald, Minnesota Geological Survey, jmhorton@umn.edu; David Ullman, Northland College; Kenneth Lepper, North Dakota State Univ.
- T12. **All Things Aeolian.** *Cosponsored by GSA Quaternary Geology & Geomorphology Division.* Phillip Larson, Minnesota State Univ. Mankato, phillip.larson@mnsu.edu; Randall Schaetzl, Michigan State Univ.; Garry Running, Univ. of Wisconsin–Eau Claire.
- T13. **Geoarchaeology: Exploring the Connections between Humanity and Geology.** Michele D. Stillinger, Univ. of St. Thomas, mdstillinger@stthomas.edu.
- T14. **Magnetism from the Infinitesimal to the Planetsimal.** Michele D. Stillinger, Univ. of St. Thomas, mdstillinger@stthomas.edu; Joshua M. Feinberg, Univ. of Minnesota Institute for Rock Magnetism.
- T15. **Geophysical Studies in the Midcontinent of North America.** *Cosponsored by GSA Geophysics & Geodynamics Division.* Kevin Mickus, Missouri State Univ., kevinmickus@missouristate.edu.
- T16. **Subsurface Imaging within the Geosciences.** Harry Jol, Univ. of Wisconsin–Eau Claire, jolhm@uwec.edu.
- T17. **Geochemical Cycling of Environmentally Relevant Elements.** Cara M. Santelli, Univ. of Minnesota Dept. of Earth Sciences, BioTechnology Institute & MnDRIVE, santelli@umn.edu; Tingying Xu, Univ. of Minnesota Dept. of Earth Sciences, BioTechnology Institute & MnDRIVE; Jacqueline Mejia, Univ. of Minnesota Dept. of Earth Sciences, BioTechnology Institute & MnDRIVE.
- T18. **It's a Small (Microbial) World.** Elizabeth Swanner, Iowa State Univ., eswanner@iastate.edu; Jeff Havig, Univ. of Minnesota Twin Cities; Cody Sheik, Univ. of Minnesota Duluth.
- T19. **Applications of 3D Modeling Using Structure from Motion or Terrestrial Laser Scanning.** Stephanie S. Day, North Dakota State Univ., stephanie.day@ndsu.edu; Zachary Phillips, North Dakota State Univ.
- T20. **River Restoration Strategies in a Changing Climate.** *Cosponsored by GSA Quaternary Geology & Geomorphology Division.* Marty Melchior, Interfluve, mmelchior@interfluve.com; Faith Fitzpatrick, U.S. Geological Survey.
- T21. **Flash Floods, Landslides, and Debris Flows in the Midcontinent.** *Cosponsored by GSA Quaternary Geology & Geomorphology Division.* Carrie E. Jennings, Freshwater Society, cjennings@freshwater.org; Karen Gran, Univ. of Minnesota Duluth; Thomas Oommen, Michigan Technological Univ.
- T22. **Drainage Basin Evolution, Fluvial Geomorphology, and Fluvial Processes of the Great Plains, Great Lakes, and Upper Mississippi River Basin.** *Cosponsored by GSA Quaternary Geology & Geomorphology Division.* Phillip Larson, Minnesota State Mankato, phillip.larson@mnsu.edu; Andrew Wickert, Univ. of Minnesota; Douglas Faulkner, Univ. of Wisconsin–Eau Claire.
- T23. **Cores to Drones: Understanding Shoreline Behavior, Processes, and Coastal Landscape Changes in the Great Lakes.** *Cosponsored by GSA Quaternary Geology & Geomorphology Division.* Erin P. Argyilan, Indiana Univ. Northwest, eargyila@iun.edu; John Johnston, Univ. of Waterloo; Todd A. Thompson, Indiana Geological Survey.
- T24. **Lakes as Sentinels of Environmental Change.** Byron A. Steinman, Univ. of Minnesota Duluth, Dept. of Earth and Environmental Sciences and Large Lakes Observatory, bsteinma@d.umn.edu; Kathryn M. Schreiner, Univ. of Minnesota Duluth, Dept. of Chemistry and Biochemistry and Large Lakes Observatory; Matthew Finkenbinder, Wilkes Univ., Dept. of Environmental Engineering and Earth Sciences.
- T25. **Land-Lake Connections: The Importance of Hydrologic Processes on Aquatic Ecosystems.** Christopher T. Filstrup, Natural Resources Research Institute, Univ. of Minnesota

- Duluth, filstrup@d.umn.edu; John A. Downing, Minnesota Sea Grant and Large Lakes Observatory, Univ. of Minnesota Duluth.
- T26. **Groundwater Quality Degradation and Protection: Water Quality Assessment, Modeling, and Uncertainty Analysis, and Water Supply Management.** *Cosponsored by Minnesota Ground Water Association.* Melinda L. Erickson, U.S. Geological Survey, merickso@usgs.gov; Katherine S. Pound, St. Cloud State Univ. and Minnesota Ground Water Association (president); William W. Simpkins, Iowa State Univ.
- T27. **The Hydrogeology of Fracture and Karst Bedrock Aquifers.** *Cosponsored by GSA Karst Division.* E. Calvin Alexander Jr., Univ. of Minnesota, alexa001@umn.edu; Anthony Runkel, Minnesota Geological Survey.
- T28. **Caves and Karst of the Midwest.** *Cosponsored by GSA Karst Division.* Erik Larson, Shawnee State Univ., elarson@shawnee.edu; Maurice Testa, Univ. of Arkansas–Fort Smith.
- T29. **Addressing Habitat, Water, Ecosystem, and Sustainability Issues through Interdisciplinary Work.** *Cosponsored by GSA Geobiology & Geomicrobiology Division; GSA Hydrogeology Division; GSA Environmental & Engineering Geology Division; GSA Soils and Soil Processes Division.* Lisa Lamb, Univ. of St. Thomas, malamb@stthomas.edu; Scott Clark, Univ. of Wisconsin–Eau Claire; Richard Kiesling, U.S. Geological Survey; Eric Chapman, Univ. of St. Thomas.
- T30. **Nutrient and Sediment Loading in Freshwater Systems: Sources, Fate, Transport, and Strategies for Mitigation.** Sarah Vitale, Univ. of Wisconsin–Eau Claire, vitalesa@uwec.edu; Anna Baker, U.S. Geological Survey.
- T31. **Preventing, Responding to, and Understanding the Long-Term Behavior of Crude Oil and Petroleum in Terrestrial and Aquatic Environments.** Jared Trost, U.S. Geological Survey, jtrost@usgs.gov; Mark Toso, Minnesota Pollution Control Agency; Faith Fitzpatrick, U.S. Geological Survey.
- T32. **Unique Geology and Geohistory of the Lake Superior Region.** Erika Vye, Center for Science and Environmental Outreach, Michigan Technological Univ., ecvye@mtu.edu; William I. Rose, Geological and Mining Engineering and Sciences, Michigan Technological Univ.; Jim Miller; James M. DeGraff, Geological and Mining Engineering and Sciences, Michigan Technological Univ.
- T33. **Highlighting Indigenous-Centered Geoscience Research and Education.** Wendy Smythe, Univ. of Minnesota Duluth, wsmythe@d.umn.edu; Christie Poitra, Michigan State Univ. Native American Institute; Judi Brown Clarke, Michigan State Univ. BEACON Center.
- T34. **Strategies to Address Barriers to Learning in Classroom, Lab, and/or Field.** Prajukti (Juk) Bhattacharyya, Univ. of Wisconsin–Whitewater, bhatacj@uwv.edu; Caitlin Callahan, Grand Valley State Univ.
- T35. **Encouraging New Scientists: What Works in STEM Recruitment and Retention.** *Cosponsored by GSA Geoscience Education Division; National Association of Geoscience Teachers Geo2YC Division.* Joy Branlund, Southwestern Illinois College, joy.branlund@swic.edu; Sheldon Turner, Triton College.
- T36. **Teaching, Learning, and Research in Geoscience Education.** *Cosponsored by National Association of Geoscience Teachers.* Kyle Gray, Univ. of Northern Iowa, kyle.gray@uni.edu; Beth A. Johnson, Univ. of Wisconsin–Oshkosh, Fox Cities Campus.
- T37. **Undergraduate Research Poster Session.** *Cosponsored by Council on Undergraduate Research.* Robert D. Shuster, Univ. of Nebraska–Omaha, rshuster@unomaha.edu.

