

# GSA TODAY

A PUBLICATION OF THE GEOLOGICAL SOCIETY OF AMERICA®

The development and evolution of the William Smith  
1815 geological map from a digital perspective



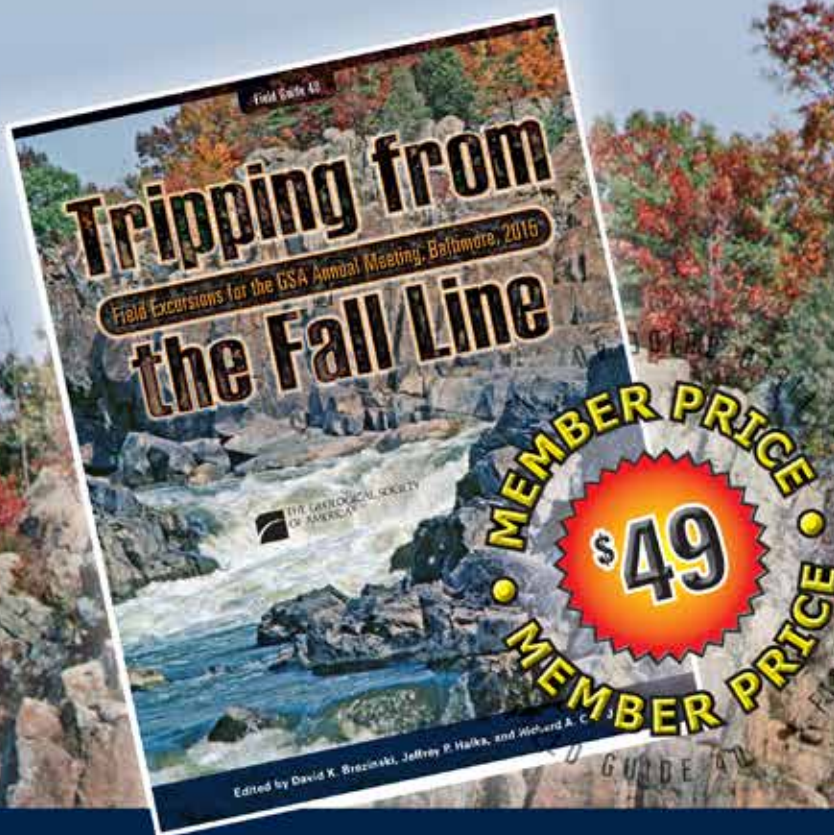
# Tripping from the Fall Line

Field Excursions for the GSA Annual Meeting, Baltimore, 2015

Edited by David K. Brezinski, Jeffrey P. Halka, and Richard A. Ortt Jr.

Prepared in conjunction with the 2015 GSA Annual Meeting in Baltimore, Maryland, this volume contains guides to field trips in this historic region. Emanating from the Fall Line city of Baltimore, these trips reflect the diversity of geological features in the mid-Atlantic region including the Piedmont, Appalachian Mountains, and Coastal Plain, and the importance of geology for the development and construction of the Baltimore–Washington, D.C., metropolitan area. Trips to the core of the Appalachian orogen concern themselves with the tectonic and metamorphic history, early Paleozoic carbonate platform development, Devonian paleoclimate, and coal-mine fire hazards. Excursions to the Coastal Plain examine various aspects of Cenozoic stratigraphy, structure, barrier island formation, and wetland and ecosystem development. A variety of trips also explore urban geology, including building and monument stones of Baltimore and Washington, D.C., urban hydrogeology, and Civil War battlefield geology.

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## Featured Article

### SCIENCE

#### 4 The development and evolution of the William Smith 1815 geological map from a digital perspective

Peter Wigley

**Cover:** Digital reconstructions of maps of the English county of Somerset used by William Smith in his geologic mapping. (A) Smith's first geological map around the city of Bath on a base map made by Taylor and Meyley (1799). (B) Part of the Day and Masters (1782) map of Somerset known to have been used by Smith. (C) Smith's geological map of Somerset based on his engraved geological lines on a map by John Cary. All maps have been re-projected and overlain on part of Smith's 1815 geological map of England and Wales. (Courtesy Peter Wigley.) See related article, p. 4–10.



## GSA 2016 Annual Meeting & Exposition

- 11 Abstracts Deadline
- 12 Education, Mentoring, and Careers
- 13 Feed Your Brain—Lunchtime Enlightenment *and* GSA Geology and Society Distinguished Lecturer: Lucile "Lucy" M. Jones
- 14 Visit Denver Neighborhood Spotlight: RiNo (River North Art District)

## GSA News

- 15 2016 GSA Medal & Award Recipients
- 16 2016 GSA Division Primary Awards
- 17 2016 GSA Fellows
- 22 GSA Celebrates 50-Year Member Anniversaries
- 23 2016 GSA Research Grant Recipients
- 30 2016 GSA Division & Section Student Research Awards
- 31 2016 Cole Awards
- 32 Welcome New GSA Members!
- 46 In Memoriam
- 48 2015–2016 GSA-USGS Congressional Science Fellow Report: "If you're not at the table, you're on the menu."
- 49 Meet Your Fiscal Year 2017 Officers & Councilors
- 50 Open Access
- 51 GSA Position Statement Revisions
- 52 Supporting Diverse Students to Attend GSA and SACNAS Annual Meetings
- 54 2015 GSA International Distinguished Lecture Tour: Lisa Ely
- 56 Speaking of Geoscience
- 59 Classified Advertising
- 61 GSA Foundation Update

# The development and evolution of the William Smith 1815 geological map from a digital perspective

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## ABSTRACT

William Smith's 1815 geological map of England and Wales is a masterpiece; the map differs from all other contemporaneous maps in that Smith applied the principles of stratigraphy to its construction. The maps are extremely rare and therefore not readily available for study and analysis; however, over the past decade a number of Smith geological maps have been digitally scanned and some incorporated into a Geographic Information System (GIS). Early nineteenth-century maps of the United Kingdom (UK) present a number of difficulties when trying to build them into a GIS, mostly related to projection problems and the fact that many pre-date the "1st Principal Triangulation" of the UK. However, once in the GIS, they can be used with great effect to show the evolution of Smith's maps and also to compare his maps with modern geology. When combined with digital terrain data, Smith's maps can be displayed in 3D.

## NINETEENTH-CENTURY MAP TECHNOLOGY

William Smith (1769–1839) was an undoubted geological genius with an amazing eye for the countryside and an ability to think in three dimensions. He was also an expert surveyor, apprenticed in his youth to Edward Webb (1751–1828) at Stow-on-the-Wold, where he learned to measure and value land during the time of the Enclosure Acts (Torrens, 2001). This skill may have classified him as an artisan in the eyes of the gentlemen of the Geological Society of London and thus precluded his membership of the Society; however, it was to prove essential in the production of the great map. Through use of sextant, plane table, and other surveying instruments (the high-tech of the time), Smith was able to locate outcrops on his field maps. Today with GPS, laser range-finders, and access to remote-sensing data, the whole process of map making is very much easier than it was in Smith's day—yet, for all that, some eighteenth- and nineteenth-century maps of England are remarkably accurate.

It is highly unlikely that Smith's map would ever have been made were it not for the help of John Cary (1755–1835). Cary was a mapmaker, engraver, and publisher; he probably first met Smith when he engraved his plan of the Somerset Canal in 1793 (Torrens, 2007, p. 13). At that time, Cary's maps were some of the best available. In 1794, he was commissioned by the Post Office to map towns and roads on his New Map of England and Wales. At that time, postal charges were based on distance, and it was therefore important to the Post Office that Cary show "the actual

distance from one Market Town to another with the exact admeasurement prefixed to each from the Metropolis [London]" (Cary, 1796). Cary was aided in this task by material provided by the Post Master General, but he also undertook a number of local, detailed triangulated surveys in order to complete the map. The map was produced at a scale of approximately one inch to five miles (1:316,000) and Cary was to use this map as the basis for the 1815 Smith map.

Figure 1 illustrates how the base map was compiled; the three maps are from part of the county of Wiltshire. The top map (A) is from Cary's 1794 New Map of England and Wales and shows in extraordinary detail roads, canals, rivers, towns, and villages included by Cary. The middle (B) map is a de-colored Smith 1815 map and shows how Cary and Smith simplified the road network, reduced the number of towns and villages located (and reduced the size and style of the typeface), while at the same time emphasizing topographic features. Incidentally, Cary, ever mindful of commercial implications, ensured that the outlines of the estates of wealthy landowners were always included. This map also shows Smith's engraved geological lines. Map (C) is the corresponding part of the 1815 map, which was hand-colored to show the geology.

Smith's geological mapping was not limited to the great 1815 map. Between 1819 and 1824, John Cary published, in six parts, Smith's geological maps of 21 English counties. The *New Geological Atlas of England and Wales* was used for its base maps. The large county sheets of Cary's *New English Atlas* have been described as "remarkable for their accuracy and their clear, clean print brilliantly engraved, and rank with the Ordnance Survey as the finest maps of the nineteenth century" (Tooley, 1952). Smith could not have had a finer set of topographic maps upon which to draw his geological lines.

## SMITH'S REPRESENTATION OF GEOLOGY ON THE MAP

Smith's initial problem was how best to show the distribution of his strata on maps. Should it be by point locations, lines, or colors? As we know, Smith chose a combination of both line and color. His colors generally had some lithological significance and indeed are still used today. Smith also used graded tints on his maps, with the strongest color at the base of the bed at outcrop, lightening upward. This is what Smith says in his memoir to the map:

The Society of Arts very wisely foresaw, in offering their premium for a mineralogical map (which I have just had the honour to obtain), that one of the greatest difficulties in understanding such an extensive branch of natural history arose from the want of some method of generalizing the information, which could only be



Figure 1. Stages in the compilation of William Smith's 1815 Geology map by John Cary (showing part of Wiltshire).

supplied by a map that gives, in one view, the locality of thousands of specimens. By strong lines of colour, the principal ranges of strata are rendered conspicuous, and naturally formed into classes, which may be seen and understood at a distance from the map, without distressing the eye to search for small characters. This is the advantage of colours over any other mode of representation. (Smith, 1815, p. 11)

The effect of Smith's striking coloring technique also serves to give added depth to the two-dimensional plane of the map: the individual strata appear to have a measure of three-dimensional relief, which makes their relationship to one another more apparent.

## MAPPING SCALE

The 1815 map measures more than eight feet by six feet and was printed on 15 sheets. This map was the canvas upon which Smith

documented his observations; he would not have used it in the field because the scale was too small. Smith did make an early experiment using a Cary one-inch to twenty-mile (~1:1,300,000) map, but he said that the "maps were spoiled by speculating on the ranges of stratification without sufficient data" (Smith, 1815, p. 27). His memoirs also record that he colored a map in the vicinity of Bath and also used the Day and Masters County Survey of Somerset (1782) (Phillips, 1844, p. 27).

In the early nineteenth century, scale adjustment was more difficult but not insurmountable. In order to scale his field maps onto the 1815 base map, Smith would almost certainly have used a pantograph. Smith was very familiar with this instrument. In his journal entry for Friday, 18 December 1789, Smith records time spent "Repairing and Setting the pentograph [pantograph]" before he "began to reduce the Plan of a Mr. C. Norton's allotments" (OUMNH Archive, Diaries, WS/B0 p. 55). It is important to realize that although Smith's final map may have been small scale, its content was derived from his large-scale field maps.

## PROJECTIONS

Smith would not have been overly concerned about the projection of his base map; however, projections are a crucial element of any Geographic Information System (GIS). Projection information does not appear on any Cary or Smith map. The graticules around the margins of the maps show ticks of longitude and latitude (usually based on the Greenwich meridian), but in most cases there are no internal coordinate lines/ticks within the body of the map. On the Cary Turnpike map, the latitude degree ticks are angled to the frame, indicating that parallels may be curved lines. Meridians may or may not be straight, but in all cases are not parallel. However, although only a small-scale map, the General Index Map for Cary's 1794 New Map of England and Wales and Part of Scotland does have internal longitude and latitude lines. Some information is available regarding commonly used late eighteenth-century and early nineteenth-century projections. John Snyder gives a good account of these projections (Snyder, 1993); his list of projections was tested on the Smith and Cary maps used in the GIS. First-order polynomial transformation (affine) was used to project map images to coordinates for each of the tested projections. Residual (RMS) errors were calculated based on the framing graticules. Typical errors ranged from >4,500 m (14,764 ft) to <1000 m (3281 ft). Some projections (e.g., Lambert Azimuthal Equal Area) achieved a good fit on the graticule but had a considerably distorted shape. Apart from the residual errors on the graticules, a judgment also had to be made on the fit to places and coastlines. In this regard, it is worth remembering that the maps are all about 200 years old. Essentially, they predate the 1st Principal Triangulation of the country, which started in 1783 and was not completed until 1853 (although the first phase was complete by 1796). Although the general shape of England and Wales is excellent on all maps, it does differ from the modern coastline. For example, the Cary and Smith maps show the position of Lands End to be >4 miles north of its actual position; similarly, the Isle of Man is offset by ~8 miles to the northeast. Bonne, Cassini, and Transverse Mercator projections all achieved relatively good results. Bonne was marginally the best fit on the Smith 1815 map, closely followed by Cassini (used by the Ordnance Survey for the Old Series 1" maps of

England and Wales), which gave the best fit on the Smith County maps. One additional piece of indirect evidence is that projection tests on the small-scale General Index to Cary's 1794 New Map of England and Wales, which does contain internal coordinate lines, give RMS errors of 1448 m (4750 ft) for Cassini against 1637 m (5370 ft) for Bonne. The difference in error is too small for any definitive statement to be made as to which projection was used, but on balance it is more likely that a Cassini projection (on a sphere) was used for both the Smith 1815 and County maps.

## TRANSFORMATIONS

Having decided that Cassini was overall the best-fit projection, the maps were transformed to that projection. Graticules on the 1815 map provided some limited information, which was supplemented by John Cary's locations of towns and villages. For the county maps, some 1,800 graticule longitude and latitude points were transformed using town and village locations and RMS errors obtained. In general, transformation errors were lower in southeast England and tended to increase to the north and west.

## THE 1ST PRINCIPAL TRIANGULATION

The 1st Principal Triangulation of the UK and Ireland was conducted over six decades and was a remarkable achievement that significantly improved the accuracy of nineteenth-century maps of the country. The Principal Triangulation commenced in 1783 under the direction of General William Roy with the objective of connecting the observatories of Greenwich and Paris and determining the difference in longitude between them. After Roy's death in 1790, the survey was extended across the UK and Ireland under the direction of Colonel Williams, General Mudge, General Colby, Colonel Hall, and finally Colonel Henry James. Apart from improving map accuracy, the triangulation allowed Alexander Clarke to compute a spheroid for Earth and make density calculations. The first stage in the triangulation was the measurement of an accurate baseline between Kings Arbour (now the site of the Heathrow Airport car park) and the Poor House at Hampton. This was first achieved by iron bars and deal rods and then remeasured using glass tubes. Corrections were made for temperature and humidity and the line accurately leveled; the final accuracy is estimated at an amazing one inch in 27,400 ft. After completion of the line, a number of triangulations were made in a southeasterly direction toward the Kent coast. The triangulations were made using a specially commissioned theodolite constructed by Jesse Ramsden. As the triangulation proceeded, it became obvious that there were large inaccuracies in existing maps of the country. In 1799, Mudge and Dalby made a number of severe criticisms of the "erroneous state of our maps." Cary's maps were not specifically mentioned by Mudge and Dalby and while at the local level Cary's maps are accurate, errors become amplified in country-wide maps.

## EVOLUTION OF SMITH'S GEOLOGICAL MAPPING

Smith's 1815 map exists in at least six main variants in five series as recognized by Eyles and Eyles (1938), based on changes to the geology, coloring, and topographic detail. These include an early unnumbered issue (Series I); an early issue second series numbered 1–100 (Series II); another, mostly second issue third series, numbered a1 to a100 (Series III); a third issue, numbered

b1–b75 or possibly to b100 (Series IV); and a late unnumbered series (Series V), which is divided into Va maps, similar to late Series IV and Vb, possibly part of a second 1830s series (Sharpe, 2007, and personal commun.). The early and late unnumbered maps are not signed by Smith, while the numbered issues are usually signed. The map is dated 1st August 1815; however, two early Series I unnumbered maps were issued before this date, with a further 20 in September–October 1815. However, most maps were not issued until after 2 November 1815, when Smith began signing and numbering his maps. Countermarks on the very late Z map (which hangs in The Geological Society of London's Burlington House) date it as 1836 or later. Smith's memoir lists 410 subscribers for 414 copies of his 1815 map. Not all subscribers took their copies, and some maps went to non-subscribers; the total production run was probably around 350, of which 120–130 may still survive (Tom Sharpe, 2014, personal commun.).

In order to demonstrate the evolution of Smith's geological mapping, extracts from various maps around the city of Oxford have been produced from the GIS and are shown in Figure 2. All three Smith maps use the same basic scheme of colors and tinting technique, although there are some significant changes in geological content. All the maps show a succession of strata, oldest (Great Oolite) in the northwest and getting progressively younger to the southeast (Chalk). The Smith A map at the top of the panel is a very early unsigned copy and was probably the Geological Society subscription copy. Tinting on the A map tends to be light, almost tentative, often grading to no color. Smith himself says, "In many cases the edge of one stratum terminating on another is so gradual, as not to admit of any distinction or definite line" (Smith, 1815, p. 8). Where there is no color, the formation is assumed to be intermediate between the strata above and below. However, on early issue maps (like the A map) the Greensand is purposely shown colorless. Also, in early maps the Coral Rag is not shown as a separate formation, only sandstone between the Clunch Clay and the Oaktree Clay. The later issue P map (Series Va, possibly 1816, Tom Sharpe, 2014, personal commun.) is more fully and confidently colored. On this map, the Coral Rag appears and the Oaktree Clay is extended to the base of the Chalk. Smith's Oaktree Clay is somewhat problematic; on the 1815 map legend, he shows "Blue Marl or Oak Tree Soil" beneath the Greensand and above the Purbeck stone. However, on his later cross sections, geological tables, and the county maps, the Oaktree Clay is clearly below the Portland stone and above the Clunch/Coral Rag, making it the equivalent of the modern Kimmeridge Clay. The changes in geological coloring are accompanied by new engraved geological lines. The third map is a composite of parts of Smith's geological maps of Oxfordshire and Berkshire published between 1819 and 1820. The topographic and cultural information shown is more detailed because the county sheets are at a larger scale; the geological boundaries are also more detailed. For general comparison, the last map illustrates a simplified version of the modern geology published by the British Geological Survey.

## GEOLOGICAL SIGNIFICANCE OF SMITH'S MAPS

William Smith did not make the first geological map. Jean-Étienne Guettard (1715–1786) and Philippe Buache (1700–1773) published a map in 1746 containing a large amount of regional lithological information that significantly shows an attempt at the distribution of the chalk in France and England. Later in the

**SMITH 1815 A MAP**

-  Great Oolite
-  Forest Marble
-  Cornbrash
-  Clunch Clay
-  Sand under Coral Rag
-  Oaktree Clay
-  Chalk













**SMITH 1815 P MAP**

-  Great Oolite
-  Forest Marble
-  Cornbrash
-  Clunch Clay
-  Sand under Coral Rag
-  Coral Rag
-  Oaktree Clay
-  Portland
-  Chalk




**SMITH COUNTY 1819-20**

-  Great Oolite
-  Forest Marble
-  Cornbrash
-  Clunch Clay
-  Sand under Coral Rag
-  Coral Rag
-  Oaktree Clay
-  Portland
-  Greensand & Gault
-  Chalk



**MODERN GEOLOGY**

-  Great Oolite
-  Cornbrash
-  Oxford Clay
-  Corallian
-  Kimmeridge Clay
-  Portland
-  Greensand and Gault
-  Chalk

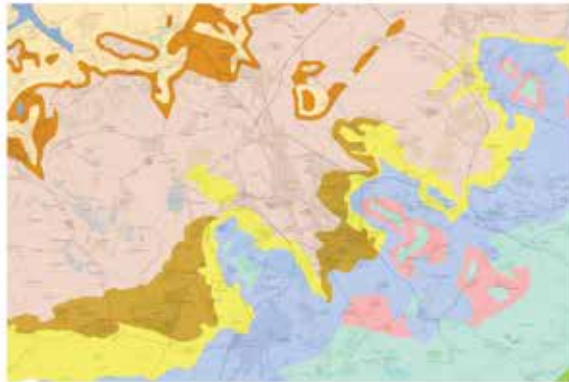


Figure 2. Maps of the area around the city of Oxford showing the evolution of William Smith's geological mapping and a comparison with the present day geological interpretation simplified from work by the British Geological Survey. (Extracts of William Smith county maps and the William Smith A map are published by kind permission of the Geological Society of London and the P map by kind permission of the Manuscripts and Special Collections, The University of Nottingham.)

1770s, Guettard and Lavoisier published a series of mineralogical maps of north-eastern France showing point locations of rocks and minerals, but no attempt was made to map strata. Later, in 1809, the Scottish-American William Maclure (1763–1840) published a geological map of the United States that pre-dated Smith's map by six years. Maclure was strongly influenced by the work of Abraham Gottlob Werner (1749–1817), who had developed a theory of universal rock genesis based on precipitation and erosion within a receding primordial ocean (later known as Neptunism). On his 1809 map, Maclure used Werner's rock classification, which ultimately proved to be a geological cul-de-sac. Maclure did meet Smith in 1815 and purchased a copy of his map, yet he completely failed to understand the importance of Smith's work (Torrens, 2001), for on his 1817 version of the USA map, the classification is essentially the same as the one he had used in 1809.

It is not known whether Smith was aware of Werner's work, but if so, he was most certainly not influenced by it. Smith realized that an understanding of the "ordering of strata" was essential in geological mapping, and it was the application of his stratigraphic method that was so geologically significant. Smith first became interested in this ordering when employed as a surveyor on the Somerset Coal Canal in 1795. Through detailed study of canal sections, he managed to separate several repetitious clay formations and also to separate the Upper and Lower Oolite (Torrens, 2003, p. 161). By August 1797, Smith had made his first attempt at a more general order of strata, starting with Number 1 "Chalk Strata" and descending to Number 28 "Limestone" below the Coal Measures. In June 1799, at the home of the Rev. Joseph Townsend, Smith dictated his famous "Order of the Strata in the Bath area" to the Rev. Benjamin Richardson (Phillips, 1844, p. 29) and during the course of several iterations it evolved into the geological table, part of which is shown in Figure 3.