FIELD TRIPS

For additional information, please contact the Field Trip chair, Carrie Jennings, cjennings@freshwater.org. All Field Trips depart from the DECC unless otherwise noted.

Pre-Meeting Trips

- FT1. **Northern Minnesota Peatland and Soil Research Tour.** Sat.–Sun., 16–17 May, 9 a.m. Cost: US\$300. Max.: 20 participants. Ed Nater, nater001@umn.edu; Kyungsoo Yoo, Univ. of Minnesota; Stephen Sebestyen, U.S. Northern Forest Research Station.
- FT2. **Geology Field Trip along the Mesabi Iron Range with Fossil Collecting.** Sun., 17 May. Cost: US\$95. Max.: 33 participants. Allyse Freeman, Minnesota Discovery Center, allyse.freeman@mndiscoverycenter.com; John Westgaard, Science Museum of Minnesota.
- FT4. **The Sandstone Karst of Pine County, Minnesota.** Sun., 17 May. Cost: US\$115. Calvin Alexander, Univ. of Minnesota, alexa001@umn.edu; Greg Brick.

During the Meeting

- FT5. **Walking Tour of Minnesota Point.** Mon., 18 May. Free. Max.: 30 participants. Harry Jol, Univ. of Wisconsin–Eau Claire, jolhm@uwec.edu; Andy Breckenridge, Univ. of Wisconsin–Superior.
- FT6. **Geology under the Surface: Lake Superior and the Research Vessel *Blue Heron*—Morning Trip.** Tues., 19 May, 8 a.m. Cost: US\$15. Max.: 15 participants. Doug Ricketts, Univ. of Minnesota Duluth, ricketts@d.umn.edu; Nigel Watrus, Univ. of Minnesota Duluth.
- FT7. **Geology under the Surface: Lake Superior and the Research Vessel *Blue Heron*—Afternoon Trip.** Tues., 19 May, 1 p.m. Cost: US\$15. Max.: 15 participants. Doug Ricketts, Univ. of Minnesota Duluth, ricketts@d.umn.edu; Nigel Watrus, Univ. of Minnesota Duluth.

Post-Meeting

- FT8. **Minnesota's Minerals, Mining, and the Environment of the Mesabi Iron Range.** Weds., 20 May, 7:15 a.m. Cost: US\$85. Max.: 22 participants. Megan Kelly, megan.j.kelly@state.mn.us; Heather Arends, MnDNR Lands and Minerals.
- FT9. **Slope Stability, Extreme Floods, and Implications for Restoration in the Duluth Area.** Weds., 20 May, 9 a.m. Cost: US\$100. Max.: 16 participants. Emilie Richard, rich1726@d.umn.edu; Karen Gran, Univ. of Minnesota Duluth; Faith Fitzpatrick, U.S. Geological Survey; Marty Melchoir, Inter-Fluve.
- FT10. **Duluth to Two Harbors—Transect through the Duluth Complex and Base of the North Shore Volcanic Group.** Weds., 20 May, 8 a.m. Cost: US\$40. Max.: 22 participants. Jim Miller, emeritus, Univ. of Minnesota Duluth, mille066@d.umn.edu; Terry Boerboom, Minnesota Geological Survey.
- FT11. **Sediments, Landforms, and Proglacial Lake History in Western St. Louis County, Minnesota.** Weds., 20 May. Cost: US\$95. Max.: 17 participants. Jennifer McDonald, jmhorton@umn.edu; Kaleb Wagner, Minnesota Geological Survey; Andy Breckenridge, Univ. of Wisconsin—Superior.
- FT12. **Geologic Setting of the 1850 Ma Sudbury Meteorite Impact Layer on the Gunflint Trail, Northeastern Minnesota.** Weds.–Thurs., 20–21 May, 8 a.m. Cost: US\$285. Max.: 24 participants. Mark Jirsa, Minnesota Geological Survey, jirsa001@umn.edu.

SHORT COURSES

For additional information, please contact the Short Course chair, Josh Feinberg, feinberg@umn.edu.

- SC1. **Navigating the Path to Professional Licensure.** Sun., 17 May, 1–4 p.m. Free. Max.: 48 participants. Keith B. Rapp, AELS LAGID Geoscience Board Member, kbrapp@comcast.net.
- SC2. **3D Modeling Using Structure from Motion and Terrestrial Laser Scanning.** Sun., 17 May, 9 a.m.–4 p.m. Fee: \$70. Max.: 20 participants. Stephanie S. Day, North Dakota State Univ., stephanie.day@ndsu.edu; Zachary Phillips, North Dakota State Univ.
- SC3. **Programming IoT Monitoring Stations Built on the Arduino Framework with the EnviroDIY Modular Sensor Library.** Sun., 17 May, 9 a.m.–4 p.m. Fee: \$70. Max.: 12 participants. Beth A. Fisher, Minnesota State Univ. Mankato, beth.fisher@mnsu.edu; Anthony K. Aufdenkampe, LimnoTech.
- SC4. **Professional Ethics for Engineers and Geologists (2 PDH).** Sun., 17 May, 9–11 a.m. Fee: \$40. Max.: 48 participants. Karl D. Everett, KEA Associates, karl_everett@q.com.
- SC6. **Workflow for Unmanned Aerial Systems UAS.** Sun., 17 May, 8 a.m.–noon. Free. Max.: 48 participants. Scott M. Galetka,

Bayfield County, Sgaletka@bayfieldcounty.org; Martin Goettl, Univ. of Wisconsin—Eau Claire.

OPPORTUNITIES FOR STUDENTS AND EARLY CAREER PROFESSIONALS

Student Travel Grants

Deadline: 13 Apr.

Students who are GSA members and who register for the meeting are eligible to apply for student travel grants. Find information and applications for student travel grants at the North-Central Section website; go to <https://www.geosociety.org/nc-mtg> and click on “Students & ECPs.”

Career Mentoring Luncheons

Ask your career-related questions and learn about non-academic pathways in the geosciences while networking with professionals at the Roy J. Shlemon and John Mann Mentor Luncheons. GSA student members are welcome. Space is limited; this event is first-come, first-served.

Career Workshop Series

This three-part series will feature career development planning, an exploration of geoscience job sectors, and information on best practices for crafting a résumé and cover letter. Non-technical skills and workforce statistics will be reviewed. The series will be led by workshop presenters and geoscientists. No registration is required, and everyone is welcome.

To learn more about mentors and career workshops, go to <https://www.geosociety.org/mentors> or contact Jennifer Nocerino, jnocerino@geosociety.org.

Presentation Awards

Awards for the best graduate and undergraduate student posters and oral presentations are supported by the GSA North-Central Section and by the Great Lakes Section of SEPM (Society for Sedimentary Geology).

Lightning Talks

Students, please join us for an informal lightning talk session during the Welcome Reception on Sunday night, 17 May. Lightning talks provide an opportunity to draw people to your poster or talk or just to sharpen your presentation skills. Lightning talks must be three minutes (or less); the three-minute limit will be enforced. Speakers may include up to two slides in their presentation, not including a title slide. The session is a great opportunity to meet other students and learn about their research. Everyone is encouraged to attend, but speakers must be undergraduate or graduate students. Indicate your interest in giving a lightning talk when you register for the meeting. If you have questions, please contact Collin Roland, cjroland@wisc.edu.

First-Time Attendee Workshop

Sun., 17 May, 5–5:30 p.m., Harbor Side Convention Center, Horizon Room. Learn how to get the most out of your first North-Central Section Annual Meeting! This short workshop will be held Sunday evening and cover general information, highlight special events, discuss best practices and the code of conduct, and answer any questions you may have.

PROFESSIONALS

Interested in sharing information about your applied geoscience or hydrology career with students? Being a mentor is a rewarding experience. To learn more about serving as a mentor, contact Jennifer Nocerino, jnocerino@geosociety.org.

The North-Central Section Meeting also offers an excellent opportunity to earn CEUs toward your continuing education requirements for your employer, K–12 school, or professional registration. Please check the meeting website after the meeting to download your CEU certificate.

LOCAL COMMITTEE

Chair: Karen Gran, kgran@d.umn.edu

Vice-Chair: Harry Jol, jolhm@uwec.edu

Technical Program Chair: Chad Wittkop, chad.wittkop@mnsu.edu

Field Trip Chair: Carrie Jennings, cjennings@freshwater.org

Sponsorship Chair: Howard Mooers, hmooers@d.umn.edu

Exhibits Chair: Erik Brown, etbrown@d.umn.edu

Student Programs/Student Volunteer Chair: Prajukti (Juk)

Bhattacharyya, bhatacj@uww.edu

Treasurer: Doug Ricketts, ricketts@d.umn.edu

Short Course Chair: Josh Feinberg, feinberg@umn.edu

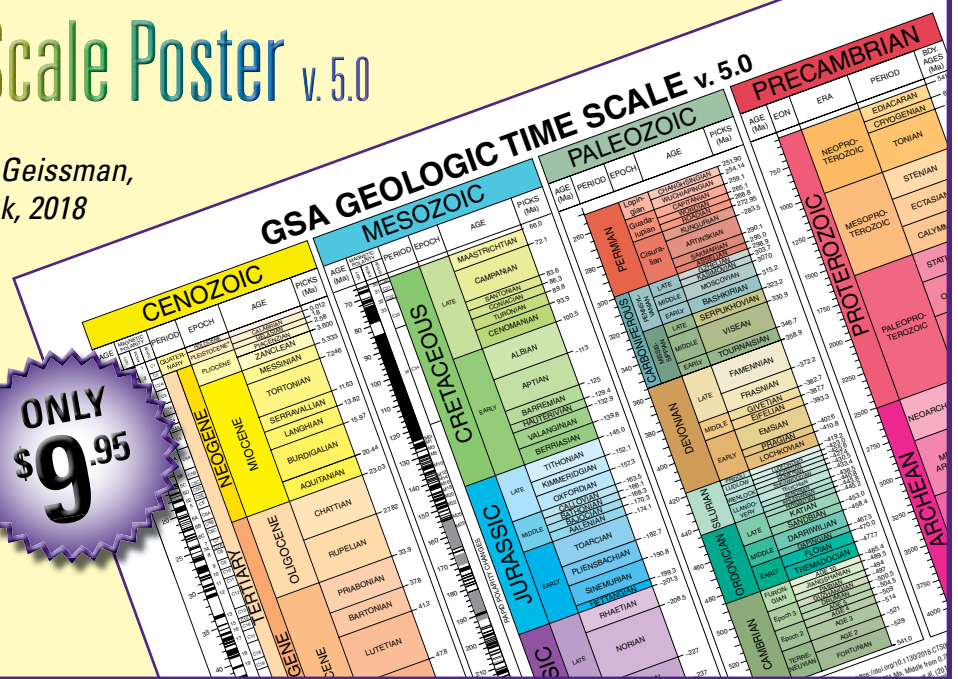
Geologic Time Scale Poster v. 5.0

Compiled by J.D. Walker, J.W. Geissman, S.A. Bowring, and L.E. Babcock, 2018

Use this colorful, poster-size version of GSA's Geologic Time Scale (v. 5.0) to decorate your office or classroom.

GTSP05 | 20" × 26" | \$9.95

ONLY
\$9.95




THE GEOLOGICAL SOCIETY
OF AMERICA®

BUY ONLINE ► <http://rock.geosociety.org/store/>

toll-free 1.888.443.4472 | +1.303.357.1000, option 3 | gsaservice@geosociety.org

GeoCareers Programs at the 2020 Section Meetings

Career Workshops

Geoscience Career Workshop Part 1: Career Planning and Informational Interviewing

Your job-hunting process should begin with career planning, not when you apply for jobs. This workshop will help you begin this process and will introduce you to informational interviewing. This section is highly recommended for freshmen, sophomores, and juniors. The earlier you start your career planning the better.

Geoscience Career Workshop Part 2: Geoscience Career Exploration

What do geologists in various sectors earn? What do they do? What are the pros and cons of working in academia, government,

and industry? Workshop presenters and professionals in the field will address these issues.

Geoscience Career Workshop Part 3: Cover Letters, Résumés, and CVs

How do you prepare a cover letter? Does your résumé need a good edit? Whether you are currently in the market for a job or not, learn how to prepare the best résumé possible. You will review numerous examples to help you learn important résumé dos and don'ts.

Mentor Programs for GSA Student Members

GSA student members: Enjoy a free lunch while meeting with geoscience mentors working in applied sectors. The popularity of these programs means that space is limited, so plan to arrive early, because lunch is first-come, first-served. For further information, contact Jennifer Nocerino at jnocerino@geosociety.org.

South-Central Section: Fort Worth, Texas, USA
Shlemon Mentor Luncheon: Monday, 9 March
Mann Mentors in Applied Hydrology Luncheon: Tuesday, 10 March

Joint Meeting: Southeastern and Northeastern Sections:
Reston, Virginia, USA
Shlemon Mentor Luncheon: Friday, 20 March
Mann Mentors in Applied Hydrology Luncheon: Saturday, 21 March

Rocky Mountain Section: Provo, Utah, USA
Shlemon Mentor Luncheon: Monday, 4 May
Mann Mentors in Applied Hydrology Luncheon: Tuesday, 5 May

Cordilleran Section: Pasadena, California, USA
Shlemon Mentor Luncheon: Tuesday, 12 May
Mann Mentors in Applied Hydrology Luncheon: Wednesday, 13 May

North-Central Section: Duluth, Minnesota, USA
Shlemon Mentor Luncheon: Monday, 18 May
Mann Mentors in Applied Hydrology Luncheon: Tuesday, 19 May



CALL FOR NOMINATIONS

GSA Scientific Division Awards



ENERGY GEOLOGY DIVISION

NEW: Curtis-Hedberg Petroleum Career Achievement Award

Nominations due 1 Mar.

Submit nominations to Laura S. Ruhl, lsruhl@ualr.edu

The inaugural Curtis-Hedberg Petroleum Career Achievement Award will be made for outstanding contributions in the field of petroleum geology. The award will go to a GSA member who has had a career in petroleum geology and has made contributions to the discovery of petroleum reserves or the development of a new idea(s) and/or technology that increased petroleum resources. Considerations will be given for their publications and their contributions to geoscience societies and institutions. Petroleum geology is defined as the field of knowledge concerning the origin, occurrence, relationships, and geologic characteristics of petroleum reserves, resources, and exploration, including economic implications and petroleum technology. This new Division award honors two former GSA presidents who made outstanding contributions to petroleum geoscience: Doris Malkin Curtis and Hollis Hedberg. Learn more at <https://community.geosociety.org/energydivision/awards/curtishedberg>.