Like others before, Smith could recognize strata based on their lithology, some rocks (e.g., oolites) being very distinctive. However the problem with a purely lithological approach to stratigraphy can be the incorrect correlation of strata of differing age but with similar lithology. Smith,

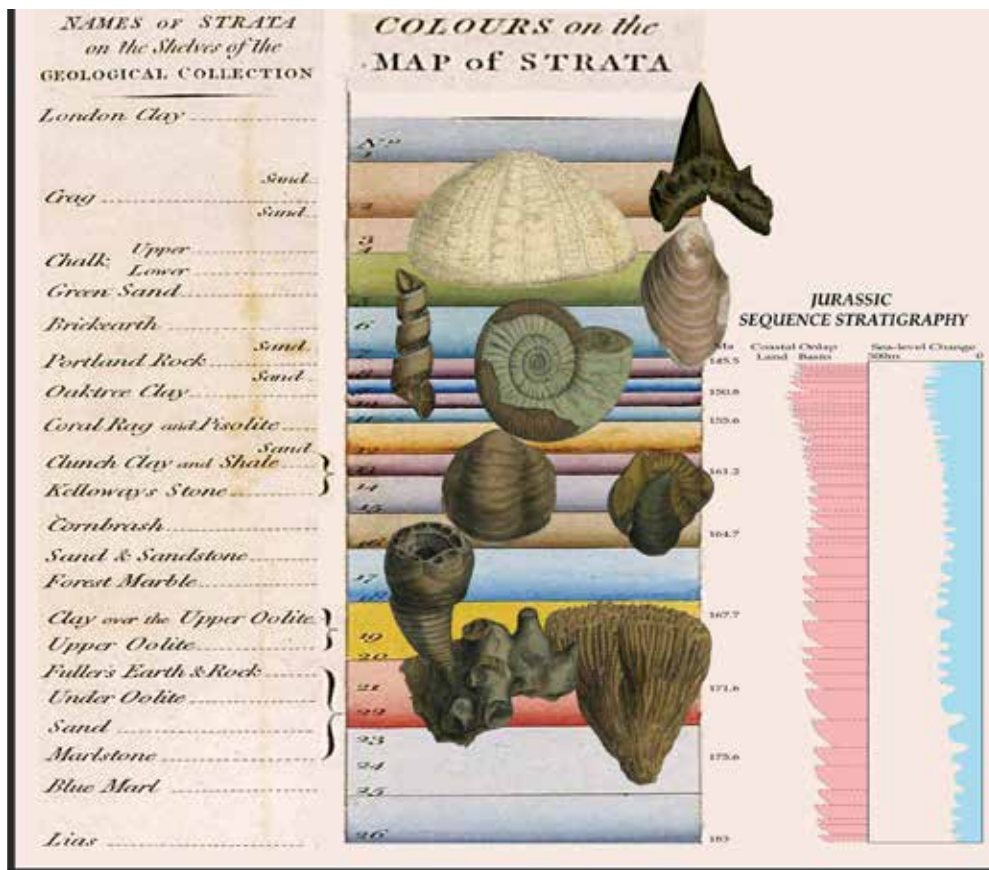


Figure 3. Composite illustration showing part of William Smith's geological table of strata, some examples by Sowerby of stratigraphically arranged fossils from Smith's 1816–1819 publication, "Strata Identified by Organized Fossils...", and a modern stratigraphic sequence chart of the Jurassic (modified from Snedden and Liu, 2010).

however, realized early in his career that particular fossils were associated with each strata. He was an avid collector of fossils, but unlike the genteel collectors in Bath, did not see them as ornaments; to him, they were a key tool to identify and type specific strata in the geological record, and he built up a huge collection that he could relate to specific strata. Based on this, it can be fairly said that he founded the science of biostratigraphy. Some of Smith's fossils from his 1816–1819 publication, "Strata Identified by Organized Fossils..." are illustrated in Figure 3.

William Smith laid the foundation for stratigraphy in England; later, his pioneering work was to be continued by others. Of note were Carl Albert Opper and Alcide d'Orbigny. Opper provided a detailed zonation of the Jurassic by use of ammonites and was able to subdivide the Jurassic into 33 different zones (Opper, 1856–1858). A major revolution in the understanding of stratigraphy came in the late twentieth century with the advent of high-resolution seismic acquisition. For the first time it became possible to resolve individual stratigraphic units and to understand their architecture; from this, the concept of sequence stratigraphy emerged. Figure 3 includes a diagram of Jurassic sequences, coastal onlap, and global sea-level change (0 = present day) compared to part of Smith's Table of Strata. The science of stratigraphy has made significance advances during the past 200 years, yet for all these advances there is still a direct link back to William Smith's original work.

### STRATIGRAPHY IN THREE DIMENSIONS

Smith's interest in representing geology in three dimensions can be traced back to his early career as a mine surveyor. In 1793,

he proposed to make a reduced scale model of the Mearns colliery showing the coals and other strata (Phillips, 1844, p. 6). Later, Smith made a geological model by taking one of his geological maps and cutting along the edges of the strata in order to accentuate their relationships (Phillips, 1844, p. 27). He continued the three-dimensional theme in his magnificent stratigraphic cross sections. From 1817 on, he prepared and published a series of seven cross sections across England and Wales. Smith did not invent the geological cross section, for it is known that he was influenced by the pioneering work of John Strachey (Strachey, 1727, Fuller, 2004, p. 15). However, Smith took sections to a new level by combining a two-dimensional cross section with a three-dimensional panorama. Using modern digital technology, it is possible to further enhance these sections. The display in Figure 4 shows Smith's section across the Weald of southern England, together with part of his 1815 map, which has been draped on a digital elevation model. Also shown is a modern composite seismic section (Butler and Jamieson, 2013). Smith's cross section demonstrates the general anticlinal structure of the Weald with the chalk dipping to the north and the south. However, he wrongly interpreted the age of the thick section in the core of the anticline as Jurassic (Smith Strata Numbers 8–13). This was understandable because he had never before encountered thick strata between the Greensand-Gault and Portland-Purbeck stone. For obvious reasons, he could not have known that the Weald had been an actively subsiding basin during the Mesozoic, which had subsequently been inverted and unroofed. For all this, the cross section remains a remarkable achievement.



NORTH

SOUTH

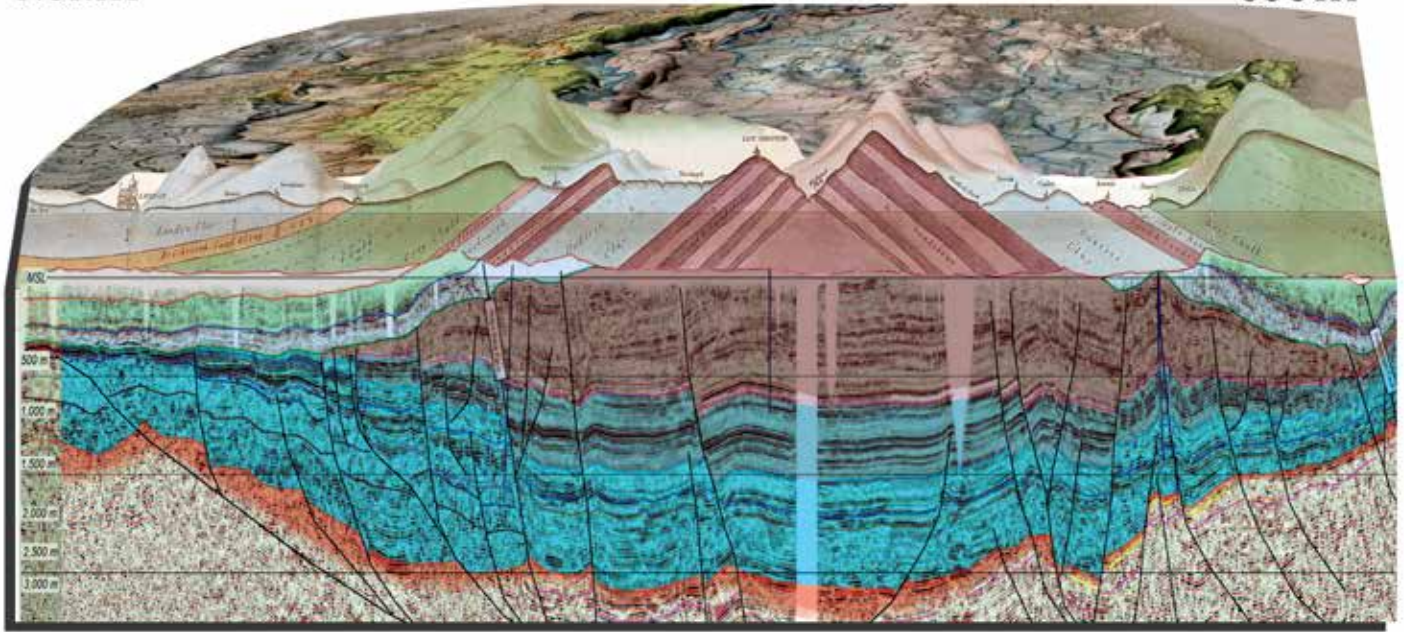


Figure 4. Part of William Smith's 1819 Section of the Strata across Surrey and Sussex shown with part of his 1815 map, which has been draped on an SRTM elevation model. Also shown is a modern composite seismic section (modified from Butler and Jamieson, 2013). Green—Chalk; blue-gray—Greensand and Gault; pink-brown—Purbeck-Portland; blue—older Jurassic; orange-brown—Triassic. The locations of the seismic section (A–A') and Smith's section (B–B') are shown on Smith's county geological maps of Kent, Sussex, and Surrey.

## ACKNOWLEDGMENTS

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## REFERENCES CITED

- Butler, M., and Jamieson, R., 2013, Preliminary interpretation of six regional profiles across onshore basins of England: UK Onshore Geophysical Library, <http://maps.lynxinfo.co.uk/docs/images/interpretations/>.
- Cary, J., 1796, Cary's Reduction of his large map of England and Wales with part of Scotland comprehending the whole of the Turnpike Roads with the great rivers and the course of the navigable canals: J. Cary, Engraver and Map-seller.
- Eyles, V.A., and Eyles, J.M., 1938, On the different issues of the first geological map of England and Wales: *Annals of Science*, v. 3, p. 190–212.

- Fuller, J.G.C.M., 2004, The origins of stratigraphy 1719–1801: London: Geologists' Association Guide No 65, 53 p.
- Mudge, W., and Dalby, I., 1799, An account of the operations carried out for accomplishing a Trigonometric Survey of England and Wales from the commencement in the year 1784, to the end of the year 1796: London, Philosophical Transactions, vi + 205 p.
- Oppel, C.A., 1856, Die Juraformation Englands: Stuttgart, Frankreichs and des südwestlichen Deutschlands. 556 p.
- Oxford University Museum of Natural History (OUMNH) Archive and Library Collection, William Smith (1769–1839) Collection, Diaries 1789, WS/B0 p. 55.
- Phillips, J., 1844, Memoirs of William Smith LLD: London, John Murray, vii + 150 p.
- Sharpe, T., 2007, Sources of Maps, sections, other documents and digital data, in Wigley, P., Dolan, P., Sharpe, T., and Torrens, H.S., eds., 2007, 'Strata' Smith: His two hundred year legacy. Digitally enhanced maps and sections by William Smith, George Bellas Greenough, John Cary and Richard Thomas 1796–1840: London: The Geological Society, DVD.
- Smith, W., 1815, A Memoir to the Map and Delineation of the Strata of England and Wales with part of Scotland: London: Cary, facsimile reprint, History of Geology Group of the Geological Society, 2015 + 26 p. introduction.
- Smith, W., 1816–1819, Strata Identified by Organized Fossils containing prints on colored paper of the most characteristic specimens in each stratum: London, W. Arding, 59 p.
- Snedden, J.W., and Liu, C., 2010, A compilation of Phanerozoic sea-level change, coastal onlaps, and recommended sequence designations: AAPG Datapages, Search and Discovery article #40594, 20 Aug. 2010, [http://www.searchanddiscovery.com/documents/2010/40594snedden/ndx\\_snedden.pdf](http://www.searchanddiscovery.com/documents/2010/40594snedden/ndx_snedden.pdf) (last accessed 9 May 2016).
- Snyder, J., 1993, Flattening the Earth; Two Thousand Years of Map Projections: Chicago, The University of Chicago Press, 365 p.
- Strachey, J., 1727, Observations on the different strata of Earths and Minerals: London, Walthoe.
- Tooley, R.V., 1952, Map and Map Makers: London, B.T. Batsford, p. xii, 140 p., plus plates.
- Torrens, H.S., 2001, Timeless order: William Smith (1769–1839) and the search for raw materials 1800–1820, in Lewis, C.L.E., and Knell, S.J., eds., The age of the Earth from 4004 BC to AD 2002: Geological Society of London Special Publication 190, p. 61–83.
- Torrens, H.S., 2003, An introduction to the life and times of William Smith (1769–1839), in Memoirs of William Smith L.L.D., author of the "Map of the Strata of England and Wales" by his nephew and pupil John Phillips, F.R.S., first published in 1844. Reprint: Bath, Bath Royal Literary and Scientific Institution. p. xi–xxxviii.
- Torrens, H.S., 2007, Notes on the Maps of William Smith (1815 onwards), George Bellas Greenough (1820 and 1840) and John Cary (1794 & 1796), in Wigley, P., Dolan, P., Sharpe, T., and Torrens, H.S., eds., 2007, 'Strata' Smith: His two hundred year legacy: Digitally enhanced maps and sections by William Smith, George Bellas Greenough, John Cary and Richard Thomas 1796–1840: The Geological Society, London, DVD.

Manuscript received 18 Dec. 2015; accepted 20 Feb. 2016.



## The Next Step for Your Annual Meeting Science: PENROSE CONFERENCES and THOMPSON FIELD FORUMS

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[bsundeen@geosociety.org](mailto:bsundeen@geosociety.org).



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GSA 2016 ANNUAL MEETING & EXPOSITION



25-28 SEPTEMBER

**GSA 2016**

Denver, Colorado, USA

The abstracts deadline is fast approaching!  
Submit an abstract for the Annual Meeting in Denver  
before 11:59 p.m. (PT) on **12 July**.

[community.geosociety.org/gsa2016/science-careers/sessions](http://community.geosociety.org/gsa2016/science-careers/sessions)



Photo courtesy of the Denver Metro Convention & Visitors Bureau.



# Education, Mentoring, and Careers

## SHORT COURSES

Don't forget to sign up for a Short Course; prices go up after 22 August.

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## ON TO THE FUTURE (OTF)

Be a Part of the Movement

Since 2013, GSA has helped 350 students from underrepresented groups attend their first GSA Annual Meeting.

Support from members is instrumental in shaping careers, changing lives, and diversifying our profession. Join us as we look forward to another successful year by mentoring an OTF student at the meeting and/or donating to support a student (<https://www.gsafweb.org/donate/#fund=on-to-the-future-initiative-fund>).

Learn more about this program and how you can get involved at

[community.geosociety.org/otf/annualmeetingprogram/mentors](http://community.geosociety.org/otf/annualmeetingprogram/mentors).

## JUMPSTART YOUR CAREER AT GSA'S ANNUAL MEETING

If you are interested in a career in government or industry, you won't want to miss the GeoCareers Day on Sunday, 25 September. You can interact with professionals from government and industry sectors and ask them career-related questions. This program includes a career workshop, booths highlighting careers and career opportunities, a lunch panel of professional representatives, and 30 mentors with a variety of careers with whom you will interact in a small group setting.

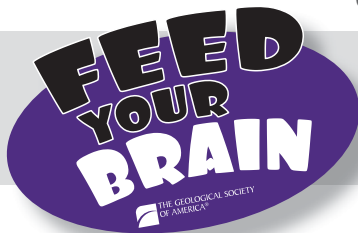
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## MAKE AN IMPACT—BE A MENTOR

GSA is recruiting mentors to provide real-world information and insight to students and early career professionals at GSA's Annual Meeting. Mentoring can range from one-on-one mentor pairs for the duration of the meeting to short-term mentoring opportunities.

Learn more about becoming a mentor and sign up.

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## LUNCHTIME ENLIGHTENMENT

### GSA Geology and Society Division Distinguished Lecturer



**Lucile "Lucy" M. Jones,**

*"Earth Science in Public Policy: What society needs from scientists"*

► Tues., 27 Sept., 12:15–1:15 p.m.

Plan to grab your lunch to-go and join us at the Colorado Convention Center to hear Lucy Jones discuss earth science and public policy. Known globally as an expert in earthquakes and resilience, Jones has dedicated her life to helping communities and leaders prepare for the inevitable. Jones retired from federal service in March 2016 after working as a seismologist with the U.S. Geological Survey since 1983.

In a world of natural hazards, resource limitations, and climate change, it is obvious that policy makers need results from earth science to make informed decisions. It is less obvious to see how the interchange of information can best take place and what are the appropriate roles of scientist and policy maker in that interchange. Jones spent a year working with the mayor of Los Angeles to develop policies for seismic resilience. This talk will discuss that process, how science was brought to the policy makers, and how a coalition of interested parties was able to form and create a successful adoption of the most sweeping changes of seismic policy ever seen in southern California.

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### 5th International EarthCache Event

Saturday, 24 Sept. 2016 | Denver, Colorado, USA

EarthCaching gets people out in the field to learn about their planet first-hand. Participants in this annual event will learn all about EarthCaching, interact with EarthCachers from around the globe, meet EarthCache developers and reviewers, find local EarthCaches, and engage in many other exciting and educational activities. The 2016 event will be held in conjunction with the GSA Annual Meeting, which provides a unique opportunity for GSA members to connect with the EarthCaching and Geocaching communities! For details, go to [www.earthcache.org](http://www.earthcache.org), [www.facebook.com/earthcache](http://www.facebook.com/earthcache), or contact Matt Dawson at [mdawson@geosociety.org](mailto:mdawson@geosociety.org).

*Let the Earth be your teacher!*



# Visit Denver Neighborhood Spotlight



Photo courtesy of Visit Denver.

## RiNo (RIVER NORTH ART DISTRICT)

The River North Art District “where art is made” goes by the nickname of “RiNo” and has even adopted a rhino design for its official logo, so look for creative rhinos in art and signage all around the neighborhood. The district’s interesting blend of urban charm and unique industrial revival makes it a great destination for visitors. Historic warehouses and factories now house jazz bars, restaurants, brewpubs, art galleries, and working studios. RiNo boasts a diverse mix of creative businesses ranging from visual artists, designers, and furniture makers, to craft distillers and brewers, winemakers, creators of unique outdoor gear, and small-batch coffee roasters. Learn more by following the QR code on this page.



Photo by Adam Larkey and Visit Denver.

## THE SOURCE

Explore the converted iron foundry on Brighton Boulevard, now housing a variety of restaurants, markets, artisan shops, and a craft brewery.



Photo by Adam Larkey and Visit Denver.

## CRAFT BEER, WINE, AND SPIRITS

RiNo has become an incubator for Denver’s craft brewing industry. Longtime favorite Great Divide recently opened a taproom across the street from The Source. Don’t miss the rest of the breweries in the neighborhood, which are featured in the Denver Beer Trail (follow the QR code, this page). The neighborhood is also home to an urban winery, Infinite Monkey Theorem.



Go to GSA’s Visit Denver Microsite at  
[www.denver.org/gsa](http://www.denver.org/gsa) to learn more.

[community.geosociety.org/gsa2016/home](http://community.geosociety.org/gsa2016/home)

# 2016 GSA Medal & Award Recipients



## PRESIDENT'S MEDAL OF THE GEOLOGICAL SOCIETY OF AMERICA

**Sarah Andrews**, Geologist and Author

## PENROSE MEDAL

**John T. Andrews**, University of Colorado

## ARTHUR L. DAY MEDAL

**Donald B. Dingwell**, University of Munich

## YOUNG SCIENTIST AWARD (DONATH MEDAL)

**Whitney M. Behr**, University of Texas at Austin

## GSA PUBLIC SERVICE AWARD

**Rex C. Buchanan**, Kansas Geological Survey

## RANDOLPH W. "BILL" AND CECILE T. BROMERY AWARD FOR MINORITIES

**Kathleen R. Johnson**, University of California Irvine

## GSA DISTINGUISHED SERVICE AWARD

**J. Christopher Hepburn**, Boston College  
**Lori L. Summa**, ExxonMobil Upstream Research Company

## DORIS M. CURTIS OUTSTANDING WOMAN IN SCIENCE AWARD

**Christine A. Regalla**, Boston University

## GEOLOGIC MAPPING AWARD

**Marc Robert St-Onge**, Geological Survey of Canada

## HONORARY FELLOW

**Bor-Ming Jahn**, Taiwan

## JOHN C. FRYE AWARD

**Johnson, P.S., Koning, D.J., Timmons, S.S., and Felix, B.**, 2016, Geology and Hydrology of Groundwater-Fed Springs and Wetlands at La Cienega, Santa Fe County, New Mexico: New Mexico Bureau of Geology and Mineral Resources Bulletin 161, 92 p.



**Claudia I. Mora**



Show your support for our 2016 Awardees by attending the GSA Presidential Address & Awards Ceremony on 25 September at the 2016 GSA Annual Meeting & Exposition in Denver. You will also have the privilege of hearing GSA President **Claudia I. Mora's** Presidential Address.



# 2016 GSA Division Primary Awards



## RIP RAPP ARCHAEOLOGICAL GEOLOGY AWARD

*Archaeological Geology Division*

**Daniel H. Sandweiss**, University of Maine

## O.E. MEINZER AWARD

*Hydrogeology Division*

**Andy Fisher**, University of California, Santa Cruz

## GILBERT H. CADY AWARD

*Energy Geology Division*

**Robert A. Gastaldo**, Colby College

## ISRAEL C. RUSSELL AWARD

*Limnogeology Division*

**Alan R. Carroll**, University of Wisconsin–Madison

## E.B. BURWELL, JR. AWARD

*Environmental & Engineering Geology Division*

**Keaton, J.R., Wartman, J., Anderson, S., Benoit, J., de LaChapelle, J., Gilbert, R. and Montgomery, D.R.**, 2014, The 22 March 2014 Oso Landslide, Snohomish County, Washington: Geotechnical Extreme Events Reconnaissance Sponsored by the National Science Foundation, July 22, 2014, 186 p.

## DISTINGUISHED GEOLOGIC CAREER AWARD

*Mineralogy, Geochemistry, Petrology, and Volcanology Division*

**Donald A. Swanson**, U.S. Geological Survey, Hawaiian Volcano Observatory

## G.K. GILBERT AWARD

*Planetary Geology Division*

**M. Darby Dyar**, Mount Holyoke College

## OUTSTANDING CONTRIBUTIONS AWARD

*Geoinformatics Division*

**Betty Adrian**, U.S. Geological Survey, Denver

## KIRK BRYAN AWARD FOR RESEARCH EXCELLENCE

*Quaternary Geology and Geomorphology Division*

**Goldfinger, C., Nelson, C.H., Morey, A.E., Johnson, J.E., Patton, J.R., Karabanov, E., Gutiérrez-Pastor, J., Eriksson, A.T., Gràcia, E., Dunhill, G., Enkin, R.J., Dallimore, A., and Vallier, T.**, 2012, Turbidite event history—Methods and implications for Holocene paleoseismicity of the Cascadia subduction zone: U.S. Geological Survey Professional Paper 1661–F: U.S. Geological Survey, Reston, 170 p.

## GEORGE P. WOOLLARD AWARD

*Geophysics Division*

**William J. “Bill” Hinze**, Professor Emeritus Purdue University

## BIGGS AWARD FOR EXCELLENCE IN EARTH SCIENCE TEACHING

*Geoscience Education Division*

**Joshua Villalobos**, El Paso Community College

## LAURENCE L. SLOSS AWARD

*Sedimentary Geology Division*

**Tim Lowenstein**, State University of New York at Binghamton

## MARY C. RABBITT HISTORY OF GEOLOGY AWARD

*History and Philosophy of Geology Division*

**Mott Greene**, University of Washington

## CAREER CONTRIBUTION AWARD

*Structural Geology and Tectonics Division*

**David Pollard**, Stanford University



# 2016 GSA Fellows



## Fellowship nominations are submitted in the following categories:

- Publication of the results of geologic research;
- Applied research;
- Training of geologists;
- Administration of geological programs;
- Public awareness of geology;
- Professional organizations;
- Editorial, bibliographic, and library responsibilities; and
- Other.

Fellowship in the Geological Society of America is an honor bestowed on the best of the geoscience profession by election at the spring GSA Council meeting. GSA members are nominated by current GSA Fellows in recognition of their distinguished contributions to the geosciences. Learn more at [www.geosociety.org/members/fellow.htm](http://www.geosociety.org/members/fellow.htm).

GSA's newly elected Fellows will be recognized at the 2016 GSA Annual Meeting Presidential Address & Awards Ceremony on 25 September in Denver, Colorado, USA. We invite you to read some of what their nominators had to say:

**Gary D. Acton** (Sam Houston State University): In recognition of creative and insightful research applying paleomagnetic and other techniques to a broad range of tectonic questions and major contributions to the scientific community via the Ocean Drilling Program. —Seth Stein

**Jay J. Ague** (Yale University): Jay has made outstanding contributions to the fields of igneous and metamorphic geology, including recognition and quantification of exhumation depths in ancient magmatic arcs, thermal pulse durations and petrologic indicators of ultrahigh pressure/temperature conditions in metamorphic terrains, and fluid and carbon fluxes in orogens and subduction systems. —David Evans

**Thomas J. Algeo** (University of Cincinnati): Tom has unequivocally established himself as a leader in deep-time biogeochemistry, paleoceanography, and geobiology. His efforts in the development and application of geochemical proxies of paleoredox, paleoproductivity and paleohydrography have provided key constraints on the dynamics of ancient seas, global carbon cycling, marine paleoproductivity, and extinction events. —Isabel Montanez

**Rivka Amit** (Geological Survey of Israel): Dr. Amit is a superb arid lands and soil geomorphologist who has made significant contributions to the geological community for many years. In addition to her 49 scientific papers, she is the Director of the Geological Survey of Israel. She is also adviser to M.S. and Ph.D. graduate students. —Alan Gillespie

**Estella A. Atekwana** (Oklahoma State University): Estella is recognized for her pioneering work in biogeophysics, including innovative applications of geoelectrical methods to understand interactions between microbial communities and hydrocarbon contaminants in the subsurface; her contributions to understanding the incipient stages of continental rifting; and her valued service to the science profession. —Dennis Harry

**Aida A. Awad** (Maine East High School, Illinois): Aida has introduced untold numbers of students to geology through exemplary instruction and has been a tireless advocate for improving K–12 earth-science education. She has held key leadership positions in the National Association of Geoscience Teachers and greatly advanced both NAGT and the education mission of GSA. —Roy E. Plotnick

**Jens T. Birkholzer** (Lawrence Berkeley National Laboratory): Jens is recognized for his transformative scientific contributions associated with prediction of subsurface multiphase fluid, solute, and heat transport, and to the impact that his developments have had on informing U.S. decisions and regulations associated with nuclear waste disposal, carbon sequestration, and the environmental consequences of hydraulic fracturing. —Susan Hubbard

**Gabriel J. Bowen** (University of Utah): Dr. Bowen has made pioneering advancements on the interpretation of stable isotope data in a spatial context. By constructing “isoscape” maps he has shown the isotope effects of water transport systems. His Online Isotopes in Precipitation Calculator (OIPC) has become a staple for research in isotope hydrology. —Douglas Solomon

**Mark L. Brusseau** (The University of Arizona): Dr. Brusseau is nominated for fellowship in the Geological Society of America for his pioneering contributions to the elucidation of coupled processes that control mass transfer and reactive transport in the subsurface, and the development of innovative technologies for characterization and remediation of contaminated sites. —Qinhong Hu

**Christopher P. Carlson** (USDA Forest Service): Christopher should become a Fellow because of his contributions to governmental policies on protecting the quality and sustainability of groundwater resources, his leadership of hydrogeological research programs for state and federal agencies, and his efforts in expanding public awareness of the importance of geology in formulating policies. —Jonathan Goodwin

*“Her accomplishments as a scientist and science leader represent the values our society wishes to honor.”*

## 2016 GSA Fellows

**C. Page Chamberlain** (Stanford University): Page is at the avant-garde of research on tectonic/climate processes. He has transformed understanding of landscape development (particularly surface elevation) in relation to tectonics, sediment dispersal, and climate, and has trained and mentored a large number of undergraduate and graduate students in the use of innovative analytical techniques. —Christian Teyssier

**Anne Chin** (University of Colorado at Denver): Chin's research focuses on river process and form, including the geometry of step-pool bedforms in mountain rivers and river adjustments to urbanization. As part of her interest in how rivers respond to natural and human induced disturbances, she has developed conceptual models that represent innovative contributions to understanding coupled human landscape dynamics. —Ellen Wohl

**Marin K. Clark** (University of Michigan): Marin is nominated for her research on how continental topography, as expressed by the evolution of rivers and other landforms, relates to lithospheric deformation. She has demonstrated that these systems are a sensitive record of vertical surface movement, caused by deformation deep in the Earth's crust or uppermost mantle. —John Geissman

**Maurice Colpron** (Yukon Geological Survey): For outstanding contributions to our understanding of orogenic belt evolution, particularly the tectonic, magmatic, paleogeographic, and metallogenic evolution of the North American Cordillera. —Stephen Piercey

**Carol B. de Wet** (Franklin & Marshall College): For major contributions to the profession through publication of high quality research, as an inspiring teacher and role model, effective mentor and a passionate spokesperson calling for changes to the system to allow women to fully participate in the pursuit of career and family. —Gail M. Ashley

**Mihai N. Ducea** (University of Arizona): Dr. Ducea has made fundamental contributions to understanding the relationships among magmatic arcs, subduction zones, retroarc orogenic belts, and upper mantle processes. —Peter G. DeCelles

**Andrea Dutton** (University of Florida): Andrea displays enthusiasm and energy, as well as an encyclopedic knowledge of geology. She quotes the primary geoscience literature at will both historic as well as modern. This plus her creativity to isolate the basic mechanisms of sea level change is a rare and unbeatable combination. —Benjamin Horton

**James R. Ebert** (State University of New York–Oneonta): Acclaimed professor, researcher, and administrator. Distinguished Teaching Professor, dedicated to training earth scientists. Internationally recognized stratigrapher; 35 publications on research and education; ~half coauthored with students; 65 meeting abstracts; 82% for GSA. Cofounder and editor of *Northeastern Geoscience* online journal. Moderates four listservs in science education with >6000 subscribers nationwide. —Arthur N. Palmer

**Howard R. Feldman** (Touro College): Howard is a top expert on Mesozoic brachiopods, and an authority on the Mesozoic fossil faunas and facies of the Middle East. He has also published many studies of the Ordovician and Silurian in the Hudson Valley of New York, and has contributed to geoarchaeology in Israel. —Mark A. Wilson

**Mark P. Fischer** (Northern Illinois University): Dr. Fischer is Professor and Chair of the Department of Geology and Environmental Geoscience at Northern Illinois University. Mark's research interests are fracture mechanics, clastic injectites, fluid-rock systems, and fault-related folding. The results of his research have provided new understandings of the origin of fractures and veins. —David Malone

**Derek C. Ford** (McMaster University): Ford is nominated for his decades of leadership in research in karst, in particular for geochronological and paleoclimatological investigations of cave deposits, with some of the first research done in the alpine and subarctic regions of North America. —Gareth J. Davies

**Lydia K. Fox** (University of the Pacific): Lydia is an inspirational, innovative educator of undergraduate geoscience students. As department chair, she skillfully addressed both facilities relocation and curricular changes. As a champion of undergraduate research, she established an Undergraduate Research & Creativity Conference at Pacific and has directed its success for the past sixteen years. —Eugene F. Pearson

**Baohua Gu** (Oak Ridge National Laboratory): Dr. Gu's seminal work on elucidating key molecular scale mechanisms that govern biogeochemical cycling of contaminants, trace metals, and natural organic matter have made significant contributions to our understanding of soil organic and metal cycling in terrestrial ecosystems and remediation of contaminated sites. —Joel D. Blum

**Peter J. Haeussler** (U.S. Geological Survey): Peter is a research geologist with the USGS. The breadth, depth, and impact of his work are demonstrated by widely cited publications on Alaskan tectonic history, regional geology, metallogeny, neotectonics, and earthquakes, and tsunami hazards. Peter makes frequent media appearances as an expert on Alaskan geology and hazards. —Dwight C. Bradley

**Arjun M. Heimsath** (Arizona State University): Arjun is an accomplished geoscientist whose pioneering work on the rates and processes of the conversion of rock into colluvial soil (or "mobile regolith") and subsequent downslope transport and mixing has

*"He has always shared his experience and expertise willingly and freely with any students who sought his advice."*

been nothing short of foundational to understanding of the evolution of soil-mantled erosional landscapes. —Kelin X. Whipple

**G. Warfield Hobbs IV** (Ammonite Resources Company): Skip has been an outstanding geologist for close to a half of a century. He has been active professionally in industry and has founded his own successful consulting firm specializing in petroleum and mineral resources. He has been active at the leadership level in several professional societies including AAPG, AGI, CSSP, and GSA. —P. Patrick Leahy

**Christopher H. House** (Pennsylvania State University): Dr. House has produced a rich set of papers ranging from analysis of ancient fossils to whole genome-based phylogenetic analysis. His body of work represents an innovative contribution to early life research using state-of-the-art geoanalytical, microbiological, and genomic techniques to answer both geological and biological questions. —Susan L. Brantley

**Miriam E. Katz** (Rensselaer Polytechnic Institute): Mimi is an active and highly productive researcher in both paleontology and paleoceanography. She has made valuable contributions to such wide and varied topics including Phanerozoic sea-level change, interpretation of the Paleocene/Eocene Thermal Maximum, phytoplankton evolution, and geochemical cycles. She is a dedicated educator, and a valued contributor to many professional organizations, including GSA. —Peter J. Sugarman

**Shuhab D. Khan** (University of Houston): Shuhab Khan is at the forefront of using remote sensing for applied geoscience research. He has mentored over 36 grad level students in the last decade and has been the undergraduate advisor at the University of Houston for the past several years. He has also offered many workshops on remote sensing methods to geology departments in developing countries. —Paul Mann

**Stephen E. Laubach** (The University of Texas at Austin): Dr. Laubach is nominated for his outstanding accomplishments and research in the geosciences. His contributions to geologic research are exemplified by his publication record and citations, and especially for his service, leadership, mentorship and research contributions in fracture mechanics, diagenesis and fracture formation in sedimentary basins. —Scott W. Tinker

**Charles E. Lesher** (University of California, Davis): For innovative studies of the chemistry and physics of magmatic systems with particular reference to physical and transport properties that impact the differentiation of Earth and the planets. —David Walker

**Fulai Liu** (Institute of Geology, Chinese Academy of Geological Sciences): Liu has a proven record as a world-class metamorphic petrologist and is best known for his successful research in micro-size mineral inclusions in zircons of supracrustal UHP rocks to establish a consistent *P-T*-time path for a collision orogen of eastern China. This approach was applied to findings of two additional new UHP terranes in China. —Juhn Liou

**Donald R. Lowe** (Stanford University): Dr. Lowe exemplifies the spirit, character and ethics of a GSA fellow and is one of, if not the leading, sedimentologists/Precambrian geologists in the world. His reputation as a scholar unraveling the early Archean world is outstanding. His original works on the fluid mechanics of sediment flows in the mid-1970s are seminal papers in the field. —Edward L. Simpson

**William R. Lund** (Utah Geological Survey): Among Utah's best geologists, Lund has served for 35 years at the Utah Geological Survey. His awards for publications (over 90) mostly on geologic hazards include: 2009 Utah Governors Medal, 2010 Holdredge (AEG), 2010 and 2016 Frye (GSA), Crawford (UGS, for 2005, 2011, 2014), and 2012 Hintze awards. —Peter D. Rowley

**Anna M. Martini** (Amherst College): Anna is an aqueous geochemist whose research has contributed to the fields of climate change, environmental contamination, and unconventional natural gas resources. She is widely recognized for her work identifying the microbial origins of economically significant shale gas deposits and widely respected for her training of future geoscientists. —Tekla A. Harms

**Larry G. Mastin** (U.S. Geological Survey, Cascades Volcano Observatory): Larry is recognized for his wide ranging contributions to volcanology, primarily focused on the physics of magma ascent and eruption, and the dynamics of volcanic plumes. He has also led the development of a number of software tools used worldwide for volcanic hazards assessment and mitigation. —Mark S. Ghiorso

**J. Barry Maynard** (University of Cincinnati): Dr. Maynard is one of the world's leading authorities on sedimentary ore deposits and participated especially in key studies on the origin of manganese carbonate ores. He also coauthored two milestone books on fine-grained clastics and made significant contributions in unravelling controls on heavy metal distributions in modern environments. —Nicolas J. Beukes

**David A. McConnell** (North Carolina State University): Dr. McConnell's research determines effective strategies for teaching geoscience to undergraduate students. He engages faculty in pursuing collaborative research on geoscience learning across the country and uses the results of this research to help them improve their teaching. —Cathryn A. Manduca

**Suzanne A. McEnroe** (Norwegian University of Science & Technology): Suzanne is nominated for her significant contributions and publications in paleomagnetism, magnetic mineralogy, and magnetic anomalies on Earth and other planets. Her continued research on magnetic properties of hematite-ilmenite minerals has introduced us to an important but previously unrecognized type of remanence called lamellar magnetism. —Laurie L. Brown

*"He is a fierce defender of academic and scientific integrity & ethics."*

*“She exemplifies what a modern earth scientist should be.”*

**Peter P. McLaughlin Jr.** (Delaware Geological Survey/University of Delaware): Peter has integrated the knowledge, tools, and techniques he used in private industry into his research, which has resulted in a landmark effort to modernize the hydrostratigraphy, water-use information, and groundwater allocations by aquifer in the state of Delaware. —David R. Wunsch

**James McManus** (University of Akron): In recognition of Jim’s seminal contribution to the study of biogeochemical cycling within continental margins and lakes, sediment diagenesis, and the classification and use of metals and their isotopes as paleoproxies within ocean and lake systems. —Charles G. Wheat

**Jerry X. Mitrovica** (Harvard University): Elected to Fellowship as the 2015 GSA Day Medal recipient.

**Andreas Mulch** (Goethe Universität Frankfurt): Andreas is a highly creative scientist who has published influential papers on dynamic interactions of the lithosphere, atmosphere, and biosphere through time, including links between continental paleorecords of deformation at different crustal levels, the evolution of topography, and the co-evolution of life and the environment. —Donna L. Whitney

**Christina A. Neal** (U.S. Geological Survey/Hawaiian Volcano Observatory): For application of volcanology to hazard assessment and eruption response and communication of science to government agencies and the public for 25 years at the Alaska Volcano Observatory, as well as for leadership in international North Pacific volcano monitoring and now as Scientist in Charge of the Hawaiian Volcano Observatory. —Charles R. Bacon

**Michael H. Ort** (Northern Arizona University): Dr. Ort is a volcanologist with rare interdisciplinary expertise. He is an exemplary geological educator with a demonstrated commitment to outreach and public engagement. A leader in his research area, he has also served his professional community through editorial activities, active society memberships, and leadership roles. —Shanaka L. de Silva

**David R. Pevear** (Exxon Production Research Company, retired): David is nominated for his outstanding contributions to the science of clay minerals, including applications of clays to petroleum geology, burial diagenesis, and thermochronology, for his dedicated service to the Clay Mineral Society, and for his enthusiastic outreach and mentoring of early career scientists. —Lori L. Summa

**George R. Priest** (Oregon Department of Geology and Mineral Industry): Elected to Fellowship as one of the Engineering and Environmental Geology Division’s 2015 E.B. Burwell Jr. Award recipients.

**Carol A. Raymond** (California Institute of Technology Jet Propulsion Laboratory): Carol effectively manages and leads spacecraft missions that explore the geology of other planets. Her own research, focused on the Earth’s seafloor, Antarctica, and other planets, has been instrumental in our understanding of planetary magnetic fields and their relationship to crustal structures and tectonics. —Harry Y. McSween

**Eric M. Riggs** (Texas A&M University): Eric is nominated for his important research contributions to geoscience education and to diversity in the geosciences, and for his extensive record of service to multiple professional geoscientific organizations. —Steven C. Semken

**Nancy L. Ross** (Virginia Polytechnic Institute and State University): Nancy has been a pioneer in the study of the atomic-level structures, physical properties, and stabilities of Earth materials under the extreme pressures and temperatures of Earth’s lower crust and mantle as well as of the thermodynamic properties of environmental nanoparticles and their interactions with water. —Gordon E. Brown Jr.

**Jeffrey N. Rubin** (Tualatin Valley Fire & Rescue): Jeffrey is a leader in bringing safety and health issues to the forefront of the geological profession and in bringing preparedness for geological hazards to the forefront of the emergency management profession and the general public. —Jonathan G. Price

**Richard A. Schultz** (The University of Texas at Austin): Dr. Schultz for his success and qualities as an internationally recognized educator and researcher in structural geology and geomechanics. He has produced more than 112 papers, six edited volumes, five book chapters, 300 abstracts, and 60 invited seminars while mentoring three postdoctoral scholars, 25 Ph.D., M.S. students, and three Ph.D. corporate interns. —Haakon Fossen

**William H. Schulz** (U.S. Geological Survey): Elected to Fellowship as one of the Engineering and Environmental Geology Division’s 2015 E.B. Burwell Jr. Award recipients.

**R. Randall Schumann** (U.S. Geological Survey): Elected to Fellowship as one of the Quaternary Geology and Geomorphology Division’s 2015 Kirk Bryan Award recipients.

**Eugene S. Schweig** (U.S. Geological Survey): Buddy has been a valuable member of the geoscience community for three decades. His contributions span basic research (paleoseismology), applied research, teaching (University of Memphis and beyond), geoscience program leadership (U.S. Geological Survey), and public outreach. I honestly can’t think of a more deserving individual for GSA Fellow status. —Daniel R. Muhs

**Carrie E. Schweitzer** (Kent State University at Stark): Dr. Schweitzer is a preminent scholar in paleontology. Her massive research output on fossil decapod crustaceans ranks her as a major scholar in that field and, as a result, she has a global reputation. She translates this into teaching where she instills enthusiasm for geology and research into the students. —Rodney M. Feldmann

**Jill K. Singer** (State University of New York–Buffalo State): Dr. Singer is an outstanding leader who has demonstrated a unique depth and breadth in contributions to the growth and improvement of undergraduate research and geoscience education. Her work has impact on her students, the Buffalo State community, the SUNY system, CUR, the geoscience community, and undergraduate geoscience education nationally. —Suzanne O’Connell.

**Jan Smit** (Vrije Universiteit Amsterdam): Jan has contributed more to understanding the end-Cretaceous extinction than anyone else: co-discovery of the iridium anomaly, supporting the impact hypothesis, discovery of impact-melt spherules, clarifying the stratigraphy of the last dinosaurs, discovery of Chicxulub ejecta at the K-Pg boundary, and studies of K-Pg sites around the world. —Walter Alvarez

**Kristen E. St. John** (James Madison University): Kristen is a nationally recognized teacher and researcher dedicated to training geoscientists. She is well known for her research as a paleoceanographer and her editorial service with the National Association of Geoscience Teachers. Her contributions to ocean science research and education make her a role model for students and professionals. —Steven J. Whitmeyer

**Daniel F. Stockli** (University of Texas at Austin): Dr. Stockli is nominated for his contributions to our understanding of the temporal and thermal evolution of tectonic processes, petrologic systems, stratigraphy, and geomorphology, and his pioneering research on minerals used as chronometers of low temperature geological processes. —Elizabeth J. Catlos

**Ellen R. Stofan** (NASA): Dr. Stofan is a leading planetary volcanologist who has made remarkable contributions to science, both in terms of her research and leadership. She currently serves as the NASA Chief Scientist, a role in which she advises the NASA Administrator and effectively promotes science to the public and to lawmakers. —Louise M. Prockter

**Manfred R. Strecker**: Elected to Fellowship as one of the 2015 GSA Honorary Fellow recipients.

**Susan K. Swanson** (Beloit College): Susan Karin Swanson, Professor of Geology at Beloit College and Weeks Chair in Physical and Human Geography, is recognized for outstanding applied research related to elucidating geologic and hydrologic controls on springs and their associated ecosystems as well as her contributions to the training of geoscientists and to professional societies. —Jean M. Bahr

**Jeffrey R. Unruh** (Lettis Consultants International Inc.): Dr. Unruh has had a great impact on the geosciences through a series of over 70 applied geology studies and over 40 peer reviewed publications. His work has ranged from geologic hazards to regional tectonics and geophysics. He has also served as a mentor to colleagues and students. —J. Douglas Walker

*“She epitomizes the passion for science, service, and teaching that should be expected for GSA Fellowship.”*

**David A. Vanko** (Towson University): Dave is an exemplary geoscientist, not only as a researcher with a national and international reputation, but one who cares about geoscience education and students as well as educating the community about basic principles of environmental science. He brings vision, enthusiasm, and leadership to every aspect of his professional life. —William J. Fritz

**Peter D. Wilf** (Pennsylvania State University–University Park): Peter is a paleobotanist who has made foundational contributions in the areas of plant evolution, terrestrial paleoclimatology, and plant-insect interactions. Peter’s careful and wide-ranging work in South America has shone a bright light on the assembly of Gondwanan ecosystems, a critical yet understudied area. —Dana Royer

**Sherwood W. Wise Jr.** (Florida State University): Dr. Wise (Woody) has had a distinguished career as a geology professor at Florida State University. He continues as leading researcher in calcareous nannofossils. He has been involved in DSDP/ODP for many years. Woody’s students have had successful careers in academia, geological surveys, and the private sector. —Thomas M. Scott

**Dawn J. Wright** (ESRI): Elected to Fellowship as the 2015 GSA Bromery Award for Minorities recipient.

**Lesley A. Wyborn** (Australian National University): Elected to Fellowship as the Geoinformatics Division 2015 Outstanding Contributions in Geoinformatics Awardee.

**Michael H. Young** (University of Texas at Austin): Dr. Young has achieved distinction worthy of GSA’s Fellowship recognition for significant research contributions on soils and related geologic systems. His research has significantly advanced understanding of water partitioning near the land surface considering climate forcing and ecosystems. He led the GSA Soils and Soil Processes Interdisciplinary Integration Group. —Bridget R. Scanlon

*“His enthusiasm is infectious.”*

# GSA Celebrates **50-Year** Member Anniversaries



*GSA salutes the following members and Fellows on their 50-year membership anniversaries. We appreciate their dedication and loyalty to GSA for all these years.*

For a list of members who have *surpassed* the 50-year mark, please visit

<http://rock.geosociety.org/membership/50YearMembers.asp>;

the list of Fellows can be found at <http://rock.geosociety.org/membership/50Yearfellows.asp>.

Asterisks (\*) below indicate those members who have not yet been honored by election to GSA Fellowship. **GSA Fellows:** You can help maintain a dynamic, vibrant cohort by nominating these and other deserving geoscience colleagues for Fellowship. Guidelines and nomination forms are online at [www.geosociety.org/members/fellow.htm](http://www.geosociety.org/members/fellow.htm). If you have questions, please e-mail [awards@geosociety.org](mailto:awards@geosociety.org).