Gilbert H. Cady Award

Nominations due 28 Feb.

Submit nominations to Laura Ruhl at lsruhl@ualr.edu.

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. For more information, go to <https://community.geosociety.org/energydivision/awards/cady>.

Antoinette Lierman Medlin Scholarship

Nominations due 15 Mar.

Submit nominations to Richard A. Esposito, raesposi@southernco.com

The Antoinette Lierman Medlin Scholarship provides monetary support and recognition to deserving students in coal science. Money from the scholarship is used toward successful completion of a student's research project. Each year, one award is presented for the completion of laboratory/analytical research (US\$2,000) and a second award is presented for the completion of fieldwork (US\$1,500). Full-time graduate students are strongly encouraged to submit applications. Learn more at <https://community.geosociety.org/energydivision/awards/medlin>.

GEOARCHAEOLOGY DIVISION

Rip Rapp Archaeology Geology Award

Nominations due 15 Feb.

Submit nominations 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. Nominations should include a biographical sketch, a statement of outstanding achievements, and a selected bibliography of the nominee. For more information, go to <https://community.geosociety.org/geoarchdivision/awards/ripapp>.

Claude C. Albritton, Jr., Award

Nominations due 15 Mar.

Submit nominations to gsa.agd@gmail.com.

Under the auspices of the Geoarchaeology Division, family, friends, and close associates of Claude C. Albritton, Jr., formed a memorial fund in his honor through the GSA Foundation. The Albritton Award Fund provides scholarships and fellowships for graduate students in the earth sciences or archaeology for research. Recipients of the award are students who have (1) an interest in achieving a master's or Ph.D. degree in earth sciences or archaeology; (2) an interest in applying earth-science methods to archaeological research; and (3) an interest in a career in teaching and academic research. Awards in the amount of US\$650 are given in support of thesis or dissertation research, with emphasis on the field and/or laboratory aspects of the research. For more information, go to <https://community.geosociety.org/geoarchdivision/awards/student/albritton>.

Richard Hay Student Paper/Poster Award

Nominations due 1 Sept.

Submit nominations to gsa.agd@gmail.com.

At the 2006 Annual Meeting in Philadelphia, Pennsylvania, USA, the Division's management board elected to rename the student travel award for a distinguished scientist in archaeological geology. After consulting with his family, the award was officially named the Richard Hay Student Paper/Poster Award. Hay was a longstanding 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 its 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's annual meeting. The grant is competitive and is 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. For more information, go to <https://community.geosociety.org/geoarchdivision/awards/student/hay>.

GEOINFORMATICS DIVISION

Outstanding Contributions in Geoinformatics Award

Nominations due 15 Feb.

The Outstanding Contributions in Geoinformatics Award 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 should be a member of GSA. For more information, go to <https://community.geosociety.org/geoinformaticsdivision/awards>.

GEOSCIENCE EDUCATION DIVISION

Biggs Award for Excellence in Earth Science Teaching

Nominations due 15 Mar.

Submit nominations online.

The Biggs Award recognizes innovative and effective teaching in college-level earth science. Earth-science instructors and faculty members from any academic institution engaged in undergraduate education who have been teaching full-time for 10 years or fewer are eligible (part-time teaching is not counted in this requirement). Both peer- and self-nominations will be accepted. This award, administered by the GSA Foundation, is made possible by support from the Donald and Carolyn Biggs Fund, the GSA Geoscience Education Division, and GSA's education and outreach program. An additional travel reimbursement is also available to the recipient to enable him or her to attend the award presentation at the GSA Annual Meeting. For more information, go to <https://community.geosociety.org/gedivision/awards/biggsaward>.

HISTORY AND PHILOSOPHY OF GEOLOGY DIVISION

Michele Aldrich History and Philosophy of Geology Student Research Award

Nominations due 1 Feb.

Submit nominations to Michael Smith at smithms@uncw.edu.

This award, established in 2017, is made possible by the Michele Aldrich History and Philosophy of Geology Student Research Award Fund, managed by the GSA Foundation. The purpose of the fund is to support research grants through the History and Philosophy of Geology 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 Ph.D. in the previous five years may also be considered. Annual awards will be made by GSA's History and Philosophy of Geology 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 GSA History and Philosophy of Geology Division. Recipients of the Michele Aldrich History and Philosophy of Geology Student Research Award will be included in the annual GSA and/or GSA Foundation research award ceremonies, along with other student research award recipients. Students must apply online for this award through the standard **GSA Graduate Student Research Grant** process and follow all of the relevant program guidelines and deadlines. For more information, go to <https://community.geosociety.org/histphildiv/awards/aldrich>.

Mary C. Rabbitt History and Philosophy of Geology Award

Nominations due 15 Feb.

Submit nominations to Michael Smith at smithms@uncw.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. The award was established by the History of Geology Division in 1981 and renamed in 2005 in memory of Mary C. Rabbitt, whose bequest has made this award possible. 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 curriculum vitae, 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. For more information, go to <https://community.geosociety.org/histphildiv/awards/rabbitt>.

Gerald M. and Sue T. Friedman Distinguished Service Award

Nominations due 15 Feb.

Submit nominations to Michael Smith at smithms@uncw.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 need be a member of the Division or of GSA. The 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 curriculum vitae including name, title, affiliation, education, degrees, honors and awards, major career events, and the contributions that warrant the award. The award is made possible by a bequest from the estate of Mary C. Rabbitt. Monies for the award are administered by the GSA Foundation. For more information, go to <https://community.geosociety.org/histphildiv/awards/dsa>.

History and Philosophy of Geology Student Award

Nominations due 15 June

Submit nominations to Michael Smith at smithms@uncw.edu.

The History and Philosophy of Geology Division provides a student award in the amount of US\$1,000 for a paper to be given at the GSA Annual Meeting. Awards may also be given for second place. The award, established in 2004, is made possible by a bequest from the estate of Mary C. Rabbitt. 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 winners with a review of the abstract, 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 the GSA Annual Meeting. 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, and monies for the award are administered by the GSA Foundation. For more information, go to <https://community.geosociety.org/histphildiv/awards/student>.

KARST DIVISION

Meritorious Contribution Award

Nominations due 31 Mar.

Submit nominations to Jason Polk, jason.polk@wku.edu

The Meritorious Contribution Award goes 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. Nominations must include (1) the GSA Karst Division award application/nomination form; (2) a letter explaining the merit of the nominee's work and its role in advancing karst studies; and (3) the nominee's curriculum vitae. Learn more at <https://community.geosociety.org/karstdivision/awards>.

Young Scientist Award

Nominations due 31 Mar.

Submit nominations to Jason Polk, jason.polk@wku.edu

The Young Scientist Award recognizes a distinguished scientist (35 or younger throughout the year in which the award is to be presented or within five 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. Nominations must include (1) the GSA Karst Division award application/nomination form; (2) a letter explaining the merit of the nominee's work and its role in advancing karst studies; and (3) the nominee's curriculum vitae. Learn more at <https://community.geosociety.org/karstdivision/awards>.

Distinguished Service Award

Nominations due 31 Mar.

Submit nominations to Jason Polk, jason.polk@wku.edu

The Distinguished Service Award is a highly esteemed award in recognition of distinguished personal service to the karst profession and to the Karst Division. Nominations must include: (1) the GSA Karst Division award application/nomination form; (2) a letter explaining the merit of the nominee's work and its role in advancing karst studies; and (3) the nominee's curriculum vitae. Learn more at <https://community.geosociety.org/karstdivision/awards>.