Jeffrey T. Abbott*	Harold E. Eagle*	Alvin R. Leamon*	Charles C. Plummer
Walter Alvarez	Carol L. Ekstrom*	Robert E. Lingner*	Benjamin N. Powell
R. Ernest Anderson	William J. Elliott	Peter K. Link	Dean C. Presnall
L. Clark Arnold Jr.	P. Jay Fleisher	George O. Linkletter	Perry H. Rahn
Richard G. Baker	Romeo M. Flores	Ivo Lucchitta	Erk Reimnitz*
G. Arthur Barber	Walter J. Garmoe*	Richard Lung*	Malcolm M. Roeber Jr.*
Christopher R. Barnes	Robert E. Garrison	John E. Marzolf*	Alan C. Samuelson*
John L. Berry*	Larry J. Garside	Christopher C. Mathewson	B. Charlotte Schreiber
Edward C. Bingle	Clare H. Gibbs	Robert A. Matthews	Holmes A. Semken Jr.
David D. Blackwell	Leonard C. Gilbert*	Floyd W. McCoy Jr.	Peter M. Sheehan
Sam Boggs	Richard K. Glanzman*	Gregory E. McKelvey	Michael F. Sheridan
Arthur A. Bookstrom	David L. Gross	Robert Metz*	John F. Shroder Jr.
James A. Brown Jr.*	Gilmor S. Hamill IV*	Harvey J. Meyer*	K. Lee Shropshire*
Burke Burkart	John E. Hardaway*	Thomas P. Miller	Melvin C. Simons*
Richard L. Burroughs*	Grant H. Heiken	Doral S. Mills Jr.*	James G. Smith*
Robert J. Carson	James Helwig	Richard A. Mills*	Judith T. Smith
Keros Cartwright	J. Christopher Hepburn	Charles O. Morgan	Richard E. Smith
Charles E. Chapin	David F. Hess*	Frederic "Ted" B. Mullin*	Robert K. Smith*
Charlette Chastain*	Kenneth D. Hopkins*	Walter H. Munk	Roger C. Steininger*
Chin Chen	Keith A. Howard	Robert R. Murchison*	Ronald W. Stingelin
Ju-chin Chen	Liang-Chi Hsu	Arturo G. Nisperos*	Wm Thomas Straw
Eric S. Cheney	Charles S. Hutchinson Jr.	Gordon L. Nord	James B. Swinehart*
Kenneth F. Clark*	Norman J. Hyne	Larry J. Nutter*	Lynn R. Sykes
Gordon A. Clopine	James C. Ingle Jr.	Shannon A. O'Dunn*	Robert E. Tepel*
Harold G. Coffin*	Alan M. Jacobs*	John E. Parkes*	Tommy B. Thompson
Robert G. Corbett	Gary D. Johnson*	Emil F. Pashley Jr.*	Othmar T. Tobisch
Frank B. Couch Jr.*	Gerald H. Johnson	Frederick J. Pearson Jr.	Garrie L. Tufford*
Dennis P. Cox	Stephen E. Kesler	Raymond Pestrong	Russell G. Tysdal*
Ian W. Dalziel	John D. Kiefer	Zell E. Peterman	Frederick J. Vine
Bruno D'Argenio	Edmund Kiessling*	Ulrich Petersen	Chester A. Wallace
Richard A. Davis*	Daniel B. Kinsley	Frank L. Peterson	Raymond H. Wallace Jr.*
Kenneth J. De Nault	Paul W. Lambert*	David R. Pevear	Peter L. Ward
Richard F. Dondanville	Cooper B. Land*	Ralph D. Phillips*	Terry R. West
Wendell A. Duffield	Frederick D. Larsen*	John A. Philpotts	Bruce H. Wilkinson
Paul B. DuMontelle	Robert D. Lawrence	Robert A. Phinney	Lee Wilson



*Thank you for your membership!*

# 2016 GSA Research Grant Recipients



**The 2016 GSA Committee on Research Grants awarded US\$741,738 to 359 graduate students (51% of the 699 who applied), with an average grant of US\$2,038.** The committee also selected 10 alternate candidates in the event that any grantees return all or part of their funds due to a change in their research project or receipt of funds from another source. The GSA Graduate Student Research Grant Program is funded by GSA, the GSA Foundation, GSA Divisions, and the National Science Foundation.

**Committee members:** Thomas C. Johnson (Chair), Sarah Hayes (Past-Chair), Robert S. Anderson, Kristin Dorfler, Maya Elrick, Joshua M. Feinberg, Rebecca M. Flowers, Martin B. Goldhaber, Laurel B. Goodwin, Timothy W. Grover, Judith L.

Hannah, Janet S. Herman, Christopher S. Holm-Denoma, Michael T. Hren, Alexandra R. Isern, Elizabeth A. Johnson, Sharon L. Kanfoush, Todd A. LaMaskin, Nicholas Lancaster, Kevin H. Mahan, Andrew H. Manning, Sarah C. Penniston-Dorland, Jeffrey S. Pigati, Richard W. Saltus, Jacob O. Sewall, Daniel M. Sturmer, Ellen Thomas, James Vogl, Richard B. Waitt, Brent B. Wolfe, and Shuhai Xiao.

**Alternate committee members:** Jonathan S. Caine, Alan R. Carroll, Ibrahim Çemen, Duane G. Froese, Steven E. Ingebritsen, Kitty Milliken, Mark K. Reagan, Benjamin Schwartz, Robert D. Shuster, and Dylan Ward.

*The following awards will be presented at the GSA 2016 Annual Meeting & Exposition in Denver, Colorado, USA.*



## Outstanding Mentions

(proposals having exceptional merit in conception and presentation)

**Ivan Carabjal**, University of Cincinnati

**Mitchell Dziekan**, University of Toledo

**Richard James**, Montclair State University

**Emily Judd**, Syracuse University

**Nicolas Roberts**, University of Wisconsin–Madison

**Elizabeth Rutila**, Oregon State University

**Joel Singley**, University of Colorado Boulder

**Jeffrey Thompson**, University of Southern California

**Ted Uecker**, Central Washington University

**Dustin Williams**, California State University, Fullerton



## ExxonMobil/GSA Student Geoscience Grants

ExxonMobil has recognized 10 of the top 30 GSA student research grant proposals with grants of US\$7,500 each.

**David Canova**, Northern Illinois University

**Gilbert Ching**, Washington State University

**Aubry DeReuil**, University of Utah

**Ryan Gall**, University of Utah

**Cristina Lugo Centeno**, Syracuse University

**Camille Mayberry**, Central Washington University

**Audrina Pryer**, Northern Illinois University

**Ani Pytlewski**, California State University, Long Beach

**Evan Ramos**, University of Texas at Austin

**Danielle Shulaker**, Stanford University

# Specialized Awards



*Sponsored by the GSA Foundation*

## MARLAND PRATT BILLINGS AND KATHERINE FOWLER-BILLINGS RESEARCH AWARD

**Meghan Toft**, University of Massachusetts Amherst  
*Undergraduate Award: Erik Divan and Audrey Wheatcroft*,  
Bates College

The Marland Pratt Billings and Katherine Fowler-Billings Research Award encourages and promotes geological fieldwork and related research in New England and adjacent regions.

## JOHN A. BLACK AWARD

**Lauren Brown**, University of California, Los Angeles  
The John A. Black Award supports graduate student field-based research on coastal processes. All field-based coastal geomorphology research should be located in the USA, Puerto Rico, or Canada. In the event there are no worthy graduate student field-based research projects in coastal geomorphology, the award may be used to support graduate student field-based research in volcanology. All field-based volcanology research should be located in the USA, New Zealand, or Iceland.

## GRETCHEN L. BLECHSCHMIDT AWARD

**Nina Whitney**, Iowa State University  
The Gretchen Louise Blechschmidt Award Fund was established for women in the geological sciences who have an interest in achieving a Ph.D. in the fields of biostratigraphy and/or paleoceanography, sequence stratigraphy analysis, particularly in conjunction with research in deep-sea sedimentology, and a career in academic research.

## JOHN T. DILLON ALASKA RESEARCH AWARD

**Hanna Bartram**, University of Wisconsin–Madison  
**Joseph Tulenko**, University at Buffalo–SUNY  
The John T. Dillon Alaska Research Award honors the memory of Dr. Dillon who was particularly noted for his radiometric age-dating work in the Brooks Range, Alaska. Two areas that serve as guidelines for selection of the award are field-based studies dealing with the structural and tectonic development of Alaska, and studies that include some aspect of geochronology (either paleontologic or radiometric) to provide new age control for significant rock units in Alaska.

## DIVERSITY AWARD

**Simon George Scarpetta**, University of Texas at Austin  
This award is presented to the top student(s), based on application race/ethnicity status and overall quality of the research.

## ROBERT K. FAHNESTOCK AWARD

**Lauren Colliver**, Purdue University  
The Robert K. Fahnestock Award honors the memory of Dr. Fahnestock, a former member of the Research Grants Committee, who died indirectly as a result of service on the committee. The grant is awarded for the best proposal in sediment transport or related aspects of fluvial geomorphology, Dr. Fahnestock's field.

## ROBERT D. HATCHER RESEARCH AWARD

**Yiduo Liu**, University of Houston  
The Robert D. Hatcher Research Award supports field-based research and geologic mapping through an annual award to an outstanding graduate student in the earth sciences to conduct research for that student's master's thesis or Ph.D. dissertation. Preference may be given to students working in the Appalachian orogeny broadly construed, but is not restricted to this region.

## JOHN W. HESS RESEARCH GRANT

**Isabelle Weisman**, Vanderbilt University  
The John W. Hess Research Grant in Karst Research Studies supports student research involving any aspect of cave and karst studies aimed at providing improved understanding of how caves and karst work, including how these resources can be better managed.

## ROSCOE G. JACKSON II AWARD

**Hamilton Goodner**, The University of Kansas  
The Roscoe G. Jackson II Award funds one recipient per year in the field of sedimentology.

## LIPMAN RESEARCH AWARD

**Olivia Barbee**, Michigan Technological University  
**Zoe Braden**, Queens University  
**Matthew Dunlop**, University of Wyoming  
**Joana Voigt**, The University of Arizona  
The Lipman Research Fund was established in 1993 and is supported by gifts from the Howard and Jean Lipman



Foundation. The purpose of the fund is to promote and support student research grants in volcanology and petrology. The president of the Lipman Foundation, Peter W. Lipman, was the recipient of a GSA research grant in 1965.

#### JOHN T. AND CAROL G. MCGILL AWARD

**DeAnna Laurel**, Colorado State University

**Dorothea Lundberg**, University of Maryland

The John T. and Carol G. McGill Award, which is in the memory of John T. McGill, supports graduate student scholarships and research grants in engineering geology and geomorphology.

#### JOHN MONTAGNE AWARD

**Ny Riavo Voarintsoa**, The University of Georgia

The John Montagne Fund is awarded annually in support of research in the field of quaternary/geomorphology.

#### BRUCE L. "BIFF" REED SCHOLARSHIP AWARD

**Tess Caswell**, Brown University

The Bruce L. "Biff" Reed Scholarship Fund was established to provide research grants to graduate students pursuing studies in the tectonic and magmatic evolution of Alaska primarily, and also can fund other geologic research.

#### CHARLES A. & JUNE R.P. ROSS RESEARCH AWARD

**Christine Chen**, Massachusetts Institute of Technology

**Allison Karp**, Pennsylvania State University

**Andrew Kleinberg**, Florida State University

**Hadley McIntosh**, University of Maryland

The Charles A. & June R.P. Ross Research Fund is awarded to support research projects for graduate students, post-graduate students, and post-doctorate researchers in the fields of biostratigraphy (including, but not limited to, fossil age dating and the study of evolutionary faunal successions), stratigraphy and stratigraphic correlation, paleogeography and paleobiogeography, interpreting past environments of deposition and their biological significance, and the integration of these research areas into better global understanding of (1) past plate motions (plate tectonics and sea-floor spreading); (2) past sea-level events, including their identification and ages; and/or (3) climate changes and effects of those climate changes on the earth's inhabitants through geologic time. There should be, over time, a balance of money among the awards across these various subject sub-field categories depending on the merit of the annual project proposals.

#### ALEXANDER SISSON RESEARCH AWARD

**Renee Pelletier**, University of North Carolina at Wilmington

Family members of Alexander Sisson established a fund in his memory to promote and support research for students pursuing studies in Alaska and the Caribbean.

#### PARKE D. SNAVELY, JR., CASCADIA RESEARCH AWARD

**Rebekah Lee**, Boise State University

The Parke D. Snavely, Jr., Cascadia Research Award Fund provides support for field-oriented graduate student research that contributes to the understanding of the geologic processes and history of the Pacific Northwest convergent margin, or to the evaluation of its hazard or resource potential.

#### HAROLD T. STEARNS FELLOWSHIP AWARD

**Kirstin Washington**, University of Southern California

Dr. Stearns established the Harold T. Stearns Fellowship Award in 1973 for student research on aspects of the geology of the Pacific Islands and the circum-Pacific region.

#### ALEXANDER & GERALDINE WANER FUND

**Benjamin Barnes**, University of Wisconsin—Madison

The Waner Fund was established in 2002 to support research dealing with coal and petroleum resources, mapping, and engineering geology, marine resources, petroleum economics, appraisal, and evaluation, and the geology of phosphate resources.

#### LAUREN A. WRIGHT & BENNIE W. TROXEL STUDENT RESEARCH AWARD

**Nur Uddin Md. Khaled Chowdhury**, Texas Tech University

**Zachariah Fleming**, University of Texas at El Paso

The Lauren A. Wright & Bennie W. Troxel Student Research Fund supports two graduate students in masters or Ph.D. programs conducting field-based research (1) in the region broadly centered on Death Valley National Park or (2) in the western and southern Basin and Range Tectonic Province. This research grant is associated with GSA's Structure and Tectonics Division.

#### FAROUK EL-BAZ STUDENT RESEARCH GRANTS

**Christine Chen**, Massachusetts Institute of Technology, for "Reconstructing past precipitation changes from ancient high-altitude lakes in the Central Andes."

**Elena Favaro**, University of Calgary, for "Initiation of Yardangs in Northwestern Argentina and the Implications for Martian Surface Evolution."

This grant is to encourage and support desert studies by students world-wide either in their senior year of their undergraduate studies, or at the master's or Ph.D. level.

# 2016 Research Grant Recipients List



*(listed in alphabetical order by university)*

**Arizona State University**

Emily Zawacki

**Auburn University**

Drew Daymond  
Jason Fisher

**Baylor University**

Bulbul Ahmmed

**Binghamton University**

Kuwanna Dyer-Pietras  
Kennie Leet  
Emma McNulty

**Boise State University**

Jacob Anderson  
Buchanan Kerswell  
Rebekah Lee  
Megan Maksimowicz  
Aida Mendieta  
Nicholas Pollock

**Boston College**

Samantha Dow

**Bowling Green State University**

David Mertz

**Brown University**

Tess Caswell  
Rachel Lupien

**California State University, Bakersfield**

Blake Foreshee

**California State University, Fullerton**

Dustin Williams

**California State University, Long Beach**

Kelsey Doiron  
Ani Pytlewski  
Yannick Wirtz

**California State University, Los Angeles**

Edith Rojas Salazar

**California State University, Northridge**

Emily Homan  
Katherine Lewis

**California State University, Sacramento**

Michael Stephens

**Carleton University**

Nawaf Nasser

**Central Washington University**

Colin Bloom  
David Hernandez Uribe  
Dallin Jensen  
Camille Mayberry  
Conner Toth  
Ted Uecker

**Colorado School of Mines**

Hang Deng  
Emilie Gentry  
Dante Huff  
Shawn Lopez  
Maxwell Pommer  
Timothy Wyatt  
Kristine Zellman

**Colorado State University**

DeAnna Laurel  
Andrew Pfeiffer  
Nikki Seymour  
Evan Strickland

**Cornell University**

Brendan Anderson

**Dalhousie University**

Rachel Milligan

**Dartmouth College**

Mackenzie Marti

**Duke University**

Margaret Zimmer

**Florida State University**

Gary Fowler  
Andrew Kleinberg

**Georgia State University**

Frederick Kaminer

**Humboldt State University**

Selin Toledo

**Idaho State University**

Brandon Crawford

**Illinois State University**

Joseph Miller  
Ryan Plath

**Indiana University**

Ryan Deasy  
John Kearney  
Andrea Shilling  
Zhiyang Li

**Iowa State University**

Diana Thatcher  
Natalie Thompson  
Nina Whitney  
Nathan Young

**Johns Hopkins University**

Daniel Wilusz

**Kansas State University**

Ian Andree  
Rachel Garth  
Grant Zwiefelhofer

**Kent State University**

Kiersten Duroe

**Laurentian University**

Melanie Bouchard

**Lehigh University**

James Carrigan  
Katie Jaeckel

**Loma Linda University**

Sarah Maithel

**Louisiana State University**

Brittney Gregory  
Kevin Gryger  
Chang Liu

**Massachusetts Institute of Technology**

Christine Chen

**McGill University**

Samantha Carruthers  
 Peter Crockford  
 Kelian Dascher-Cousineau  
 Malcolm Hodgskiss  
 Rebecca Paisley  
 Noah Phillips  
 Erik Young

**Michigan Technological University**

Olivia Barbee

**Missouri State University**

Shannon Rentz  
 Emily Salings  
 Wesley Weichert

**Montana State University**

Aaron Feldhaus

**Montclair State University**

Richard James  
 April Kelly

**National Autonomous University of Mexico**

Daniel Ruiz Arriaga

**New Mexico Institute of Mining and Technology**

Michael Wine

**New Mexico State University**

Jascha Coddington  
 Meredith Cole  
 Ryan Creitz  
 Cody Stopka  
 Vanessa Swenton

**North Carolina State University**

Gantulga Bayasgalan  
 Julian Chesnutt  
 Kevin Clay

**Northern Arizona University**

Stephen Dobbs  
 Rebecca Ellerbroek  
 Derek Field  
 Joel Kane  
 Rachel Krueger  
 Sam Werner

**Northern Illinois University**

David Canova  
 Jacob Feller  
 Audrina Pryer  
 George Reo  
 Marlena Rock  
 Nicholas Williams

**Oregon State University**

Heather Bervid  
 Anna Glueder  
 Carolyn Gombert  
 Ann Morey  
 Caroline Nash  
 Brendan Reilly  
 Elizabeth Rutila  
 Wesley von Dassow  
 Kellie Wall  
 John Zunka

**Pennsylvania State University**

Claire Cleveland  
 Evan Greenberg  
 Beth Hoagland  
 Allison Karp  
 Sarah Moore  
 Kendall Wnuk

**Portland State University**

Tessa Carlson  
 Kristofer Hornsby  
 Hillarie Sales

**Purdue University**

Lauren Colliver

**Queens University**

Zoe Braden

**Rensselaer Polytechnic Institute**

Megan Holycross  
 Krystyna Kornecki  
 Gina Oliver

**Rutgers University**

Kathleen Warrell

**San Diego State University**

Jennifer Luscombe  
 Eui-jo Marquez

**Simon Fraser University**

Jeff Crompton  
 Reuben Dandurand  
 Cheryl Hodgson

**Stanford University**

Jake Harrington  
 Mae Marcaida  
 Danielle Shulaker  
 Molly Witter

**Stony Brook University**

Alireza Bahadori

**Sul Ross State University**

Jacob Helesic

**Syracuse University**

Robin Glas  
 Joseph Gonzalez  
 Emily Judd  
 Cristina Lugo Centeno

**Temple University**

Karen Kopcznski

**Texas A&M University**

William Ligon

**Texas Tech University**

Nur Uddin Md. Khaled Chowdhury  
 Eric Friedman

**The Ohio State University**

George Grant  
 Casey Saup  
 Corey Wallace

**The University of Akron**

Julian Grochocki

**The University of Alabama**

Alexandra Nicosia  
 Peng Shang

**The University of Arizona**

Ravindra Dwivedi  
 Brendan Fenerty  
 Mathew Fox  
 Susana Henriquez  
 Barbara Lafuente Valverde  
 Lucia Profeta  
 Carson Richardson  
 Ethan Schaefer  
 Joana Voigt

**The University of Georgia**

Kelly Cronin  
 Bolton Howes  
 Ny Riavo Voarintsoa  
 Sarah Wright  
 Jiaying Wu

**The University of Kansas**

Karin Abrahamsson  
 Erich de Zoeten  
 Hamilton Goodner  
 Deserae Jennings  
 Katherine Kuklewicz  
 Bridget Pettit  
 Andrew Philbin

**The University of Oklahoma**

Ann Ojeda

## 2016 Research Grant Recipients List

### **The University of Tulsa**

Brian Diehl

---

### **Tulane University**

Rachel Sortor

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### **University of Alaska Anchorage**

Charles Rust

---

### **University of Alaska Fairbanks**

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Nicole Knight

Deirdre LaBounty

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### **University of Alberta**

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Mandy Krebs

Lei Wu

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### **University at Buffalo–SUNY**

Andrew Harp

Joseph Tulenko

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### **University of British Columbia**

Sudip Shrestha

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### **University of California Davis**

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Julie Griffin

Michael Kenney

Brady O'Donnell

Elaine Young

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### **University of California Los Angeles**

Lauren Brown

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### **University of California Riverside**

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Christine Hall

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### **University of California Santa Barbara**

Nina Bingham

William Junkin

Minda Monteagudo

Alexander Wrobel

Julie Zurbuchen

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### **University of California Santa Cruz**

Karen Lykkebo Petersen

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Jason Cesta

Anastasia Fries

Elizabeth Orr

Wesley Parker

Sourav Saha

Yeon Jee Suh

Rachel Thornton

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### **University of Colorado Boulder**

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Rachel Havranek

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Joel Singley

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### **University of Connecticut**

Han-Cheng Yu

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### **University of Delaware**

Julia Guimond

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### **University of Florida**

Peter Chutcharavan

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### **University of Houston**

Yiduo Liu

Tyson Smith

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### **University of Idaho**

Andrew Canada

Zachary Foster-Baril

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### **University of Kentucky**

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Kevin Walsh

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### **University of Maine**

Dulcinea Groff

Amy Kireta

Steven Spreitzer

Peter Strand

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### **University of Maryland**

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Dorothea Lundberg

Hadley McIntosh

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### **University of Massachusetts Amherst**

Adriane Lam

Jessica McBeck

Kevin Toeneboehn

Meghan Toft

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### **University of Michigan**

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Erin Lynch

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Samantha Nemkin

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### **University of Minnesota**

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### **University of Montana**

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Conor Horton

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### **University of New Mexico**

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Kaylyn Gootman

Justin McNabb

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Maria Frishman

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Dylan Colon

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Win McLaughlin

Matthew Morriss

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Federico Moreno

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Brittany Hupp  
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**Western Michigan University**

Matthew Rine

**Western Washington University**

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Darian Dixon  
Gunnar Speth  
Stephanie Truitt

**Yale University**

Ross Anderson  
Devon Cole

# 2016 GSA Division & Section Student Research Awards



GSA Divisions and GSA Sections have recognized the following research grant recipients who submitted proposals of exceptionally high merit in conception and presentation in their fields. These students will be honored at the 2016 GSA Annual Meeting & Exposition in Denver, Colorado, USA, on 25–28 September.

## DIVISION GRADUATE RESEARCH AWARDS

### Archaeological Geology Division

*Claude C. Albritton, Jr., Memorial Student Research Award*

**Justin A. Holcomb**, Boston University

### Energy Geology Division

*Antoinette Lierman Medlin Research Award*

**Qiang Wei**, China University of Mining and Technology  
in Beijing

### Geophysics Division

*Allan V. Cox Student Research Grant*

**Rebekah Lee**, Boise State University

*Geophysics Student Research Grant Award*

**Samuel Johnson**, University of Texas at Dallas

### Hydrogeology Division

*Hydrogeology Division Student Research Grant Awards*

**DeAnna Laurel**, Colorado State University

**Dorothea Lundberg**, University of Maryland

**Ravindra Dwivedi**, The University of Arizona

**Daniel Wilusz**, Johns Hopkins University

**Nathan Young**, Iowa State University

### Mineralogy, Geochemistry, Petrology, and Volcanology Division

*MGPV Division Student Research Grant Awards*

**George Reo**, Northern Illinois University

**Nikki Seymour**, Colorado State University

**Rebecca Paisley**, McGill University

**Andrew Harp**, University at Buffalo

**Jacob Anderson**, Boise State University

**David Hernandez-Uribe**, Central Washington University

### Quaternary Geology and Geomorphology Division

*Arthur D. Howard Student Research Award*

**Adam Hawkins**, University of Northern British Columbia

*J. Hoover Mackin Student Research Award*

**Helen Beeson**, University of Nevada–Reno

*Marie Morisawa Research Award*

**Joanmarie del Vecchio**, Pennsylvania State University

### Sedimentary Geology Division

*Sedimentary Geology Division Student Research Grant Award*

**Lauren Colliver**, Purdue University

### Structural Geology and Tectonics Division

*Structural Geology and Tectonics Division*

*Student Research Travel Grant Awards*

**Zoe Braden**, Queens University

**Zachariah Fleming**, University of Texas at El Paso

**Yiduo Liu**, University of Houston

**Camille Mayberry**, Central Washington University

**Danielle Shulaker**, Stanford University

### Structural Geology and Tectonics Division & Sedimentary Geology Division

*2016 Stephen E. Laubach Structural Diagenesis Research Award*

**Sebastian Cardona**, Colorado School of Mines



## SECTION RESEARCH AWARDS

### *Southeastern Section Graduate Research Grants*

**Jennifer Bauer**, The University of Tennessee

**Gourab Bhattacharya**, The University of Alabama

**Chelsie Bowman**, Florida State University

**Allen Clements**, Auburn University

**Mustuque Munim**, Auburn University

**Elizabeth Olree**, The University of Alabama

**Nathan Rabideaux**, Georgia State University

**Ryan Roney**, The University of Tennessee

### *Rocky Mountain Section Undergraduate Research Grants*

**Eirik Hunter Anderson**, Rocky Mountain College

**Samuel Callis**, University of Utah

**Adam Chumley**, University of Northern Colorado

**Todd Emmenegger**, University of Georgia

**Joel Spansel**, Louisiana State University

**Eric Stauffer**, University of Idaho

### *Northeastern Section Stephen G. Pollock Undergraduate Research Grants*

**Jonathan Gewirtzman**, Brown University

**Christen Helou**, Indiana University

**Aaron Lin**, Kingsborough Community College

**Alba Mar Rodriguez-Padilla**, College of the Atlantic

**Lorin Simboli**, University of Pittsburgh at Johnstown

**Jessica Wolfman**, Dickinson College

### *North-Central Section Undergraduate Research Grants*

**John Malone**, Augustana College

**Jennifer McLeod**, University of Wisconsin–Oshkosh

**Katy Reminga**, Grand Valley State University

### *South-Central Section Undergraduate Research Grants*

**Sarah Kuper**, University of Arkansas at Little Rock

**Asmara Lehmann**, Trinity University

**Maryevelyn Wren**, University of Arkansas at Little Rock

# 2016 Cole Awards



*The Gladys W. Cole and W. Storrs Cole  
Memorial Research Awards for postdoctoral research  
are funded by the GSA Foundation.*



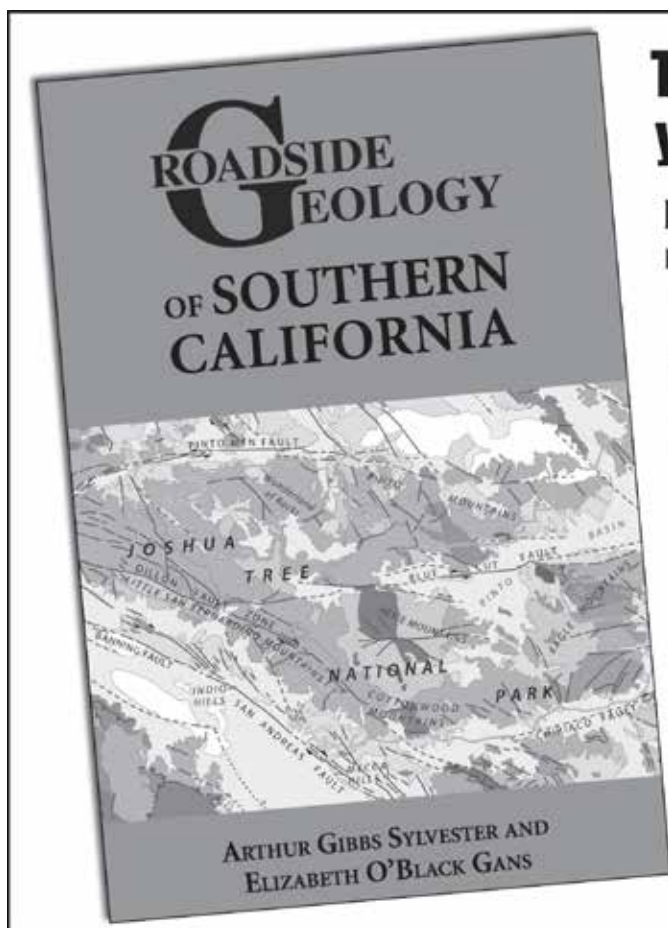
## GLADYS W. COLE MEMORIAL RESEARCH AWARD

**Sara L. Rathburn**, Colorado State University, will be awarded US\$8,000 from the *Gladys W. Cole Fund for research in geomorphology of semiarid and arid terrains* for her project, "Are All Dams Created Equal? Implications for Carbon Storage." The award will be presented at the QG&G Awards Ceremony at the 2016 GSA Annual Meeting & Exposition in Denver, Colorado, USA, on Tues., 27 Sept.



## W. STORRS COLE MEMORIAL RESEARCH AWARD

**Phoebe A. Cohen**, Williams College, will be awarded US\$8,000 from the *W. Storrs Cole Fund for research in invertebrate micropaleontology* for her project, "Exploring the Taxonomy and Functional Morphology of the Enigmatic ca. 800 Ma Apatitic Scale Microfossils from Yukon, Canada." The award will be presented at the Cushman Foundation for Foraminiferal Research Awards Ceremony at the 2016 GSA Annual Meeting & Exposition in Denver, Colorado, USA, on Tues., 27 Sept.



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# Welcome New GSA Members!

The following individuals submitted their applications for GSA membership between 1 Sept. 2015 and 13 Mar. 2016 and were approved by GSA Council at its March 2016 meeting.

## PROFESSIONALS

Oludurotimi Adetunji  
Kathleen Affholter  
Yamirka Rojas Agramonte  
Olumuyiwa Ajibade  
Taha Abdullah Al-nuaimi  
Anas Altasan  
William Althaus III  
Christoff Andermann  
David Arnold  
Gail Lee Arnold  
William Parks Ball  
Alayde Alfaia Barbosa  
Nilay Kanti Barman  
Elliott Barnhart  
Laura Barnwell  
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Yang Chen  
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Juan Contreras  
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Thomas P. Cronin  
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Priscilla Duskin  
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James Klaus  
Marko Komac  
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 Morales-Cartagena  
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 L. Felipe Opazo  
 Ajani Adedapo Opeyemi  
 Kathleen Ottens  
 Abiezer Pagan  
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 Eric Pascual-Cebrian  
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 Jordan Pelfrey  
 Matt Pendleton  
 Donald E. Penman  
 Anniina Penttila  
 Joseph M. Piccolotti  
 Ryan Portner  
 Ashleigh N. Price  
 Peter Vincent Price  
 Anne Pyrak  
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 Paola Giuseppina Rachello  
 Tyler Randall  
 Mariel Richter  
 Michael Brown Riedman  
 Jeffery Austin Robinson  
 Natasha B. Romito  
 Daniel Vito Russo  
 Matthew Safford

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 · Haley Morgan Sapers  
 · Adam John Sax  
 · Taryn Estelle Scharf  
 · Erik Schlenker  
 · Alyssa M. Schmid  
 · Mitchell Terrance Schneider  
 · Ryan Schwegman  
 · Elaine M. Scott  
 · Caitlin Michele Shannon  
 · Raven Sharma  
 · Timothy Shaw  
 · Thomas Sherman  
 · Nathaniel Gibson Shuff  
 · Marcus E. Silva  
 · Kristen Miller Slawter  
 · Kristyn Smith  
 · Christophe Snoeck  
 · Christopher Thomas Snow  
 · Robert Frank Snyder  
 · Amy L. Spaziani  
 · Anna V. Spears  
 · Alicia Barbara Staszyc  
 · Meredith K. Steele  
 · Matthew Steele-Macinnis  
 · Koen Stein  
 · Angela M. Stickle  
 · Mona Stockhecke  
 · Amanda Stromecki  
 · Tim Stroope  
 · Stephen Stukins  
 · Mingjing Sun  
 · Elizabeth R. Sylvia  
 · Naser Tamimi  
 · Garrett W. Tate  
 · Michelle Lauren Taylor  
 · Noble C. Taylor  
 · Emilia Teige  
 · Heather Kathryn Tennant  
 · Steven Paul Thibodeau  
 · Erica L. Thieleman  
 · Benjamin Hays Timm  
 · Cameron Lee Tracy  
 · Genevieve Trafelet  
 · Mice Trkaleski  
 · Sheila K. Tucker  
 · Talin Tuestad  
 · Ruth Leigh Tull  
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 · Hannah Zellner  
 · Rui Zhai  
 · Anna Zhdanova  
 · Xue jun Zhou  
 · Aaron James Zielsdorf  
 · Kevin Zoller

### STUDENTS

(Listed by Professional Interest)

#### Archaeological Geology

· Jordan Abell  
 · Kleanthis Nicholas Andreadakis  
 · Dawn Elizabeth Beamer  
 · Karl J. Beck  
 · Neeshell Q. Bradley-Lewis  
 · Amanda Renee Breeden  
 · Regina Marie Brown  
 · Aaron Dale Brunhofer  
 · Jacqueline Buskop  
 · Timothy S. De Smet II  
 · Signe Marie Carlson Englert  
 · Lacey S. Fleming  
 · Jonathan Michael Flood  
 · Daniel J. Forbes  
 · Olivia Fry  
 · Andrea M. Grenga  
 · Shane Keehn  
 · Samantha Marie Krause  
 · Adrienne Jane Leavitt-Phibbs  
 · David E. Leslie  
 · Mason Phillip Luster  
 · Eva M. Mann  
 · Ryan McKay  
 · Amy Elaine McLemore  
 · Christy M. Mog  
 · Erin Mortensen  
 · Amanda Namsinh  
 · Brianna Lynn Patterson  
 · Nathan Beebe Peltier  
 · Joshua William Perez  
 · James Edward Ruehlman  
 · Clayton Sapp  
 · Emily R. Soreghan  
 · Sydney Donohoe Steele  
 · Richard Sullivan  
 · Heidi Larena Van Etten

· Marianne Venable  
 · Robert S. Weiner

#### Biogeosciences

· Katherine N. Acosta  
 · Jishnu Adhikari  
 · Vikas Agrawal  
 · Ace Vladimir Alcantara  
 · Amanda Anthony  
 · Kathleen Brannen-Donnelly  
 · Harrison Kennedy Brock  
 · Isabella Castiglioni  
 · Mamta Sanam Chaudhary  
 · Vinton David Clarke Jr.  
 · Czarinna Kyly Clay  
 · Niels de Winter  
 · Travis Dennis  
 · Sophie S. Duncan  
 · Zachary Sean Elliott  
 · Jessica Fisher  
 · Mackenzie Renee Freeman  
 · Jacqueline Gerson  
 · Ben Richard Haller  
 · Robert Harvey  
 · Bahareh Hassanpour Guilvaiee  
 · Emmanuel Higa  
 · Sarah Elizabeth Hogrefe  
 · Zhijian Jiang  
 · Sunendra Raj Joshi  
 · Allison Karp  
 · Katalina Kimball  
 · Samantha Beth Lichtin  
 · Dru Lockamy  
 · Shelby L. Lyons  
 · Isabella Martin  
 · Tessa McGann  
 · Hadley McIntosh  
 · Caitlin Theresa McManimon  
 · Sebastian Tobias Mergelsberg  
 · Kate M. Moore  
 · Dana A. Morgan  
 · Lydia Orr  
 · Amanda Kavy Patrick  
 · Kelden Pehr  
 · Renee Pelletier  
 · Karen Lykkebo Petersen  
 · Jacob Henry Rumschlag  
 · Antonio Sandoval  
 · Harmandeep Sharma  
 · Kevin Singleton  
 · Joel Singley  
 · Rose Marie Smith  
 · Alana Burton Spaetzel  
 · Brett D. St. Pierre  
 · Ezgi Tok  
 · Selin Toledo  
 · Paul A. Tosello  
 · Clay S. Tucker  
 · Luis Alejandro Urrea  
 · Alexis Rose Van Venrooy  
 · Alexandra Walczak

Anna Rose Waldeck  
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**Climatology/Meteorology**

Alexander Panahy Alfano  
Alice Alpert  
Jennifer Alspach  
Katherine C. Bolles  
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Tina Chen  
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Zachary George Decker  
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Maxwell James Fortin  
Sarah Gotwals  
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Rebekah D. Jones  
Kate Kupfer  
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Emma Treat Leflar  
Scott Edward Lydon  
Kara M. Mangiola  
Haley Elizabeth Mauriello  
Andrew McCollum  
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Sara Schmidt  
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Caitlyn E. Sutherland  
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Miranda R. Ulmer  
Sara Wall  
Adam Wilson

**Economic Geology**

Nathaniel Huntley Adams  
Elijah Olusola Adeniyi  
Kaleo Muniz Ferreira Almeida  
Giovanni Alvarez  
Brian Lee Ammon  
Rocky Devon Barker  
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Daniel Brito Sr.  
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Ashley N. Cocciadiferro  
Zachary Russell Dick  
Michelle Franke  
Erica Donetta Gerweck  
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Scott J. Hill  
Philip Hirshman  
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Dante Huff  
Jacob M. Hughes  
Christopher Kelly  
Kevin J. Kidd  
Sergey A. Konyshv  
Kullamard Krueworramunee  
Afe Uoleva Langi  
Eric Ian Larson  
Ava Lazor  
Graham Leroux  
Li Liu  
Ty G. Magee  
Francisco David Martínez Cervantes  
Kendall Andrew Mayfield  
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Kyle A. McDaniel  
Brayden McDonald  
Chad Alan Miedel  
Gabriel Ribeiro Moizinho  
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Kristine Nagy  
Sam Vincent Nowak  
Luis Alberto Palomino  
Jonathan Pullum  
George Anthony Reo  
Oyungerel Sarantuya  
Christopher David Schuler  
Michael J.E. Sims  
Sarah Elisabeth Smith  
Yeun Jae Song  
Olivia E. Sue  
Teymoor Tahbaz  
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Kimberly Talbert  
Philippe Gerald Eric Trudel  
Brendon G. Tucker  
Rachelle B. Turnier  
Margaret Whipple  
Joshua William Wright  
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**Energy Geology**

Jaime Abregana III  
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Seyi Ajayi  
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Eirik Hunter Anderson  
Spariharijaona Andriamihaja  
Cameron Arey  
Alexander Arita  
Thomas Joseph Armstrong  
Erik Dale Bachman  
Joshua M. Bedell  
Christopher Beliveau  
Cassidy Anne Belske  
Albert Nathaniel Bertram III  
Kyle Francis Bige

Christopher K. Birchfield  
John Blackwell III  
Andrew R. Bladen Jr.  
Phillip David Blecher  
Troy Andrew Bole  
Heather Brissey  
David Bruce  
Laura Burns  
Kathy Bussiere  
Ryan W. Callender  
Sam Carmalt  
Natalie Castro  
Hsin-wei Chen  
Victor Cimino  
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Clarke A. Clayton  
Erin Coleman  
Christopher M. Cook  
Jason Lael Cotton  
Ian Cox  
Michelle Nikolay Dafov  
Jared S. Daniels  
Kyle A. Dayton  
Sean M. Driggers  
Brant Patrick Dulaney  
Caroline Aubrey Dunkel  
Nicholas P. Ettinger  
Chad Edward Fagan  
Fazil Fayaz  
Ashley Nichole Filkins  
Connor Hughes Foley  
Evelynlove Fosuduah  
Eli C. Fraley  
Anastasia E. Fries  
George M. Galakpai  
Xiang Ge  
Jayde K. Glaser  
Aimee Lee Goodell  
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Joshua Ray Hernandez  
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Bohyun Hwang  
Jack Hybza  
Bryan Marshall Ingram  
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Ang Li  
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Zachary Ryan Lindberg  
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Steven Lopes  
Andrew Marietta  
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Peter G. Moutevelis  
Megan Neary  
James C. Nickel  
Adam Nielson  
Joshua Aaron Novello  
Brittany O'Brien  
Eric O'Risky  
Joseph Orso  
Santiago Otero  
Colton Michael Palmer  
Allison Katherine Patch  
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Rowan Anthony Pinheiro  
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Edward Harris Pritchard  
Matthew Scott Quinn  
Lucian Rinke-Hardekopf  
Tyler Anthony Rafael Robinson  
Shawna Le Roggow  
Emma Rosenthal  
Clayton Boyd Sanders

## Welcome New GSA Members

Moises Santillan  
 Jenna Schrecongost  
 Tucker Dane Schultz  
 Stephen Schwarz  
 Timothy Shane  
 Nolan Shula  
 Maurice Michael Slinger  
 Johanna Smith  
 Michael William Sobel  
 Edwin Dale Solomon  
 David R. Soto  
 Robert Kent Stafford III  
 Eli Jacob Steinbeck  
 Justin Steinmann  
 Dilyn Stevenson  
 Dreadnaught Stubbs  
 Andrew Mitchell Tharp  
 Elijah Armstrong Turner  
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 Catherine Anne Valery  
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 Raymond Ward  
 Kent Thomas Weidlich  
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 Nicholas James Williams  
 Tengfei Wu  
 Ruizhe Yin  
 Lijie Zhang

### Engineering Geology

Shelby M. Ahrendt  
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 Brooks David Alexander  
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 Sara Barrientos  
 Aaron Carl Bickel  
 Chase Vincent Breckwoldt  
 Austin Brister  
 Tanya Brosnan  
 Brianna Mae Calvin  
 Tyler James Cole  
 Suzzanne Conover  
 Zachary Cox  
 Anthony T. Davis  
 Adam J. Delaney  
 Molly P. Diggory  
 Connor Dean Estes  
 Adam Fernandez  
 Dillon Scott Fields  
 Sam Mark Fleagle  
 Judith Gibson-Okunieff  
 Mary Hannah Giddens  
 Adam Blake Goodwin  
 Matthew Gramke  
 Zach Grimac  
 Zane William Grunewald  
 Ernesto Guerra  
 Kady Hansey  
 Madeline Marie Happ

Abigail Athena Harrison  
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 Elliott Conley Helgans  
 Ryan Holmes  
 Eva Marie Hover  
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 Nafis Jalil  
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 Weson Jones  
 Nirjung Karki  
 Shishay Tadios Kidanu  
 Sydney A. Lawson  
 John Paul Ligush  
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 Xiaolong Liu  
 Paul J. Louissaint  
 Emma Macalister  
 Daniel Patrick Mallon  
 Caryn Elizabeth Martin  
 Neal Allan Mathes  
 Michael Everette Menafro  
 Emily Moase  
 Anthony Moraes  
 Abigail Owens  
 Jacob Aaron Parente  
 Ethan Pinkley  
 Alvaro Puente Querejazu  
 Branden Risso  
 Jesse Keen Rubin  
 Casey J. Ruiz  
 Mehmet Sagnak  
 Jane Saunders  
 Nicholas Schrecongost  
 Daniel R. Schwartz  
 Igor Shymeilo  
 David Simmons  
 Madison Slepica  
 Mackenzie Sandoval Smith  
 Riley J. Snyder  
 Haley Anna Spencer  
 Lilan Dhanushka Sri kumara  
 Louis J. St-Pierre  
 Rebecca E. Steever  
 Crit B. Stender  
 Cesar Tapia  
 Kori Lynn Taylor  
 Ethan Tyler Truman  
 Aaron Weisinger  
 Leslie A. Williams  
 Wilfredo Nicolas Zevallos Sr.  
 Abdullah Zulfiqar

### Environmental Science

Jennifer Adachi  
 Amanda Adams  
 Carrie Elizabeth Adams  
 Dominic Aluia  
 Elvis Andino-Nolasco  
 Louis Annino

Lina Marcela Arbelaez Moreno  
 Kevin Arias  
 Victoria Elizabeth Avalos  
 Dulci Avouris  
 Sarah M. Bailey  
 Crystal M. Bair  
 Fatai Olabanji Balogun  
 Fabiane Barato  
 Remi Bardou  
 Drew Grady Barnum  
 Clayton Bean  
 Claire Elizabeth Bearden  
 Jennifer P. Becker  
 Aims Lurette Bennett  
 Stephanie Lane Bennett  
 Jonathan F. Birkel  
 Ksawery Jozef Biskup  
 Ellen Blazer  
 Kaitie Marie Bouch  
 Rebecca Nicole Britton  
 Anna Zipporah Brooks  
 Jonathan Brotsch  
 Danielle Janine Brown  
 Trevor Ryan Brown  
 Gabrielle Buck  
 Tyler Paz Burt  
 Allison K. Buys  
 Adam Caligiuri  
 Benjamin B. Chaffin  
 Md abu Raihan Chowdhury  
 Connor Paul Christoffersen  
 Priscilla Emily Clark  
 Sarah Clark  
 Elizabeth Cohen  
 Kassandra L. Combs  
 Zachary Cook  
 Christine Samantha Cooler  
 Samuel Crane  
 Alison Taveau Cribb  
 Julianna Crumlish  
 Sarah E. Cryer  
 Kacey A. Cummings  
 Elizabeth Kelley Darnell  
 Jackie S. Delie  
 Daniel E. Dimascia  
 Evan Dismukes  
 Kyle Andrew Duckett  
 Emma Louise Duncan  
 Maigan Ansli Dunlap  
 Colleen R. Dunphy  
 Julia Dupree  
 Angela C. Dzuck  
 Amy Jeanne Eisenstadt  
 Vianey Escobar  
 Gabrielle B. Evans  
 Etienne Fang  
 Andrew Faris  
 Trevor Farrell  
 Aaron Feldhaus  
 Sarah Fitzpatrick  
 Francis Michael Flanagan