LIMNOGEOLOGY DIVISION

Israel C. Russell Award

Nominations due 15 Mar.

Submit nominations to David Finkelstein at finkelstein@hws.edu.

The Israel C. Russell Award is given 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. For more information, go to <https://community.geosociety.org/limnogeologydivision/awards/russell>.

Kerry Kelts Research Award

Nominations due 30 June

Submit nominations to David Finkelstein at finkelstein@hws.edu.

The Kerry Kelts Research Award is for undergraduate or graduate student research related to limnogeology, limnology, or paleolimnology. For more information, go to <https://community.geosociety.org/limnogeologydivision/awards/kerrykelts>.

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

MGPV Distinguished Geologic Career Award

Nominations due 31 Mar.

Submit nominations to J. Alex Speer at jaspeer@minsocam.org.

The MGPV Distinguished Geologic Career Award will go to an individual who, throughout his or 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. For more information, go to <https://community.geosociety.org/mgpvdivision/awards/dgca>.

MGPV Early Career Award

Nominations due 31 Mar.

Submit nominations to J. Alex Speer at jaspeer@minsocam.org.

The MGPV Early Career Award will go to an individual near the beginning of his or her professional career who has made distinguished contributions in one or more of the following fields of research: mineralogy, geochemistry, petrology, and 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 required. The award will not be given posthumously. For more information, go to <https://community.geosociety.org/mgpvdivision/awards/earlycareer>.

PLANETARY GEOLOGY DIVISION (PGD)

Eugene M. Shoemaker Impact Cratering Award

Nominations due 19 Aug.

Submit nominations online.

The Shoemaker 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\$2,500, 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 are not necessarily limited to impact cratering processes; the bodies (asteroidal or cometary) that make the impacts; or the geological, chemical, or biological results of impact cratering. For more information, go to <https://community.geosociety.org/pgd/awards/shoemaker>.

Ronald Greeley Award for Distinguished Service

Nominations due 30 June

Submit nominations to the PGD management board at <https://community.geosociety.org/pgd/aboutus/officers>.

In 2011, the PGD established the Ronald Greeley Award for Distinguished Service. This award may be given to those members of the PGD, and those outside of the Division and GSA, who have rendered exceptional service to the PGD for a multi-year period. The award is not open to currently serving members of the management board, but may be awarded to past members of the management board who have provided exceptional service to the PGD after their term on the management board has ended. Nominations for the award, which should include a description of what the nominee has given to the PGD community, may be made by any PGD member. For more information, go to <https://community.geosociety.org/pgd/awards/greeley>.

QUATERNARY GEOLOGY & GEOMORPHOLOGY DIVISION

Farouk El-Baz Award for Desert Research

Nominations due 1 Apr.

Submit nominations to the first vice-chair.

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. The award is normally given to one person but may be shared by two people if the recognized research was the result of a coequal partnership. Any scientist from any country may be nominated. Because the award recognizes research excellence, self-nomination is not permitted. Neither nominators nor nominees need be GSA members. 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. Please submit electronically unless hardcopy previously approved. For more information, go to <https://community.geosociety.org/qggdivision/awards/el-baz>.

Distinguished Career Award

Nominations due 1 Apr.

Submit nominations to Sarah Lewis at sarah.lewis@oregonstate.edu.

The Distinguished Career Award is presented annually to a Quaternary geologist or geomorphologist who has demonstrated excellence in their contributions to science. Because the award recognizes research excellence, self-nomination is not permitted. Neither nominators nor nominees need be GSA members.

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 minimum of four letters from colleagues supporting the nomination. Please submit electronically unless hardcopy previously approved. For more information, go to <https://community.geosociety.org/qggdivision/awards/distinguished-career>.

SEDIMENTARY GEOLOGY DIVISION

Laurence L. Sloss Award for Sedimentary Geology

Nominations due 15 Feb.

Submit nominations to Brett McLaurin at bmclauri@bloomu.edu.

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. Submit (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. For more information, go to <https://community.geosociety.org/sedimentarygeologydiv/awards/sloss>.

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

Nominations due 1 Apr.

Submit nominations to Timothy Byrne at timothy.byrne@uconn.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. The award alternates between being awarded by the Sedimentary Geology Division on odd-numbered years and the Structural Geology and Tectonics Division on even-numbered years, reflecting the focus of the award on this cycle. Graduate students, postgraduates, and faculty-level researchers are eligible. For information and application requirements, go to <https://community.geosociety.org/sedimentarygeologydiv/awards/laubach> or <https://community.geosociety.org/sgt/awards/laubachaward>.

STRUCTURAL GEOLOGY & TECTONICS DIVISION

Career Contribution Award

Nominations due 1 Mar.

Submit nominations to Jeff Amato at amato@nmsu.edu.

The Career Contribution Award is for an individual who throughout his or 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 GSA membership is not required. Nominations should include the following information: (1) name of nominee, present institutional affiliation, and address; (2) summary statement of nominee's major career contributions to the science of structural geology and tectonics; (3) selected key published works of the nominee; and (4) name and address of the nominator. For more information, go to <https://community.geosociety.org/sgt/awards/careercontribution>.

Outstanding Publication Award

Nominations due 1 Mar.

Submit nominations to Julie Newman at newman@geo.tamu.edu.

The Outstanding Publication 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 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. For more information, go to <https://community.geosociety.org/sgt/awards/outstandingpublication>.

Tectonics, Sedimentary Basins, and Provenance: A Celebration of the Career of William R. Dickinson

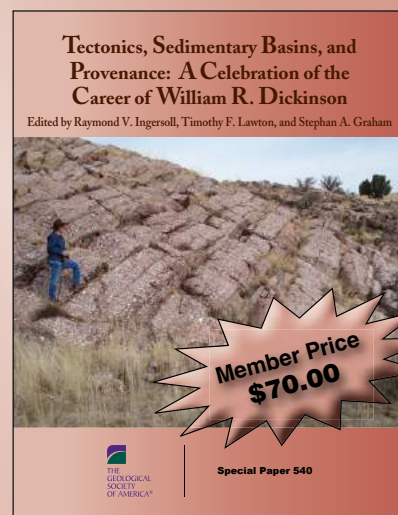
Edited by Raymond V. Ingersoll,
Timothy F. Lawton, and Stephan A. Graham

Through a remarkable combination of intellect, self-confidence, engaging humility, and prodigious output of published work, William R. Dickinson influenced and challenged three generations of sedimentary geologists, igneous petrologists, tectonicists, sandstone petrologists, archaeologists, and other geoscientists. A key figure in the plate-tectonic revolution of the 1960s and 1970s, he explained how the distribution of sediments on Earth's surface could be traced to tectonic processes, and is widely recognized as a founder of modern sedimentary basin analysis. This volume consists of 31 chapters related to Dickinson's research interests; many of the authors are his former students, their students, and their students' students, demonstrating his continuing profound influence. The papers in this volume are an impressive tribute to the depth and breadth of Bill Dickinson's contributions to the geosciences.