Anneliese Fliger  
 Michael Frazier  
 James R. Freeman IV  
 Maria Frishman  
 Matthew T. Fryer  
 Jennifer L. Fuller  
 Emily Marie Furl  
 Mackenzie G. Gaikema  
 Laura Garcia  
 Taylor Rae Garton  
 Andrew C. Geleske  
 Maximilien Genest  
 Shanay Lucretia George  
 Pierre Gerard  
 Jonathan Gewirtzman  
 Madison Giuntoli  
 Marisa Goepfner  
 Bernt Spencer Goodson  
 Spencer Edward Gray III  
 Molly Rose Guiney  
 Kirk Daniel Gulliver  
 Evelyn Paola Gutierrez  
 Danielle K. Guttman  
 Jalen Alexander Hairston  
 Anna Ruth Weston Halberstadt  
 Alexander S. Hall  
 Zackariah Al Ameen Hamid  
 John Allen Harris  
 Tracie J. Harrison  
 Victoria Jolene Havens  
 Carson Hedberg  
 Jennifer M. Heit  
 Alaina Nicole Hickey  
 Anais Hiedra  
 Mallory Hinks  
 Scott Joseph Holewinski II  
 Alexandra Holland  
 Kathryn Suzanne Holtzclaw  
 Margaret Louise Honig  
 Sam Horvath  
 Samuel James Howarth  
 Brittany Lynn Huhmann  
 Katherine Annette Hull  
 Rachel Adelle Irvin  
 Rehnuma Islam  
 Ryleigh H. Jacobs  
 Lauren N. Jendrock  
 Cora B. Johnson  
 Luke Johnson  
 Mary Jane Keffer  
 Sean Matthew Kelly  
 Chelsey Kipper  
 Ashleigh Nicole Kirker  
 Sarah W. Kittross  
 Joseph Tom Koeske  
 Allison Krieder  
 Sarah Kuo  
 Colton Kyro  
 Colleen Anne Lane  
 Haven Lane  
 Johnna Lasmanis

## Welcome New GSA Members

Michelle Lawniczak  
Justin M. Lazaro  
Brian Lenell  
Kaitlin Lento  
Abby Whitmarsh Letts  
Qingyun Li  
Florence Ling  
Amanda Rose Livingston  
Adrienne Loftus  
Jonathan Michael Ludovico  
Margit Katherine Lund  
Quan Que Ly  
Joseph Mack  
Russell Clayton Maddrey  
Ryan Michael Maher  
Lorena Roque Martinez  
Mary M. Masse  
Lauren Mae Maurer  
Nicholas Ray McConnell  
Amber Lee McDonald  
Sawyer McFadden  
Caitlin McGuire  
Seamus Charles McLaughlin  
John Melien  
Thomas Edward Melvin Jr.  
Aaron Meneghini  
Ashley Meredith  
Scott Mesich II  
Joseph J. Miller  
Logan P. Miller  
Tyson Andrew Miller  
Scott Mills  
Amelia D. Mindich  
Heather B. Monroe  
Malcolm M. Morrin  
Laurel Ann Muldoon  
Scout B. Munday  
Christa Murphy  
Natalie Nicole Murphy  
Trevor Murray  
Nabil Mzee  
Alex Nash  
Rose Nash  
Kelsea Cathleen Nolan  
Nathaniel Norris  
Audrey Caroline Northcutt  
Grant William Nussbaum  
William D. Oakes  
Ann Sullivan Ojeda  
Nickolas Augustus Orr  
Nebechi Osia  
Daksha Patel  
Sierra Faye Patterson  
Elizabeth Peichel  
Shayna Perdeck  
Leticia Pereira  
Sierra Perez  
Malik Perry  
Rhonda Perry  
Christina A. Peterson  
Jake Pfannenstiel

Taylor Alexander Phelps  
Morgan Phillips  
Michelle Poletti  
Max Price  
Ivan A. Prushnok  
Katherine G. Quimby  
Alon Rabinovich  
Marlon V. Ramlogan  
Emily M. Reich  
Monica S. Reilly  
Eli Reisman  
Zachary Richard  
Justin Tyler Ridge  
Trevor Neal Roark  
Michael W. Robb  
Leah Robison  
Jared Wesley Rose  
Amy Elizabeth Rosebrough  
Rupsa Roy  
Catherine T. Ruhm  
William Russo  
Elizabeth Clara Rutila  
Corinn Elizabeth Rutkoski  
Shahzad Saffari Ghandehari  
Andres Saldarriaga  
Jordan Elise Salley  
Alexis Jade Santiago  
Emery Hayes Saylor  
Shelby Lynn Schettler  
Jennifer Ann Schoenstein  
Samantha Schonberger  
Brandon Thomas Scott  
Kerri Scrivanos  
Austin Vaughan Seeger  
Riley Shaak  
Mahrukh Shaikh  
David Simpson  
Caleb D. Sims  
Owen Sitler  
Erin Slifer  
Boyoung Song  
Katherine C. Sorrows  
Claire Elizabeth Spangenberg  
Meghan Maureen Spoth  
Kathleen Staebell  
Anna M. Starks  
Michael Stefan  
Alexis Jean Steffen  
Cameron Marcel Stewart  
Casey Findley Stone  
Nathan Dale Storer  
Cora Summerfield  
Christopher James Tafoya  
Daniel Thew  
Russell Peter Thorsen  
William R. Toth  
Ashlee Nicole Townsend  
Katelyn Tresino  
Michael Turley  
Caroline Tuttle  
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Nancy Carolina Urbano  
Jonathan Valentine  
Hannah R. Vanderkin  
Kelsey Vaneyl-Godin  
John Roman Vaught  
Gollamudi Venkata Srujan  
Caroline Verdi  
Roxanne Yolanda Walker  
Riley E. Wall  
Irene Rizza Wallrich  
Courtney Bridget Walsh  
Abigail Weibel  
Isabelle Ellis Weisman  
Hang Wen  
Jonathan Ivar Weyhrauch  
Cody Wheeler  
Jaide Lee Wible  
Emma Dale Wiggins  
Julia Wilcots  
John Timothy Williams  
Kelsey A. Williams  
Lara Isabella Williams  
Mario Williams  
Travis Aaron Wilson  
Glenn Elizabeth Woerndle  
Rachel Elizabeth Yesenchak  
Shiliang Zhao  
Alexandra Leigh Zobel  
Maria Elizabeth Zubizarreta

### Geography

Maria Christine Carinci  
Sydney Clackett  
Elizabeth Lefebvre Dickman  
Yoselin Doyle  
Jean Eichhorst  
Jessica M. Groff  
Brandyn Heck  
Ashton Micaela Johnston  
Alyssa Krantz  
Kyle Landolt  
Sarmistha Mallick  
Elise Sara Mazur  
Morgan Michels  
Dylan Murphy  
Spencer O'Bryan  
Madison Lynn Reid  
Derek Richards  
Ronald Stuart  
Joseph W. Warth  
Jane White  
Kelsey Anne Wilber  
Dana Marie Williams  
Robert Michael Worley  
Samuel Thomas Wright  
Wang Xuetian Sr.

### Geoinformatics

Hayley Roxana Beitel  
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Alexander Doig  
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Hillary Gray  
Emad Hasan  
John Alfred Knight II  
Brian John Kraegenbrink  
Angela P. Murillo  
Griffin Scott  
Ashley Shields  
Rebecca Thomas-Maurer  
Ivan Untung  
Lisa Michelle Zoellick

### Geology and Health

Stephen Ager  
Angela Kathleen Bittner  
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Jacob Browell  
Luana Calburean  
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Gabriel James Davila  
Michael Dickerson  
Michelle Marie Dionne-Vahalik  
Mary Grace Franusich  
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Alyssa M. Graveline  
Jesse Greathouse  
Elizabeth Howard  
Zachery Kihle  
Benjamin Krogmeier  
Nicholas M. Luh  
Benjamin James Marconi  
Clare Miller  
Quinn A. Nutter  
Eric Russman  
Justin Schneider  
Susan Margaret Stordeur  
Ali Wertheim  
Dustin Lee Wilson  
Mathieu Jean Xavier

### Geophysics/Tectonophysics

Ayoola Abimbola  
Elijah A. Adedeji  
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Saad Alarifi  
Moamen Mohamed Almaz  
Kousseila Amara  
Gillean Arnoux  
Jessie Bagby  
Dylan Bailey  
Isaac Bancroft  
Ines M. Barrios Galindez  
Andrew Berdine  
Walter Buckner  
William Carl Callebert  
Martina Coccia  
Benjamin Paul Consolvo  
Aren Teva Crandall-Bear  
Cansu Culha

## Welcome New GSA Members

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Sonny J. Divita  
Charles Leland Dorchester III  
Qazi M. Fahad  
Daniel Finley  
Ashley Fitch  
Wey Y. Foo  
Marshall Foster  
Louis Garcia  
Connor Gieger  
Joseph Gieger  
Jacob Alexander Gochenour  
Jeannot Francois Goussi  
Caleb M. Goward  
Prasanna Mahesh Gunawardana  
Allison A. Haddon  
Khalid Majeed Haji Omar  
Catherine Elise Hanagan  
Jordan (J.K.) Kelsi Harding  
Dana L. Harper  
John C. Hawthorn  
Erin Heilman  
Robert Hendry  
Ryan Higgins  
Jordan Lee Hollenbeck  
Cody James Howard  
Wan Hang Hui  
Chijioke Modestus Idoko  
Sajad Jazayeri  
Mario Juan Job  
Haki Johnson  
Ryan Johnson  
Samuel Paul Johnson  
Natalie Jones  
Shreya Jagdish Kanakiya  
Grant Gordon Kennis  
Jeffrey Raymond Larson  
Rebekah F. Lee  
Samuel Bradshaw Loeb  
Karyn Elizabeth Mathison  
Lewis Matthews  
Andrew Jon Mazis  
Matthew Douglas McClellan  
Matthew Scott McDaniel  
Richard A. McDermott  
Gillian McGinnis  
Tate Meehan  
Chad Aaron Melton  
Aida Lorena Mendieta  
Anna Mikheicheva  
Mark Michael Mlella  
Sarah Moore  
Vitaliy A. Morozov  
Sarah Morton  
Kelci Noelle Mynhier  
Timothy Nikoley  
Sarah Jaye Coros Oliva  
Arvind Parapuzha  
Kiyavash Parvar  
Olivia Catherine Paschall

Jessica Pentecost  
Tamara Pico  
Hailey Michelle Quinnett  
Cole Sterling Richards  
Edith C. Rojas Salazar  
Cathrene Jane Rowell  
Claudia Alexandra Rubio Zapata  
Sarah Schneider  
Kai Hannah Selwa  
Clayton James Silver  
Juliana Simon  
Dale Parker Sprinkle II  
Natalie Noel Steenken  
Nicolas Pablo Trevino IV  
Evan Tucker  
Anisha D. Tyagi  
Zachary Van Ornam  
Brandon Paul Vanderbeek  
Bethany E. Vanderhoof  
Christopher Thomas Vidic  
Hans Richard Voll  
Noah A. Vriese  
Andrew Weinrich  
Zachary Willis Williams  
Katleen Wils  
Elizabeth Diane Witte  
William J. Wright  
Lei Wu  
Han-cheng Yu  
Fan Zhang  
Sean C. Zigah

### Geoscience Education

Annaimee Aguilar  
Sarah Louise Anderson  
Hannah Baggs  
Mary Katie Bales  
Fredric William Booth  
Bodaniel L. Bradley  
Dale A. Brown  
Rita Butler  
Bryan Buttigieg  
Lindy Cain  
Haley Marie Celotti  
Chloe Adel Chambers  
Youngwoo Cho  
Diane D. Davidson  
Frances Defilippo  
Marissa Del Orfano  
Katyhryn Durkin  
Pouyan Ebrahimi  
Matthew Eckle  
Madeline Mcchesney Every  
Sara Victoria Farhat  
Arnold Fernandes  
Wallace George Giakas  
Patrick K. Gibbs  
Paige E. Haney  
June Alexandra Hazewski  
Miranda Irene Hernandez  
Olivia Joy Hinton

Elizabeth Johnson  
Seth Lawrence King  
Sophie Kirscht  
Jessica Leesburg  
Tiffany C. Leone  
Theodore Houston Lewis  
Forrest William Lloyd  
Samuel Louderback  
Alessandra Magagna  
Haylie Marquardt  
Fabrice N. Matata  
Abubakar Mijinyawa  
Aaron C. Musselman  
Allan Nolan  
Michael Robert Okely  
Sugandha Panwar  
Austin James Peppers  
Kevian Augusto Perez Valentin  
Joshua Roger Peterson  
Alyssa Pfahler  
Karina T. Redding  
Amy Joy Redhair  
Bret Desmond Sample  
Claire Sbardella  
Sarenda D. Sewell  
Rebecca A. Siladi  
D.D. Smith  
Kent Smith  
Kimberly Francis Sowards  
Gregory Fain Steltenpohl  
Cody N. Stoll  
Laura Tinigin  
Katherine Ann Tott  
Morgan Eileen Treon  
Alexandria Leigh Weaver

### Geothermal

Kevin Lee Cavett  
David Roy Harper  
Jordan M. Heath  
Clay Grant Jones  
Dillon J. Olivi  
Alexander Mark Percy  
Tyler Ray Scott  
Yizuo Shi

### History/Philosophy of Geology

Alison Nicole Aungst  
Paige L. Ottenfeld  
Philip C. Tunncliff

### Hydrogeology/Hydrology

Mabossani Mahawa-essa Akara  
Adam Albers  
Lauren E. Allin  
Mohammad Amin Amooie  
Lisa Andes  
Caitlin White Armstrong  
Andres Arroyo Jr.

Brody Adrian Arvesen  
Dillon John Bagnall  
Emily Alyssa Baker  
Janet Rice Barclay  
Cassandra A. Bergstedt  
Jenna Nicole Biegel  
Kyle Wayne Bogatz  
Anita M. Boggs  
Jason Bolduc  
Glenn Bolognese  
Caroline Borgini  
Casey Lee Boutwell  
Julia A. Bowe  
Joseph Lonnie Broome  
Garrett Brown  
Reid D. Brown  
Riley Vaughn Brown  
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Darion Carden  
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Dan L. Deifenbaugh  
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Elizabeth Kathryn Dilbone  
Graham Jones Dodge  
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Mitchel Patrick Dolan  
Jacob Donlin  
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Kyle Eldridge  
Rachel Elias  
Gibson Carter Erlewein  
Jessica E. Ewanic  
Stephen Bruce Ferencz  
Jennifer Christine Fergesen  
Brennan Matthew Ferguson  
Samuel Fixler  
Andrew Kehler Francis  
James Neil Fricke  
John Franklin Gauthier  
Jonathon Randall Gershon

## Welcome New GSA Members

Lauren Clare Giggy  
Carolyn Gombert  
Benjamin Phillip Gooding  
Jonathon Green  
Michael Grzybowski  
Melissa Ann Hackenmueller  
Hunter Harrison  
Tara Harvey  
Azzah S. Hassan  
Mitchell Hatfield  
Jordan Hebert  
Rebecca Jean Hedges  
Mark Hiler  
Ginny Sue Holcomb  
Jordan Christopher Hollinghead  
April Marie Holloway  
Jackie D. Horn  
Liam G. Horner  
Brandon Leslie House  
Christopher A. Howell  
Christopher Robert Hugh  
Rebekah C. Ingram  
Ben Irvin IV  
Haley A. Johnson  
Casey Jean Jones  
Harold Jones  
Forrest S. Kalk  
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Sean E. Karoly  
David G. Ketchum  
Rebecca M. Kickert  
Paul Adam Kinunen  
Gabriella Dawn Kitch  
Keri Klinges  
Kevin Knapp  
Eli Koslofsky  
Evan Kotlowski  
Benjamin S. Kraushaar  
Jason Kryszak  
Derringer Nicholas Kuriatnyk  
Alice Gunn Laamanen  
Ted Langhorst  
Stephanie Latour  
Ethan Lawler  
Stephen Beach Leatherman  
Valerie Alysse LeCompte  
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Theodore C. Lim  
Tianqi Liu  
Brea Dawn Lund  
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Megan Maksimowicz  
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Claire P. Martin  
Ryan Jefferson Martin  
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Ezekiel Mcginn  
Jessica Mcguire  
Kevin Richard McKenzie  
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Amy Olson  
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Jessica L. Pendle  
Chelsea N. Peters  
Julia Petreshen  
Katherine Pfeiffer  
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Amy K. Plechacek  
Hem K. Pokharel  
Sofronio Catalino Propios III  
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Jeremy R. Rapp  
Nathan Rapp  
David M. Rey  
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Aaron David Seidel  
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Shane Showalter  
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Hayley Smith  
Logan M. Smith  
Hannah Somers  
Trevor Spencer  
Tessa Leigh Sprague  
Jasmine Nicole Stefansky  
Rita Doreen Stern  
Julia Isil Sumer  
Mary K. Sweeney  
Katherine Swensen  
Jeffry Tahtouh  
Rachel Joy Talmadge  
Arik Tashie  
Brandt Alan Taylor  
Sean Henry Taylor  
Misti Marie Teinert

Daniel Alexander Thomas  
Victoria Shannon Thomas  
Sara Thurkettle  
Nicholas J. Tobia  
Emily Toczek  
Jordan Torgunrud  
Jonathon Toro  
Kathleen Torso  
Stephanie Truitt  
James Joseph Tucker IV  
Anisha Tuladhar  
Skyler K. Tulley  
Anna Turetaia  
Jacey J. Vail  
Kareem Valdez  
Stephen Vanhoesen  
Ricardo Vargas Jr.  
Mackenzie Vecchio  
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Isabellah Victoria von Trapp  
Corey David Wallace  
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John Wyatt Walls  
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Todd Richard Webb  
Jacob Christensen White  
William John White  
Catherine Elizabeth Wielgasz  
Tia Willens  
Kristal Williams  
Sharon Williams  
Daniel Casey Wilusz  
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Savannah Wing  
Samuel F. Wiswell  
Josh Woda  
John Charles Wohlford  
Gregory Woodward  
Zhongyuan Xu  
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Ryan K. Young  
David John Yousavich  
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### Karst

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Jacob W. Masslich  
Emma Grace Patterson  
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Steven Eric Smitka  
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Shaun Tomeff

### Limnogeology

Marissa Elizabeth Buck  
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Dewey W. Dunnington  
Elise Jillian Farrington  
Konrad K. Grochocki  
Zijun Liu  
Yiran Lu  
Alexander Francis Manchuck  
Emma McNulty  
Krista Falcon Myers  
Nora Richter  
Erika Lee Smith  
Jacob T. Walker  
Jianguo Zhang

### Mineralogy, Geochemistry, Petrology, Volcanology

Tariq Mohammed Akif  
Genevieve Ca Allan  
Kathryn Allen  
Jacob Anderson  
Shawn Evan Armstrong  
Aaron Wolfgang Ashley  
Tyler James Askin  
Nick Avgerinos  
Samantha K. Ayers  
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Jeneane Barber  
Mattison Hood Barickman  
Emmalyn Barkman  
Arturo J. Barron  
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U ur Can Bayhan  
Scott Christopher Beard  
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Daan Beelen  
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Joel Ben-Awuah  
Will Martin Bender  
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Noah Taiichi Biddle  
Joshua Michael Blackstock  
Daniel Blakemore  
Katreine Blomme  
Kimberly Blum  
Jeremie Joseph Boehm

## Welcome New GSA Members

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Piyali Chanda	Freya Roxanne George	Jesse Dalton Kimel	William Tyler Newman
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Anirban Chowdhury	Darbie Gibbs	Amy Louise Krause	Samuel Edwin Nilsson
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Christopher R. Emproto	Holderness-Roddam	Benjamin D. McCann	Alba Mar Rodriguez Padilla
Caleb Engle	Benjamin Holt	Anthony Jay Mccarlson	Jordan Rogers
Thomas M. Etzel	Megan Holycross	Jessica McDaniel	Sarah Chandler Rouse
Lucas L. Ewart	Donald R. Hood		



Erin Sandmeyer  
 Amanda Santilli  
 Michael James Sara  
 Anna Sartell  
 Heather R. Savage  
 Peter Scheuermann  
 Stephanie V. Schimenek  
 W. Kirk Schleiffarth  
 Hannah Elizabeth Schorr  
 Elisabeth Scibiorski  
 Scott Scifres  
 Patrick Scott  
 Catherine Sedge  
 George Segee-Wright  
 Christopher Semler  
 Lisa Amanda Petrovich Shantz  
 Lauren Shea  
 Erin Shervey  
 Daniel Skarzynski  
 Christopher Slocum  
 Matthew Smart  
 Dallas Nicole Smith  
 Kyle Soule  
 Theron Sowers  
 Natalie Marie Speaks  
 Sara Elizabeth Speetjens  
 Kaci Spooner  
 Steven Keenan Spreitzer  
 Jared Wynn Steger  
 Rebecca Marie Steinberg  
 Alicia Stephan  
 Scott Stephens  
 Gary L. Sticht  
 Karra T. Stout  
 Steven Stroup  
 Nesyereb Susana Suarez Nieto  
 Danielle Sulthaus  
 Matt Collin Suppes  
 Sarah Sutton  
 Hadley Swartz  
 Joshua Ronald Szall  
 Ousseynou Tall  
 Kaitlin N. Tanel  
 Gil Fils Tansman  
 Mackenzie Taylor  
 Natalie Marie Thomas  
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 Jacob Taylor Thompson  
 Scott David Thorson  
 William Russell Tinnell Jr.  
 Marissa Tomin  
 Marshall Trautman  
 Alison Turner  
 Robert N. Ulrich  
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 Spencer P. Vanhorn  
 Manuel Rafael Vejar  
 Alex Venzke  
 Jessica Julia Villers  
 Randall Wade  
 Anna Helena Wallace

Kevin Barry Walsh Jr.  
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 Bradley Todd Walter  
 Chaoran Wang  
 Hui Wang  
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 Lucas Andrew Weaver  
 Wei Wei  
 Justin Andrew Wells  
 Kevin Werts  
 Bayne N. Westrick-Snapp  
 Brett Wharton  
 Daniel James Wilkes  
 Lauren Williams  
 Courtney Brooke Wilson  
 Michael Wilt trout  
 Moira A. Wiora  
 Molly Witter  
 Erin M. Wood  
 Zach Yakush  
 Heqing Ye  
 Wenchao Yu  
 Mandy D. Zietz

**Oceanography/Marine Geology**

Charles Scott Adams IV  
 Paige Anderholm  
 Butsawan Bidorn  
 Katherine A. Byerly  
 Lena Capece  
 Sami Li Chen  
 Rachel Warren Clark  
 Celeste Corcoran  
 Melissa Cote  
 Claudia Deeg  
 Taylor A. Determan  
 Shannon Doherty  
 Meghan Duffy  
 Daniel Zachary Fischer  
 Victoria Fortiz  
 Lance Mellette Foxworth  
 Andrew Friedrichs  
 Michael Patrick Chappelle Fuller  
 Emma Gaines  
 Andrew Gillen  
 Michelle Guitard  
 Devin Renee Hainje  
 Justin Thomas Hensley  
 Kathryn Holper  
 Kelly Koehler Johnson  
 Heather Jones  
 Michael Tyler Kee  
 Rachel Lauren Kelly  
 Rebecca Ann Kleinen  
 Taylor Krolik  
 Whitney A. Lopic  
 Jonathan Leard  
 Yuting Li  
 Eric A. Macleod  
 Maria Makarova