SPE540, 757 p., ISBN 9780813725406
\$99.00, **member price \$70.00**

toll-free 1.888.443.4472
1.303.357.1000, option 3
gsaservice@geosociety.org

Buy online at <http://rock.geosociety.org/store/>

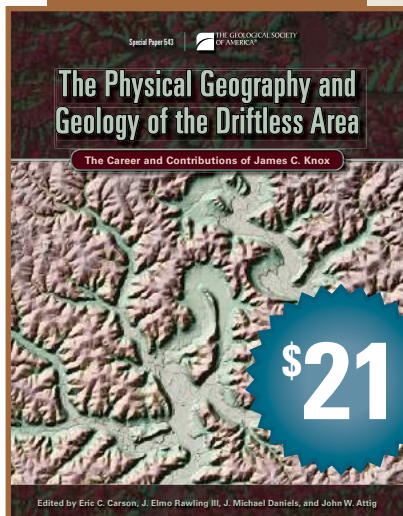


THE GEOLOGICAL SOCIETY
OF AMERICA®

Special Paper 540

EXPLORE WISCONSIN GEOLOGY

Special Paper 543



The Physical Geography and Geology of the Driftless Area: The Career and Contributions of James C. Knox

Edited by Eric C. Carson, J. Elmo Rawling III, J. Michael Daniels, and John W. Attig

Over the course of his 43-year career, James C. Knox conducted seminal research on the geomorphology of the Driftless Area of southwestern Wisconsin. His research covered wide-ranging topics such as long-term landscape evolution in the Driftless Area; responses of floods to climate change since the last glaciation; processes and timing of floodplain sediment deposition on both small streams and on the Mississippi River; impacts of European settlement on the landscape; and responses of stream systems to land-use changes. This volume presents the state of knowledge of the physical geography and geology of this unglaciated region in the otherwise-glaciated Midwest with contributions written by Knox prior to his passing in 2012 and by a number of his former colleagues and graduate students.

\$21

MEMBER PRICE

SPE543, 156 p.

ISBN 9780813725437

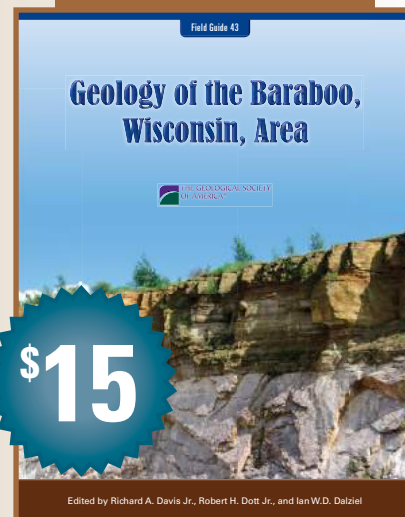
list price \$30.00

Geology of the Baraboo, Wisconsin, Area: Geological Society of America Field Guide

Edited by Richard A. Davis Jr., Robert H. Dott Jr., and Ian W.D. Dalziel

With its wide variety of geological features and phenomena packed into a small area, the Baraboo of south-central Wisconsin is among the most visited parts of the Midwest by geology students. This guidebook, the first comprehensive look at the area in decades, covers the spectrum of geological features present in the area, and it is useful as a teaching tool. An exceptional outdoor classroom, the Baraboo area contains a spectrum of geology, including excellent examples of geomorphology, glacial geology, structural geology, petrology, stratigraphy, and sedimentology. Ages of the strata range from 1.7-billion-year-old Precambrian to the Quaternary. The area has been studied for about a century, but it still holds surprises for professionals and students alike.

Field Guide 43



MEMBER ONLY

\$15

FLD043, 81 p.

ISBN 9780813700434

GSA BOOKS ▶ <https://rock.geosociety.org/store/>



THE GEOLOGICAL SOCIETY OF AMERICA®

toll-free +1.800.472.1988 | +1.303.357.1000, option 3 | gsaservice@geosociety.org

Ads (or cancellations) must reach the GSA advertising office no later than the first of the month, one month prior to the issue in which they are to be published. (Note: Combined March/April issue releases on March schedule.) Print ads will also appear on the Geoscience Job Board to coincide with the month of print issue. **Contact: advertising@geosociety.org, +1-800-472-1988 ext. 1053, or +1-303-357-1053.** Email correspondence should include complete contact information (including phone and mailing address). Rates are in U.S. dollars.

Classification	Per Line for 1st month	Per line each add'l month (same ad)
Positions Open	\$9.40	\$9.35
Fellowship Opportunities	\$9.40	\$9.35
Opportunities for Students		
First 25 lines	FREE	\$5.00
Additional lines	\$5.00	\$5.00

POSITIONS OPEN

Three Assistant Professors in Coastal Geology, Structural Geology & Tectonics, and Geodesy & Marine Geophysics-University of Hawai'i at Mānoa

The Dept. of Earth Sciences in the School of Ocean and Earth Sciences and Technology seeks to fill three tenure-track faculty positions at the level of Assistant Professor in the broad area of active geologic processes. We seek a group of talented scientists eager to leverage our unique location in the Pacific region on an ocean island chain, as well as contribute to studies of global Earth problems, while broadening our expertise in active processes that influence natural hazards. It is also desired that these scientists contribute to, or use, modern geoinformatics infrastructure and data analysis methods. The successful applicants are expected to establish externally funded and nationally recognized research programs, enthusiastically contribute to graduate and undergraduate advising and teaching, and carry out professional service activities. Willingness to engage with faculty, staff, and students in a collaborative fashion that supports diversity and inclusivity is essential.

The positions are offered in three research areas: (1) Coastal Processes and/or Geologic Framework Studies; (2) Structural Geology and Tectonics; (3) Geodesy and Marine Geophysics.

See full job announcement at: http://www.soest.hawaii.edu/GG/positions/ERTH_Faculty_Search. Review of applications will begin immediately and continue until the position is filled. Preference will be given to applications received on or prior to February 7, 2020. Address questions to Prof. Garrett Apuzen-Ito, gito@hawaii.edu.

Tier I Canada Research Chair in Metallogeny, Laurentian University

The Harquail School of Earth Sciences (HES) and Mineral Exploration Research Centre (MERC) at Laurentian University invite applications for a Tier I Canada Research Chair in Metallogeny that integrates ore system research with broad scale tectonic processes. The Chair will enhance research and teaching in the field of ore deposit geology

and tectonics, and advance the position of Laurentian University as a centre of excellence in Mineral Deposits and Precambrian Geology. The Chair will be one of the scientific leaders of Metal Earth, a Canadian \$104 million R&D program led by Laurentian University and funded through the Canada First Research Excellence Fund.

We seek an innovative individual with an outstanding record of research and publication, who will provide leadership for national and international collaborative research and become a focus for integration of research initiatives involving HES/MERC. The Chair will be expected to contribute to our BSc, MSc, and PhD programs. The successful applicant will have access to a wide range of facilities, including recently updated LA-ICP-MS facility (Teledyne Cetac Analyte G2 Excimer Laser, Thermo Neptune Plus high-resolution MC-ICP-MS, and iCap TQ triple-quadrupole ICP-MS with dedicated full-time Ph.D. technician). Additional information about the School, MERC and Metal Earth can be found at hes.laurentian.ca, merc.laurentian.ca, and merc.laurentian.ca/research/metal-earth.

A Ph.D. degree in a related field is required at the time of appointment. Applications, including a statement of teaching philosophy, evidence of teaching, an overview of research interests, and a curriculum vitae should be sent as PDF files to vpap@laurentian.ca. Applicants should arrange to have three letters of reference directly sent to the email address above. Review of complete applications will begin immediately but applications will be accepted until the position is filled. Questions concerning the position may be directed to Dr. Doug Tinkham at dtinkham@laurentian.ca. The full advertisement for this position can be downloaded at <https://hes.laurentian.ca/news-standard/careers-tier-1-canada-research-chair-metallogeny>.

Laurentian University is an inclusive and welcoming community and encourages applications from members of equity-seeking communities including women, racialized and Indigenous persons, persons with disabilities, and persons of all sexual orientations and gender identities/expressions. Laurentian University's bilingualism policy (Section 7.3.b) provides a provision regarding the language requirement for persons self-identifying as First Nations, Métis or Inuit, and the University has a policy of passive bilingualism (English/French) as a condition of tenure. Information can be found at <https://laurentian.ca/bilingualism>. LU faculty members are part of the Laurentian University Faculty Association (LUFA). Candidates are advised to consult the Collective Agreement at www.lufapul.ca/. Laurentian University is committed to providing an inclusive and barrier free experience to applicants with accessibility needs. Requests for accommodation can be made at any stage during the recruitment process. Please contact the Office of the Vice-President, Academic and Provost for more information. All qualified persons are encouraged to apply; however, in accordance with Canadian immigration requirements, Canadian citizens and permanent residents of Canada will be given priority.

OPPORTUNITIES FOR STUDENTS

Graduate Research Position University of Alaska Anchorage, Dept. of Geological Sciences.

As part of a newly funded NSF EPSCoR project, we are seeking a highly qualified individual to contribute to the "Fire and Ice" Coastal Margins stream team research <https://www.alaska.edu/epscoR/fire-and-ice/>.

Individuals with a background in geoscience especially hydrology and geochemistry are sought. The successful candidate will be part of a team of faculty and students who are investigating the impacts of freshwater and nutrients from glacier-fed to precipitation-fed watersheds on the intertidal zone in the Gulf of Alaska (Kachemak Bay) under the influence of a changing climate. The team collaborates with biologists and oceanographers from across the University of Alaska system as well as geoscientists from other universities. This is a five-year project with four field seasons; one field season (2019) has been completed. Qualifications include a B.S. (for M.S.) or M.S. (for Ph.D.) in Geological Sciences or closely related field, strong quantitative and computational skills (including GIS, database management, and experience with R or python), experience in the field with sample and data collection, the ability to hike in rugged terrain and work outdoors in various weather conditions in remote Alaskan wilderness settings. In addition to the fieldwork, other responsibilities include: 1) laboratory work such as water sample processing, 2) analysis of large data sets including stream sensor data and 3) Alaska EPS-CoR meetings and outreach involvement. The thesis or dissertation topic will be defined by the successful candidate and the faculty advisor and committee.

This is a full time (20 hrs/week fall and spring semesters, 40 hrs/week summer), two year position that includes a stipend and tuition waiver for 9 credits (FTE) per semester. The position will begin summer 2020. For more information on the UAA MSAGS Geological Sciences program please visit <https://www.uaa.alaska.edu/academics/college-of-arts-and-sciences/departments/geology/graduate.cshml>. Applications to the graduate program should be submitted no later than February 15th 2020 in order to be considered for funding. For more information or questions, please contact UAA Co-PI Dr. Lee Ann Munk at lamunk@alaska.edu.

The Institute for Field Research offers immersive, hands-on field schools across the globe. Students receive research and methods training from principal investigators in the fields of Paleontology, Geoarchaeology, Environmental Sciences, and more. Our programs are peer-reviewed for excellence in student learning and active research. 8 college semester credit units are awarded for completion of our full-length programs. Need and merit-based scholarships are available. Learn more and apply on our website: https://ifrglobal.org/environmental-studies/?utm_source=GSA&utm_medium=PaidAd&utm_campaign=ES.

TOOLS FIELD

Geologist's Wish List



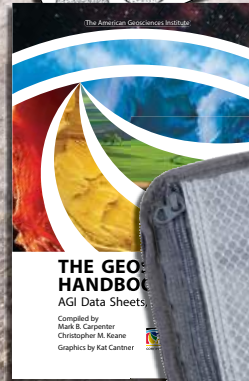
- Pocket-Size Sand Grain Sizing folder
- GSA Photo Scale / Time Scale
- Wallet-Size Geologic Time Scale
- The Geoscience Handbook 2016:
AGI Data Sheets, Fifth Edition
Published by the American Geosciences Institute

NITE IZE® PRODUCTS

- Doohickey 6x Key Tool
- Gear Tie Key Ring (Blue / Neon Yellow)
- S-Biner Ahhh
- S-Biner Dual Carabiner Aluminum
(Lime Green / Orange)

RITE-IN-THE-RAIN PRODUCTS

- Geology Field Bound Book, 4³/₄" x 7¹/₂"
- Shirt Pocket Spiral Notebook, 3" x 5"
(Yellow / Blue)
- Side Spiral Metric Notebook, 4⁵/₈" x 7"
(Yellow / Blaze Orange)
- Field Book Pouch
- Black Field-Flex Memo Book, 3¹/₂" x 5"
- Pocket Organizer Pouch
(fits books up to 3¹/₄" x 5¹/₄")



**THE GEO
HANDBOOK**
AGI Data Sheets
Compiled by
Mark B. Carpenter
Christopher M. Keane
Graphics by Kat Carther



THE
GEOLOGICAL
SOCIETY
OF AMERICA®

Buy ONLINE ▶ rock.geosociety.org/store/

toll-free 1.800.472.1988 | +1.303.357.1000, option 3 | gsaservice@geosociety.org



GSA FOUNDATION

Update

John W. (Jack) Hess, *GSA Foundation President*

An Important Investment in the Future of the Geoscience Community: Scholarships for Expanding Representation in the Geosciences

Compared to all other science and engineering fields, the geosciences have the lowest level of engagement from students from diverse communities, according to the National Science Foundation. Since 2008, GSA's Scholarships for Expanding Representation in the Geosciences (formally the Minority Student Scholarships), one of the Society's programs to help address this alarming statistic, have been granted to students from groups traditionally underrepresented in the geosciences.

What began in partnership with a corporate sponsor became such a mainstay of GSA programming that upon completion of that initial sponsorship, the Society and the GSA Foundation have remained committed to the program's continuation through a combination of occasional corporate funding and GSA strategic funds.

Hearing recipients' experiences cements our resolve to continue funding the annual grants to students from each of GSA's six

geographic Sections. Ranging from \$1,500 to \$2,000 each (depending on each year's available funds), the scholarships may be used to purchase textbooks, pay college fees, or attend GSA field trips or meetings. Along with the cash award, students receive complimentary membership and Annual Meeting registration to further aid in their engagement with the greater geoscience community and encourage participation in a professional society—where many of us meet our mentors, colleagues, and even friends that help guide the course of our careers.

Natalea Cohen says, "Receiving the GSA Minority Student Scholarship has greatly impacted my geoscience studies and career path goals. I was also a GSA On To the Future student and had the opportunity to attend the annual 2019 GSA meeting in Phoenix, including the diversity committee meeting. Being a recipient of this Minority Student Scholarship helped solidify my passion for wanting to increase the importance of diversity in the geosciences. Attending the meeting gave me the opportunity to network with professionals and gain possible contacts for future internship/job opportunities. I also learned about field camp and scholarship opportunities for field camp. The scholarship also contributed to the continuation of my academic studies at Fort Lewis College in Durango, Colorado. I am a current junior pursuing a geology major with mathematics and Spanish minors. I am extremely excited about volcanology and my goal is to complete international geologic work. I will be graduating ... in December 2020 (after 3.5 years as an undergrad). I hope to do an internship next spring if I do not go straight into research at a graduate school."

Please consider helping us in our commitment to sustain the Scholarships for Expanding Representation in the Geosciences each year, so that students like Natalea are able to pursue their studies; network, present, and learn at GSA meetings; and become involved in the Society's leadership through opportunities such as the GSA Diversity Committee. You can make a contribution at <https://gsa-foundation.org/fund/minority-scholarship/> or contact Debbie Marcinkowski at +1-303-357-1047, dmarcinkowski@geosociety.org.