Nashaat Mazrui  
 Claudia Isabela Mazur  
 Jatamia McCray  
 Liam McGrath  
 Susannah Morey  
 Kelly Leigh Nifong  
 Robert J. O'Donnell III  
 Franziska Anna Palm  
 Molly K. Parker  
 Dylan Aditya Peck  
 Patrick Michael Peck  
 Andrew D. Pekowski  
 Adriana Jean Peters  
 Joshua True Richards  
 Jay Seay Ritchie III  
 Lauren Roberts  
 Patrick A. Robichaux  
 Louise Roy  
 Jeremy Aldo Salerno  
 Kevin J. Simans  
 Simone P. Siriani  
 Leslie A. Smith  
 Fatima Sulaman  
 Joseph Edward Thomas  
 Gemma Venuti  
 Aleah Rose Walsh  
 Jiaze Wang  
 Jane Weinstock  
 Steffen Christopher Wilkinson  
 Elizabeth Willard  
 Kayla Wood

**Paleo Sciences**

Bruno Ramiro Aguilar-Cabrera  
 Daniella A. Assing  
 Jorge Alexander Barrera  
 Richard George Bayon  
 Rudolf J. Bentlage  
 Douglas M. Beri Jr.  
 Nicole Brooke Biller  
 Alexander Cole Bippus  
 Allyson A. Boggess  
 Schuyler Borges  
 Shannon K. Brophy  
 Wing tung Ruby Chiu  
 William Barrett Clark  
 Ashley Rose Costelloe  
 Samuel Paddock Cox  
 Michael Val D'ottavio Jr.  
 Randolph Glenn De La Garza  
 Matthew Decesare  
 Sarah Dickson  
 Haven Ann Diehl  
 Kelsey Elizabeth Doiron  
 Brian Daniel Duggan  
 Salvatore Dumas  
 Yuwan Ranjeev Epa  
 Jake Anthony Ganpat  
 Meagan Michelle Gilbert  
 Anthony Michael Gilman  
 Anna Glueder

George Grant  
 Braden R.B. Gregory  
 Louis John Grimmelbein V  
 Julian Lucian Grochocki  
 Jeffrey Donald Gunderson  
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 Gregory M. Harris  
 Steven Goliath Harris  
 Samuel Hunter Hay-Roe  
 Bryan Hermosillo  
 Rainee Love Howard  
 Tyler Craig Hunt  
 Holly Hurding-Jones  
 David Ryan Hurey  
 Meghan Hussey  
 Mohamed Imsalem  
 Maggie Irwin  
 Savannah J. Irwin  
 Advait Mahesh Jukar  
 Caroline Chandler Kelleher  
 Joshua Kelly  
 Hannah Kempf  
 Tyler Ulion Curry Kerr  
 Zoe Kulik  
 Ben Stanley Kwiatkowski Jr.  
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 Scott Raymond Lakeram  
 Mirinae Lee  
 Asmara Anne Lehrmann  
 Anne Longar  
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 Rachel Lupien  
 Theophan Hadrian Lyman  
 Isaac Magallanes  
 Evin Patrick Maguire  
 Hunter Manlove  
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 Colton Scott Mason  
 Annie Parker McIntosh  
 Randall Seth Miller  
 Joseph Eric Mohan  
 Minda Moriah Monteagudo  
 Jordan Andrew Morris  
 Nawaf Aa Nasser  
 Nicole Neu-Yagle  
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 Mounga Nonu  
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 Nathan Stephen Ong  
 Ozlem Gurocak Orhun  
 Michael Joseph Paradis  
 Luke Alexander Parry  
 Joseph Patterson  
 Srilak Nilmani Perera  
 Stephanie M. Plaza-Torres  
 Ashley Ratigan  
 Mhairi Lesley Reid  
 William Antonio Reyes  
 Claudia Richbourg

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Ethan Alexander Rosa  
Adolfina Savoretti  
Simon George Scarpetta  
Caren Shin  
Andrew F. Smith  
Nicholas Smith  
Wesley Park Stambaugh  
Meghan A. Stewart  
Jenny Leigh Strobel  
Kristopher Super  
Kevin Surya  
Aidan Sweeney  
Brian Tanis  
Tara Templeman  
Derek A. Trussell  
Michael Twarog  
Hali Marie Vanvalkenburg  
Christopher Vito  
Alexander Samuel Walker  
Jenelle Wallace  
Shannon Kathleen Walters  
Joshua Robert White  
Joseph Loren Woodworth  
Ethan Yackulic  
Michelle Zill

### Planetary/Space Science

Cherie Achilles  
Porsche Adams  
Gabriel Christian Ahrendt  
Alex Harry Andronikides  
Mountain Yarrow Barber  
Kelli W. Baxstrom  
Luke Ashton Beane  
Mathew Beattie  
Vincent Brinkmeyer  
Eric Britt  
Ryan Brown  
Nora Catherine Bryson  
Jesse Bunkers  
Andrew Burchwell  
Cailey Ty Burnett  
Justin Bush  
Asis Juan Carlos  
Timothy Robert Carlson  
Tess E. Caswell  
William A. Chapman  
Heather Charles  
Holly Grace Cohen  
Logan M. Combs  
Joshua Michael Cuellar  
Sean Czarnecki  
David Michael Davis  
Rajani Deepak Dhingra  
Patrick Torin Diez  
Mary Dineen  
Austin H. Fint  
Emily M. Fletcher  
Sean Hartman

Matthew James Hendrick  
David Michael Hough  
Julian Martin Irigoyen  
Bridget Johnson  
Autumn Nicole Jones  
Sierra Vivian Kaufman  
Samuel Alexander Kincaid  
Katlyn Lafranca  
Cameron Lerch  
Justin Luppens  
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Angela Giuliano Marusiak  
Dan Mason  
Grayson James McCrary  
Morgan Caitlin McDonnell  
Jonney Luc Mitchell  
Jessica Marie Mlaska  
Victoria M. Montgomery  
Anthony Michael Morell  
Logan C. Mort-Jones  
Megan Mouser  
Katherine Teresa Murphy  
Layton A. Neil  
Barbara Anne Nibur  
Jessica Noviello  
Samuel John Nunnikhoven  
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Matthew Oates  
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Eric Petersen  
Paula W. Phelps  
Madeline Price  
Katie Quinn  
John Carleton Rarick  
Chris Richardson  
Jan Thomas Rowe  
Lior Rubanenko  
Scott Leland Sage  
Ethan Immanuel Schaefer  
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Lorin Nicole Simboli  
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Hope Tornabene  
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Jorge Daniel Valdes  
Allison M. Vance  
Joana Ruth Charlotte Voigt  
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Ken Walsh  
Mark Yukelson  
Margaret Zarlengo

### Policy/Regulatory

Taylor C. Brantley  
George Khang  
Jack Edward Orloff  
Luke Piedad  
Rebecca Joyce Webster

### Quaternary Geology/ Geomorphology

Kegan Kent Aldridge  
Gantulga Bayasgalan  
Michael John Behrend  
Nina Bingham  
Truxton Greye Blazek  
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Jonathan Bridgeman  
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Lauren Thompson  
Matthew Trudeau  
Joseph Patrick Tulenko  
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Erin Elisabeth Warren  
Ben Weiserbs  
Derek Ray Williams  
Jane Wilson

### Seismology

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Chau Duc Minh Ha  
Am Imrul Islam Jr.  
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### Soil Science

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 Jaime Somers Vincent

**Stratigraphy/Sedimentology**

Gayln Wayne Adams  
 Tsolmon Adiya  
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 Mary Susan Cave  
 Daniel Cepero  
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 · Joel Robert Lemaistre  
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 · Victoria Elizabeth Anderson  
 · Casey Armanetti  
 · Kimberly Baldwin  
 · Megan Barlow  
 · David Ben  
 · Donata Borsos  
 · Maeve Bowdish  
 · Katherine Clare Brooker  
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 · Charlotte Byrd  
 · Macy Carter  
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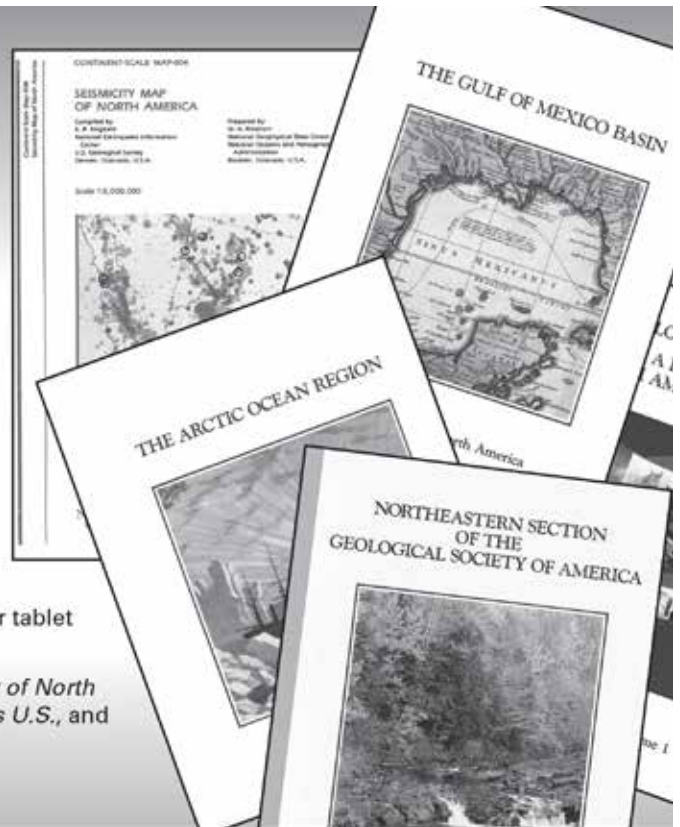
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# IN MEMORIAM



The Society notes with regret the deaths of the following members (notifications received between 29 Oct. 2015 and 9 May 2016).

**H.W. Allen**

Richfield, Utah, USA  
GSA notified: 8 Mar. 2016

**Francis D. Anderson**

Almonte, Ontario, Canada  
Date of death: 1 Oct. 2015

**Robert W. Blair Jr.**

Durango, Colorado, USA  
GSA notified: 26 Feb. 2016

**Harold Bohmer Jr.**

Tucson, Arizona, USA  
Date of death: 29 Dec. 2014

**Jon C. Boothroyd**

Merrimack, New Hampshire, USA  
Date of death: 15 Oct. 2015

**C. Wayne Burnham**

Scottsdale, Arizona, USA  
Date of death: 1 Aug. 2015

**Ben Donegan**

Albuquerque, New Mexico, USA  
Date of death: 1 Jan. 2016

**Eric K. Ericson**

Santa Fe, New Mexico, USA  
Date of death: 24 Oct. 2015

**Aida R. Green**

Saranac Lake, New York, USA  
GSA notified: 22 Apr. 2016

**Earl W. Hart**

Corte Madera, California, USA  
Date of death: 6 Jan. 2016

**Bernard R. Hawke**

Honolulu, Hawaii, USA  
GSA notified: 16 Mar. 2016

**Richard W. Hutchinson**

Plympton-Wyoming, Ontario, Canada  
Date of death: 21 Feb. 2016

**Douglas L. Inman**

La Jolla, California, USA  
GSA notified: 29 Feb. 2016

**Kenneth G. Johnson**

Buskirk, New York, USA  
Date of death: 25 Sept. 2015

**Charles Frederick Kluth**

Littleton, Colorado, USA  
Date of death: 1 May 2015

**Don R. Mabey**

Salt Lake City, Utah, USA  
Date of death: 10 Oct. 2015

**Frederick Wayne Meyer**

Palatka, Florida, USA  
Date of death: 31 May 2015

**Paul K. Morton**

Costa Mesa, California, USA  
Date of death: 1 Sept. 2015

**John Edward Moylan**

Mission, Kansas, USA  
GSA notified: 4 May 2016

**Thornton L. Neathery**

Tuscaloosa, Alabama, USA  
Date of death: 4 Oct. 2015

**Lawrence Ogdén**

Chelsea, Michigan, USA  
GSA notified: 25 Feb. 2016

**Elizabeth F. Overstreet**

Santa Fe, New Mexico, USA  
GSA notified: 20 Apr. 2016

**William C. Overstreet**

Santa Fe, New Mexico, USA  
Date of death: 14 Apr. 2016

**Don R. Owens**

Hot Springs, Arkansas, USA  
Date of death: 20 Oct. 2015

**William G. Reay**

Fort Davis, Texas, USA  
GSA notified: 27 Apr. 2016

**Claire A. Richardson**

Baltimore, Maryland, USA  
Date of death: 25 Dec. 2015

**A.E. Scheidegger**

Brugg, Switzerland  
GSA notified: 3 Jan. 2015

**William W. Schroeder**

Salida, Colorado, USA  
GSA notified: 9 Nov. 2015

**Thomas A. Steven**

Lakewood, Colorado, USA  
GSA notified: 25 Nov. 2015

**George Theokritoff**

Mount Tabor, New Jersey, USA  
Date of death: 19 Dec. 2015

**Roderick W. Tillman**

Tulsa, Oklahoma, USA  
Date of death: 21 Jan. 2016

**Georges R. Verrier**

Meudon, France  
Date of death: 1 June 2015

**Frederick R. Voner**

Marietta, Ohio, USA  
GSA notified: 14 Apr. 2016

**Marc B. Vuagnat**

Dardagny, Switzerland  
Date of death: 23 Mar. 2015

**Charles Weiner**

Houston, Texas, USA  
Date of death: 6 Apr. 2016

**John H. Whitmer**

Issaquah, Washington, USA  
Date of death: 1 Jan. 2016

**Herbert E. Wright**

Minneapolis, Minnesota, USA  
Date of death: 12 Nov. 2015

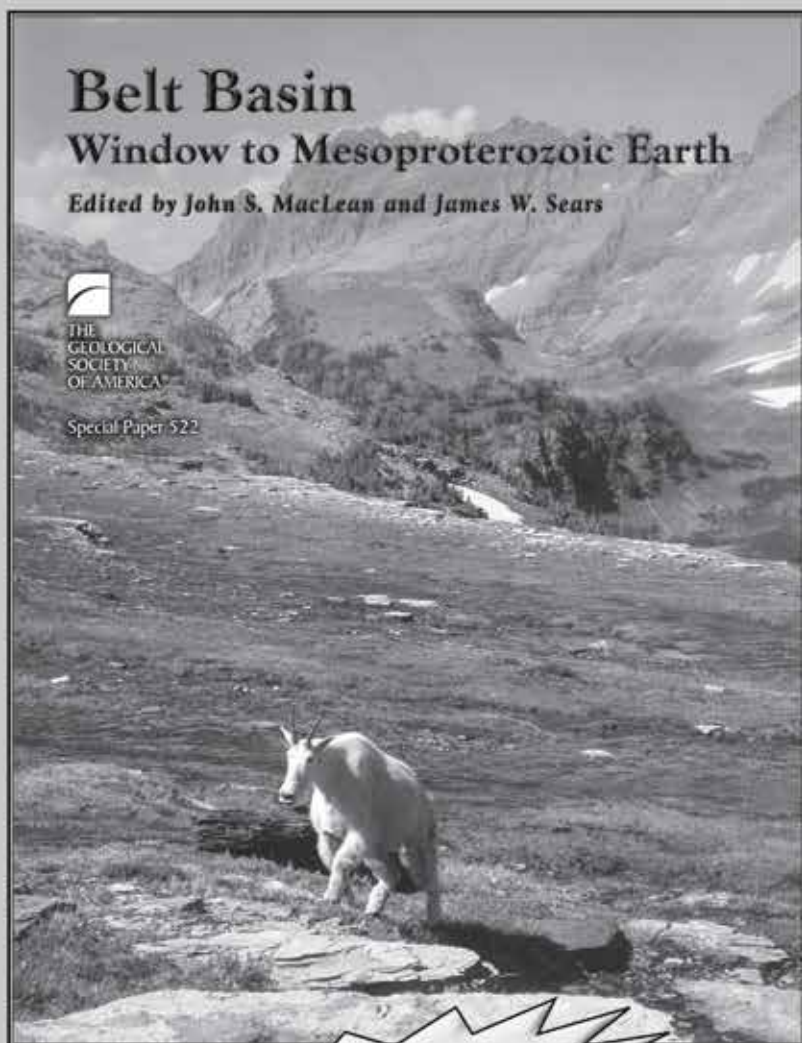
**Donald H. Zenger**

Claremont, California, USA  
GSA notified: 8 Feb. 2016

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Karen Paczkowski

“If you’re not at the table,  
you’re on the menu.”

Solving our nation’s toughest challenges requires a coordinated effort between scientific knowledge, effective legislation, and sound policy. As a society, we must decide how to protect and sustainably use our natural resources, how to mitigate and adapt to natural hazards, and how to secure our energy supply. Geoscience has an important role to play in deciding the answers to these challenging questions.

Using geoscience to inform policy has been a constant thread through my career. As a graduate student, I participated in several Geoscience and STEM (science, technology, engineering, and mathematics) Congressional Visits Days (CVDs). CVDs are two-day events where scientists from around the country travel to D.C. to meet with their congressional representatives. In my own face-to-face meetings with congressional offices and committees, I stressed the importance of federally funded basic science research by emphasizing the societal impacts of my own research, the societal benefits of geoscience as a field, and the value of geoscience education. CVDs send a powerful reminder to policymakers of the need not only to support geoscience programs verbally, but to support them financially as well. There’s an old saying in Washington: “If you’re not at the table, you’re on the menu.”

I believe these CVD visits had an effect on policymakers, and I know they had an effect on me. I discovered that my geoscience background could be used to help tackle national challenges by using science to develop better policy. After finishing my Ph.D. in geophysics, I made the leap into science policy through the GSA Science Policy Fellowship. I worked as a liaison between scientists and policymakers in GSA’s Government Affairs Office in D.C. Through this position, I gained valuable hands-on experience in key geoscience topics and insight into the inner workings of D.C.

I am honored to serve as the 2015–2016 GSA-USGS Congressional Science Fellow. This past September, I joined 200 other scientists and engineers as part of the incoming class of American Association for the Advancement of Science (AAAS) Science and Technology Policy Fellows. The fellowship began with a two-week whirlwind orientation to science policy. Senators, representatives, judges, diplomats, and many others were brought in to impart their wisdom to the new class of fellows. After the training, I interviewed with a broad range of offices, including Representatives, Senators, and committees, before accepting an offer to serve in the office of Massachusetts Senator Edward J. Markey.

I work for the Senator on a broad range of topics, including energy, the environment, and STEM research and education. I draft statements and questions for congressional hearings in the Environment and Public Works Committee and the Commerce, Science and Transportation Committee. I accompany the Senator to these hearings, helping him react in real-time to comments made by witnesses and other Senators. I also draft Statements for the Congressional

Record, including a congratulatory message to the MIT LIGO gravity waves detection team. Our office used the discovery to highlight the importance of basic science research funding provided by the National Science Foundation. I also help write the Senator’s remarks for STEM events, including a recent event on increasing the involvement of women in STEM fields.

One of my most exciting tasks has been drafting legislation. On 18 Sept. 2015, the Environmental Protection Agency announced that Volkswagen had been using defeat devices to circumvent emission test requirements on 500,000 U.S. vehicles. These defeat devices allowed Volkswagen (VW) vehicles to emit up to 40 times the nitrogen oxide (NOx) allowable under U.S. law.

In response to the VW Diesel Scandal, I helped write the CLEANUP Act. CLEAN-UP is an acronym for Compensating Losses to the Environment from Automobiles with Noxious Undisclosed Pollution. The CLEANUP Act holds VW and other automakers accountable to the American public for fraudulently circumventing U.S. emissions laws. It ensures that automakers aren’t allowed to benefit from Corporate Average Fuel Economy (CAFE) credits awarded as a result of illegal behavior. The CLEANUP Act denies CAFE credits to any auto manufacturer that circumvents emissions control requirements and allows the Department of Transportation to collect additional penalties from automakers that obtain the credits fraudulently. Penalties from violations are diverted to programs that clean up the air, including investments in electric vehicle fueling stations, retrofitting school buses to reduce air emissions, purchasing zero-emitting cars for municipal fleets, or providing grants for projects to improve air quality in low-income communities.

The senator, my fellow staffers, and I developed the ideas behind this bill and worked with legislative counsel to formalize the bill’s language. The bill circulated with a one-page summary (referred to as a one-pager) that explains what the bill does without the legal language. We also drafted a “Dear Colleague” letter asking other senators to cosponsor the bill. I dropped off the bill in the Capitol on 25 February, and it now awaits markup in the Senate’s Committee on Environment and Public Works.

As the GSA-USGS Congressional Science Fellow, I now sit on the other side of the table, meeting with constituents and stakeholders on topics in my portfolio. I particularly enjoy meeting with geoscientists during CVDs and hearing about the exciting, important research in our field. I’m happy to have found my place at the table, and I encourage all geoscientists to participate in science policy. Together, we can tackle our nation’s toughest challenges. Please feel free to contact me if you have any questions. I’m always happy to talk about the intersection between science and policy, and am eager to help scientists find their own seat at the table.

*The manuscript is submitted for publication by Karen Paczkowski, 2015–2016 GSA-USGS Congressional Science Fellow, with the understanding that the U.S. government is authorized to reproduce and distribute reprints for governmental use. The one-year fellowship is supported by GSA and the U.S. Geological Survey, Department of the Interior, under Assistance Award No. G15AP00128. The views and conclusions contained in this document are those of the author and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. government. Paczkowski works in the office of Senator Edward J. Markey (D-MA) and can be contacted by e-mail at karen\_paczowski@markey.senate.gov.*



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# OPEN ACCESS

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In the May 2015 issue of *GSA Today*, GSA Council announced its commitment to making GSA journals (*Geology*, *Geosphere*, *Lithosphere*, and *GSA Bulletin*) open access to the scientific community, with the intent of beginning with *Geology* in 2017. The spring 2016 Council meeting was scheduled to be a decision point on whether to implement the plan in 2017 or wait, given various budget uncertainties. After careful deliberations, Council voted to delay open access to *Geology* for the public and the worldwide geologic community but instead to provide free online access to *Geology* for all GSA members beginning in January 2017. This is a significant new membership benefit. The decision is also intended as a prudent approach to initiating full open access for GSA journals in the future.

Another change for *Geology* papers published beginning January 2017 is that color page-charges will be replaced with a flat fee of US\$1,750, and authors will be able to publish unlimited color figures. No article will be rejected for lack of an

ability to pay. Authors will still be able to have their papers made available to the public and worldwide geologic community immediately upon publication by paying an article processing charge (APC) for open access of \$2,500 for non-members or \$2,400 for GSA Members. No additional color page charges will be assessed to *Geology* authors paying the open access APC. The GSA Foundation is seeking endowment funds to cover required publications fees for those who cannot afford to pay (e.g., authors from countries and institutions unable to afford it).

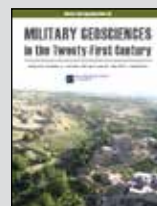
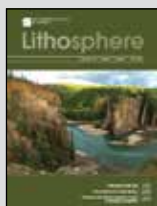
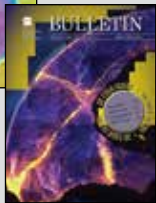
Free online access to *Geology* for GSA Members is likely to reduce demand for print subscriptions, but a print option will still be available in 2017 for those willing to cover the added costs of printing and shipping.