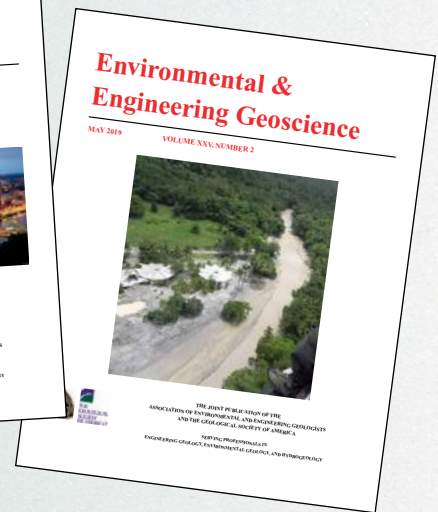
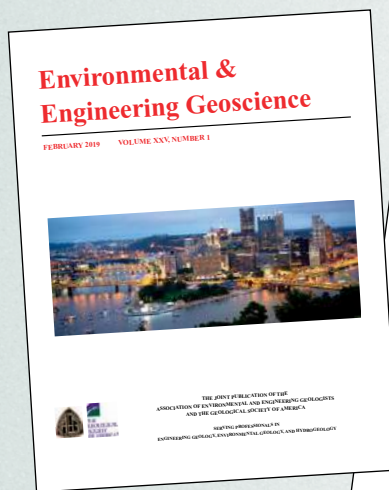
Natalea Cohen.

CALL FOR EDITOR

ENVIRONMENTAL & ENGINEERING GEOSCIENCE

GSA is soliciting applications and nominations for a science co-editor for *Environmental & Engineering Geoscience (E&EG)* with a term of 4 years beginning January 2021. Duties include: ensuring stringent peer review and expeditious processing of manuscripts; making final acceptance or rejection decisions after considering reviewer recommendations; and, along with your co-editor, setting the editorial tone of the journal. *E&EG* editors also solicit submissions to the journal through interacting with colleagues at meetings and through organizing special issues.

Research interests that complement those of the continuing editor include hydrogeology, low-T geochemistry, geomorphology, and/or environmental geophysics.



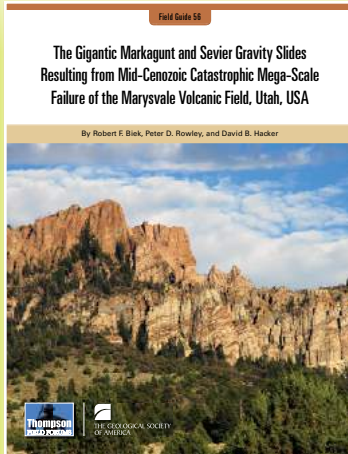
To Apply: Submit a letter detailing how your experience (including editorial experience) qualifies you for this position, and a curriculum vitae to Jeanette Hammann, jhammann@geosociety.org. The GSA Publications Committee will review applications at its spring 2020 meeting. GSA encourages applications from all qualified persons and is committed to diversity.

Editors work out of their current locations at work or at home. The positions are considered voluntary, but GSA provides an annual stipend and funds for office expenses.

DEADLINE: First consideration will be given to nominations or applications received by 15 March 2020.

FIELD GUIDES TO EXPLORE

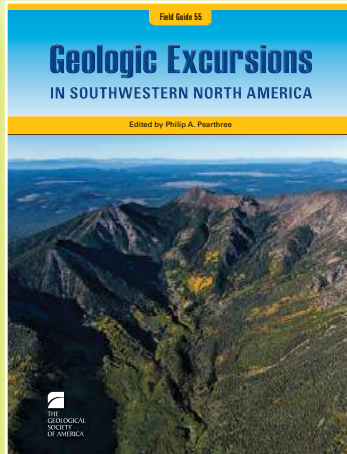
at the GSA Store



The Gigantic Markagunt and Sevier Gravity Slides Resulting from Mid-Cenozoic Catastrophic Mega-Scale Failure of the Marysvale Volcanic Field, Utah, USA

By Robert F. Biek, Peter D. Rowley, and David B. Hacker

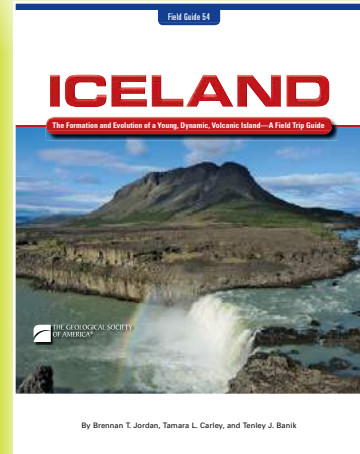
FLD056, 121 p., ISBN 9780813700564
\$23.00 | **member price \$16.00**



Geologic Excursions in Southwestern North America

Edited by Philip A. Pearthree

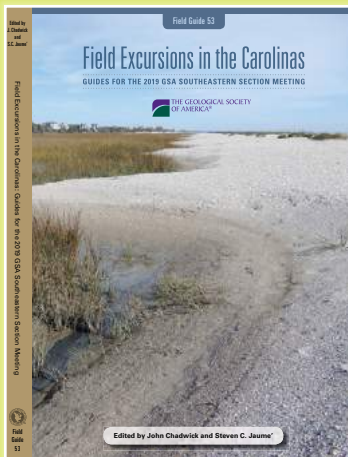
FLD055, 553 p., ISBN 9780813700557
\$80.00 | **member price \$56.00**



Iceland: The Formation and Evolution of a Young, Dynamic, Volcanic Island—A Field Trip Guide

By Brennan T. Jordan, Tamara L. Carley, and Tenley J. Banik

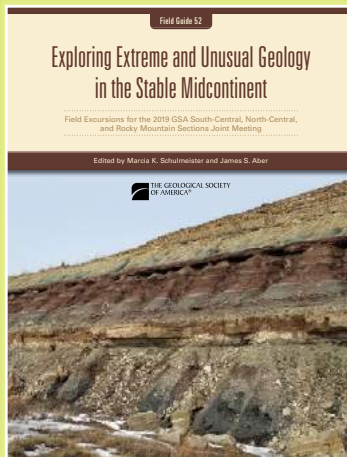
FLD054, 118 p., ISBN 9780813700540
\$40.00 | **member price \$28.00**



Field Excursions in the Carolinas: Guides to the 2019 GSA Southeastern Section Meeting

Edited by John Chadwick and Steven C. Jaume'

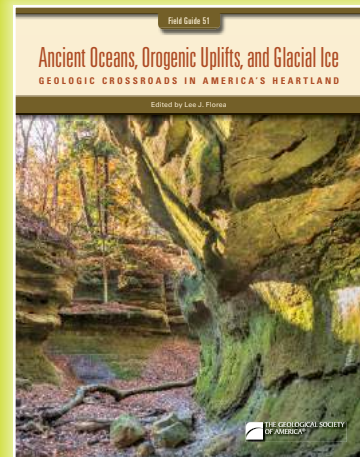
FLD053, 32 p., ISBN 9780813700533
\$26.00 | **member price \$18.00**



Exploring Extreme and Unusual Geology in the Stable Midcontinent: Field Excursions for the 2019 GSA S-C, N-C, and RM Sections Joint Meeting

Edited by Marcia K. Schulmeister and James S. Aber

FLD052, 70 p., ISBN 9780813700526
\$38.00 | **member price \$26.00**



Ancient Oceans, Orogenic Uplifts, and Glacial Ice: Geologic Crossroads in America's Heartland

Edited by Lee J. Florea

FLD051, 434 p., ISBN 9780813700519
\$64.00 | **member price \$45.00**

<https://rock.geosociety.org/store/>

toll-free 1.800.472.1988 • 1.303.357.1000, option 3
gsaservice@geosociety.org

 THE GEOLOGICAL SOCIETY
OF AMERICA®