We plan no changes to the rigorous peer review and editing that uphold the quality of *Geology* and other GSA journals. The impact factor of *Geology* is currently among the highest in the geosciences, and it should increase as the move toward full open access makes its articles easier for the global scientific community to read and cite.

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# GSA Position Statement Revisions

The Geological Society of America (GSA) Council approved minor revisions to five position statements at its spring 2016 meeting. In addition to the summary statements on this page, full versions of these and all position statements are online at [www.geosociety.org/positions/](http://www.geosociety.org/positions/). In addition, a new Critical Issue on Induced Seismicity was created and the Hydraulic Fracturing Critical Issue has been updated. GSA members are encouraged to use the statements as geoscience communication tools when interacting with policy makers, students, colleagues, and the general public.

## Diversity in the Geosciences Community

GSA affirms the value of diverse scientific ideas and the connection between diverse scientific ideas and a diverse group of contributors of those ideas, including those who comment and criticize.

## Public Investment in Earth Science Research

GSA supports strong and growing public investments in earth-science research. Earth-science research requires substantial increases in public funding from all levels of government to promote the general welfare of all citizens; to ensure the health, vitality, and security of society; and to provide sound stewardship of Earth. These investments address such issues as energy and mineral resources, water resources, climate change, and natural hazards. Earth-science research forms the basis for training and educating the next generation of earth-science professionals.

## Role of Government in Energy and Mineral Resources

GSA strongly advocates that sound scientific knowledge guide public decisions about the exploration, exploitation, and stewardship of finite energy and mineral resources. Sustaining and enhancing that knowledge requires more public investment in energy and mineral resource research, education, and stewardship.

## Expanding and Improving Geoscience in Higher Education

GSA affirms the need for strong support for geoscience departments and programs at all institutions of higher learning. Robust geoscience programs equip students with the scientific literacy required to address crucial societal issues and planetary challenges, including the rising demand for minerals and energy, guaranteeing ample supplies of clean water, protecting communities from natural hazards, managing soils to ensure secure food supplies and resilient infrastructure, the opportunities and threats from a changing ocean, confronting climate variability, and managing waste to maintain a healthy environment. Providing geoscience instruction that is accessible to all higher education students is vital to developing the scientific literacy that all of society needs in order to address the significant challenges facing the planet.

## The Importance of Teaching Earth Science

GSA recognizes that basic knowledge of Earth science is essential to meeting the environmental challenges and natural resource limitations of the twenty-first century. It is critical that earth-science education begin at the kindergarten level and include advanced offerings at the secondary school level, and that highly qualified earth-science teachers provide the instruction. GSA recommends that the study of earth science be an integral component of science education in public and private schools at all levels, from kindergarten through twelfth grade.



[www.geosociety.org/positions/](http://www.geosociety.org/positions/)

# Supporting Diverse Students to Attend GSA and SACNAS Annual Meetings

National conferences and meetings are natural venues for bringing together diverse perspectives and unique discoveries. In support of GSA's commitment to enhancing diversity in the geosciences, GSA recently partnered with the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) to support a cohort of students to attend last fall's SACNAS and GSA national conferences that occurred consecutively in the Washington/Baltimore region. Supported by the National Science Foundation and in collaboration with the American Geosciences Institute (AGI), the Incorporated Research Institute for Seismology (IRIS), the Society for Stratigraphy (SEPM), and the STEPPE Coordinating Office, 25 undergraduate and graduate students were awarded travel funds to attend these professional conferences. Students were identified as having a specific interest in geosciences and encouraged through their participation to learn about geoscience career options.

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"My experiences at SACNAS and GSA were phenomenal. From now on, I plan on attending both conferences every year, if possible. Each conference has something different to offer—SACNAS ties culture with science and shows students that you can bridge the gap between indigenous knowledge and modern science, while GSA showcases research being conducted in a wide range of topics in earth science, oceanography, and climate change."

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The benefits for students to attend professional conferences like SACNAS and GSA are tremendous. The SACNAS National Conference is the largest minority scientific meeting in the nation, with more than 3,800 attendees per year. With a broad STEM focus, sessions include career-focused roundtable discussions, keynote speakers, oral and poster scientific presentations, and a variety of professional development sessions targeted at specific educational levels. At the meeting, collaborating partners organized the session, "Geoscience Careers: Academic, Industry, Government and Non-Profit Opportunities," which featured speakers from American Geosciences Institute (AGI), the Department of Interior (DOI), GSA, the Incorporated Research Institutions for Seismology, the STEPPE coordinating office, the University of California Berkeley, the University of Colorado Boulder, and the University of Texas at San Antonio. Speakers discussed their personal career tracks that led them into the geosciences.

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"I felt honored to attend both amazing conferences and walked away with rewarding experiences. If anything, these conferences reenergized my journey as a LGBTQ Native American/Chicano student striving to obtain an advanced degree in a field that is often under-representative of minorities."

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SACNAS Executive Director Dr. Antonia Franco.

At the GSA meeting, students were integrated into On To the Future (OTF), a GSA program that brings diverse students to their first GSA Annual Meeting. Many OTF students were paired with a mentor for the duration of the meeting and attended morning sessions during which they learned about leadership opportunities, such as serving on committees, the Student Advisory Council, and being involved in their regional sections. Guest presenters provided information on research grants, internships, and other opportunities. They concluded with an invitation to the students and the community to the Diversity in the Geosciences and OTF Alumni Reception. This event featured SACNAS Executive Director Dr. Antonia Franco, who gave her personal story of the challenges faced as an underrepresented minority and the importance of professional societies and mentors in success.

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"Opportunities such as the combined travel grant can be a game changer for minority students like myself. It is crucial for us to see examples of minority students and professionals successfully navigating the geoscience pathways ahead of us. This travel experience has enriched the outlook I have for my future, by paving a clearer road toward the successful completion of my educational and career goals."

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As the population of the United States continues to diversify, partnerships like this one are important in encouraging students from underrepresented groups to build personal networks within their scientific and professional communities. The SACNAS National Conference provides such opportunities for students to interact with other students and professionals from across the STEM disciplines who come from similar backgrounds, whereas the GSA Annual Meeting is a place where students can interact with students and professionals from across the geosciences. Combined, these meetings provide a unique opportunity for student participants to network, identify mentors and build a community of support that will further enhance their academic and career success in geoscience disciplines.

For more information about OTF or to be a mentor, go to [community.geosociety.org/otf/home/myhome](http://community.geosociety.org/otf/home/myhome). Information on SACNAS is online at [www.sacnas.org](http://www.sacnas.org). You can read about a student experience at SACNAS and GSA at <https://speakingofgeoscience.org/2016/05/02/on-to-the-future-sacnas-and-gsa/>.

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“As a Native American graduate student, I am inspired to share opportunities with others, which will help increase representation of underrepresented groups in STEM disciplines. Since going through the On To the Future program, I will be eager to inform my colleagues at the University of Arizona and others about this opportunity to attend GSA and learn more about research and employment possibilities in geosciences.”

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### 2015 GSA-SACNAS STUDENT TRAVEL AWARD RECIPIENTS

David Ben	Ruby Patterson
Sami Chen	Ivory Paulk
Edward Chew	Emily Pease
Sofia de la Sota	John Ramirez
Sandra Hardy	Emilio Rivera II
Anibal Hernandez-Vega	Thooba Samimi
Nalani Kito-Ho	Ashley Sánchez
Sanjin Mehic	Diamond Tachera
Belen Molina	Hector Valencia
Alex Mundo	Jazmin Villegas
Megan Murphy	Karissa Vincent
Heidi Needham	Jessica Whiteaker
Victoria Parker	

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“I attended a session exploring traditional knowledge and climate at SACNAS, where I listened to Dr. Margaret Hiza Redsteer speak about changing climate conditions in the Navajo Nation using traditional knowledge and remote sensing techniques. At GSA, I was able to learn more about hydrologic changes in the Southwest U.S. when I listened to Dr. Brian F. Thomas speak on how to identify regional groundwater recharge episodes using remote sensing techniques at the “Satellite Remote Sensing Applications in Hydrology and Geology” oral session. I incorporated the knowledge that I gained at SACNAS and GSA into my final project in my remote sensing class on snowpack change in the Southwest. Having the opportunity to speak with and be taken seriously by leading scientists in the field was very special.”

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# 2015 GSA International Distinguished Lecturer Tours Key Locations in Central and South America

**Lisa L. Ely, Central Washington University**

As the International Lecturer from North America, I visited 11 destinations in Ecuador, Peru, Chile, Costa Rica, Mexico, and Puerto Rico. The tour was designed to include locations where the topic of my presentation, “Following in the Footsteps of Darwin: Combining Geological and Historical Evidence to Assess Earthquakes and Tsunami Hazards,” would have direct relevance.



Lisa Ely presents her GSA International Lecture at the Universidad Católica del Perú.



Charles Darwin joined the 1831–1836 expedition on The *H.M.S. Beagle* as “a young man of promising ability, extremely fond of geology, and indeed all branches of natural history” (FitzRoy, 1839, p. 18). Darwin and the ship’s captain, Robert FitzRoy, documented coseismic land-level changes and tsunami inundation following the great Chilean earthquake of 1835 (Darwin, 1839; FitzRoy, 1839). My GSA lecture described the results of seven years of research with colleagues studying past earthquakes and tsunamis in Chile, in which we incorporated historical observations by Darwin, FitzRoy, and others into geological investigations of paleoseismic features such as tsunami deposits, microfossils, and uplifted shoreline platforms (Ely et al., 2014; Wesson et al., 2015).

The lecture tour was far from a one-way communication of research results. Many of the locations on my 2015 tour contend with potentially destructive earthquakes and volcanoes, as in Costa Rica and Chile, and institutions there are at the forefront of research into the geological processes inherent to tectonically active regions. In southern Chile, I had the opportunity to accompany researchers and students from the Universidad Austral to an Andean lake to acquire reflection-seismic profiles and extract cores of lacustrine turbidite sequences that could reflect shaking during large interplate earthquakes (Moernaut et al., 2014). At the Universidad Católica de Valparaíso, I spoke at the IV Congress of Physical Oceanography, Meteorology and Climate. The meeting included for the first time an all-day session devoted to Pacific Ocean tsunamis. This brought together researchers from a variety of fields and agencies throughout Chile to discuss the means to share their data across disciplinary and institutional boundaries.

As a professor at a regional university, I am particularly interested in the educational approaches of universities of various types and sizes. A recurring theme at many universities in Latin America is the expansion of the geology curriculum beyond the traditional emphasis on mining and natural resources to include environmental geology, natural hazards, and climate change. These new directions are largely grassroots efforts by faculty in response to regional needs and student opportunities, and they have generated a palpable influx of energy into the departments. At the Universidad Católica del Perú in Lima, the newly introduced undergraduate emphasis in geology within the major in geological engineering has attracted a crew of eager students.

The Centro de Investigación en Gestión de Riesgos y Cambio Climático at the Universidad de Ciencias y Artes de Chiapas, Mexico, was developed to investigate the management of geological hazards of direct relevance to the local region, including active volcanoes, seismicity, and flooding. Faculty members, students, and I toured field sites of student projects in fluvial and coastal processes complete with a fat alligator resting at the base of an otherwise promising stratigraphic section of flood deposits.

At every destination on this tour, I was impressed with the preparation and enthusiasm of the students. Two universities



Silvia Ramos-Hernandez of the Universidad de Ciencias y Artes de Chiapas leads a field trip to examine fluvial and coastal stratigraphy along the Pacific coast of Chiapas, Mexico.

organized symposia that featured student and faculty research. At the University of Puerto Rico Mayagüez, each undergraduate geology major completes two independent research projects, several of which were exhibited in the student poster session of the geology department's 31st Annual Symposium on Caribbean Geology.

At the Escuela Superior Politecnica del Litoral (ESPOL) in Guayaquil, Ecuador, a short course for 40 students included a day of presentations followed by a two-day field trip to investigate Holocene coastal stratigraphy and volcanic tephra. Many proudly donned field vests emblazoned with the ESPOL geology logo, sold as a fund-raiser by the student geology club. The timely importance of this type of educational program in geologic hazards was brought home by the occurrence of a devastating  $M_w$  7.8 earthquake that struck the same section of coastal Ecuador on 16 April 2016, six months after our field excursion. Similar courses throughout this tectonically active region are developing the next generation of professionals to lead public education and preparations for future earthquakes.

The general public in Latin America is, in my experience, receptive to and interested in the earth sciences. During our fieldwork in Chile, many rural residents gave detailed testimonials of their experiences during the 1960 and 2010 tsunamis and were intrigued by our geological investigations of those events. The experiences recounted by the director of the Instituto de Geología at the Universidad Nacional Autónoma de México (UNAM), Elena Centeno, illuminated some of the roles played by the Institutes of Geology and Geography as societal resources for solving geoscience problems. These ranged from explaining the sudden disappearance of a river and local water supply into a karst sinkhole to consultation on forensic geology in legal cases.

My final stop, the EcoExploratorio science museum in Puerto Rico, has a mission to promote the spirit of exploration in everyone, which is resonant of the spirit of scientific curiosity expressed in the journals of the young Charles Darwin. Here I gave my presentation to an eclectic group of local citizens in tandem with Christa von Hillebrandt, director of the Caribbean Tsunami Warning Program, who encouraged public participation

in the annual CARIBE WAVE exercise in tsunami preparedness throughout the Caribbean. Through the persistent determination of its staff and founders, I have every reason to expect that by my next visit, the EcoExploratorio will have moved from its present quarters in a San Juan shopping mall to the modern building inspired by the DNA double helix, currently a 3D model in a display window there.

What was the highlight of this GSA lecture tour? The “modern-day Darwins” I met along the way. These young researchers and students embody the promising ability and enthusiasm for geology of the young man who set off on a voyage around the world 200 years ago and whose careful observations and thoughtful syntheses led to scientific interpretations that continue to evolve into the present day.

## ACKNOWLEDGMENTS

The Geological Society of America Thompson International Distinguished Lecture Tours are named after the former Harvard Professor James B. Thompson, Jr., whose bequest to GSA contributed to the endowment of two lecture tours. The research presented in this GSA International Lecture tour was supported by National Geographic Society Grant 8577-08 and U.S. National Science Foundation grants EAR-1036057 and EAR-1145170.

*The Geological Society of America Thompson International Distinguished Lecture Tours are named after the former Harvard Professor James B. Thompson, Jr., whose bequest to GSA contributed to the endowment of two lecture tours, one by a North American scientist to international universities and geological institutions and a parallel tour by a non-North American scientist within North America. The goal is to send abroad established speakers on topics at the forefront of research to raise GSA's visibility within the international geoscience community and communicate the importance and relevance of the geosciences in a global context. Both tours are arranged under the guidance of GSA International (see [www.geosociety.org/GSA\\_International](http://www.geosociety.org/GSA_International)).*

## REFERENCES CITED

- Darwin, C., 1839, Narrative of the Surveying Voyages of His Majesty's Ships Adventure and Beagle, between the Years 1826 and 1836 Describing their Examination of the Southern Shores of South America, and the Beagle's Circumnavigation of the Globe, in Three Volumes. Vol. III: Journal and Remarks. 1832–1836, by Charles Darwin, Esq., M.A.: London, Henry Colburn.
- Ely, L.L., Cisternas, M., Wesson, R.W., and Dura, T., 2014, Five centuries of tsunamis and land-level changes in the overlapping rupture area of the 1960 and 2010 Chilean earthquakes: *Geology*, v. 42, p. 995–998, doi: 10.1130/G35830.1.
- FitzRoy, R.N., 1839, Narrative of the Surveying Voyages of His Majesty's Ships Adventure and Beagle, between the Years 1826 and 1836 Describing their Examination of the Southern Shores of South America, and the Beagle's Circumnavigation of the Globe, in Three Volumes. Vol. II: Proceedings of the Second Expedition, 1831–1836 under the Command of Captain Robert FitzRoy, R.N.: London, Henry Colburn.
- Moernaut, J., Van Daele, M., Heirman, K., Fontijn, K., Strasser, M., Pino, M., Urrutia, R., and De Batist, M., 2014, Lacustrine turbidites as a tool for quantitative earthquake reconstruction: New evidence for a variable rupture mode in south central Chile: *Journal of Geophysical Research*, v. 119, p. 1607–1633, doi: 10.1002/2013JB010738.
- Wesson, R.L., Melnick, D., Cisternas, M., Moreno, M., and Ely, L.L., 2015, Vertical deformation through a complete seismic cycle at Isla Santa María, Chile: *Nature Geoscience*, v. 8, p. 547–551, doi: 10.1038/NNGEO2468.

# SPEAKING OF GEOSCIENCE™

Did you know that GSA has a guest blog? *Speaking of Geoscience*™ is a platform for giving voice to GSA members and friends in support of the Society's global mission, including informing and sharing knowledge of what geology is and what geologists do.

In its initial post (12 Aug. 2010), blog co-founder Jerry DeGraff wrote,

I am convinced that there is not a square centimeter of planet Earth that is not of interest to one or more geologists. Not surprisingly, we are very much part of a global community. Our interests are not limited to places near to our homes or places of work. Similarly, we should be interested in a broad range of geologic topics. Others have noted how the greater specialized knowledge needed to be an effective geologic practitioner tends to narrow our focus and make us less aware of developments occurring in other parts of our science. It is hoped that *Speaking of Geoscience* becomes another force in countering this tendency and engages all of us in the science as a whole. It should be capable of connecting us not only with those who share our particular geologic interest but also to those who find our particular square centimeter of Earth interesting for wholly different reasons.

*Speaking of Geoscience* is a venue for those in the geoscience community who do not already blog frequently to share ideas and information, ask questions, and dissect issues across a broad range of earth-science topics, including the following:

**Careers:** Contributors help reveal some of the unique and wondrous aspects of the geoscience profession and provide career-relevant information for students and early career professionals.

**Education:** Contributors share educational opportunities and experiences that illustrate what motivates and attracts people to geoscience. This is also a platform for engaging in discussions about education policy and pedagogy.

**Fieldwork:** Geology is a truly hands-on science, where being in the field is often an expected and enjoyable component. *Speaking of Geoscience* contributors share and discuss field experiences, exploring new scientific concepts and unique locations.

**History of Geology:** As the GSA History and Philosophy of Geology Division motto notes, "Knowing where we've come from is part of knowing where we're going." In keeping with this sentiment, *Speaking of Geoscience* has featured "evergreen" content about GSA's founders and their impact on the development of the geological sciences.



Bridge over the Snake River in Twin Falls, Idaho, USA. Photo by keagiles.



1930 GSA president and benefactor  
R.A.F. Penrose.





Road cut along Trans-Canada Highway 1 between Banff, Alberta, and Revelstoke, British Columbia, Canada. Photo by keagiles.

**GSA International:** GSA is part of a global community, and *Speaking of Geoscience* frequently features dispatches from GSA's international lecturers, from field trips, Penrose Conferences, as well as discussions around global geoscience hot topics, meetings, and GSA International's activities.

**Public Policy:** Guest contributors and GSA's Science Policy Fellows keep *Speaking of Geoscience* readers up to date on issues pertaining to international, national, and regional science policy, highlighting how the geoscience community is engaged with leaders and policymakers to address important societal issues.

New content is added to *Speaking of Geoscience* soon after it is submitted. If you aren't following the blog, we invite you check it out at [speakingofgeoscience.org](http://speakingofgeoscience.org) and add your comments to the discussion. If you would like to contribute as a GSA guest blogger, please contact [communications@geosociety.org](mailto:communications@geosociety.org).

*Note:* The information and opinions presented by *Speaking of Geoscience* guest bloggers do not necessarily represent official positions of GSA. Self-promotional content that includes links to other products and services will not be posted.



## GSA's Connected Community

*Powered by You!*

Photo by Bret Webster.

"What a great discussion." [Andrew Cullen]

### *Get Connected...*

"Thank you for joining in. ... I believe this type of discussion is exactly what was intended by GSA for this open forum."

[Michael Tarullo]

### *... In The Community*

"I would like to add to this very interesting discussion." [Georges Pardo]

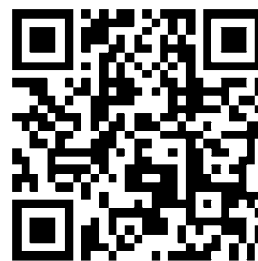


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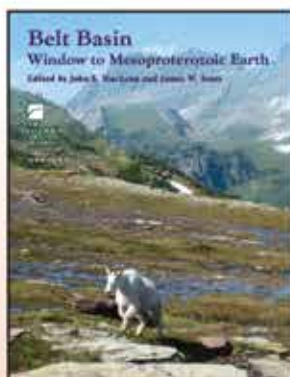
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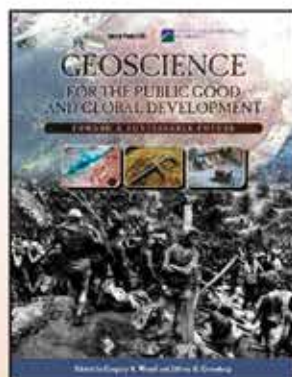


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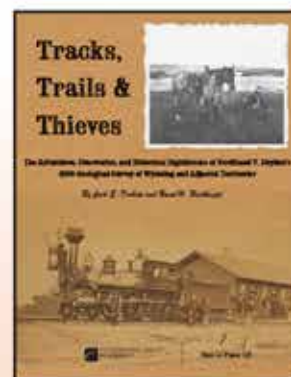
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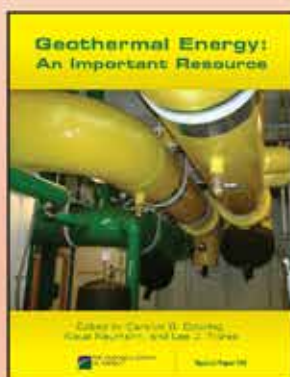
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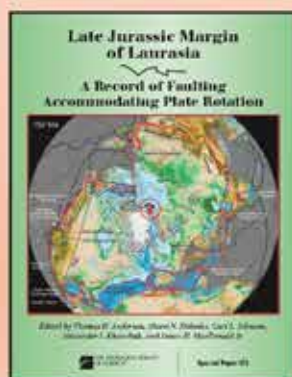
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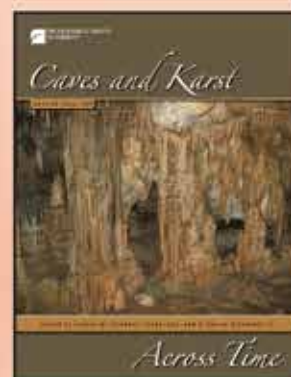
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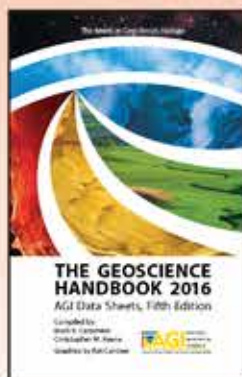
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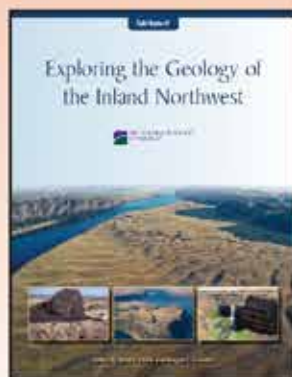
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To apply, complete a professional application at <https://jobs.geneseo.edu>. Applicants should be prepared to upload a cover letter that addresses teaching and technical qualifications and a CV. In addition, applicants should be prepared to supply contact email address for three references. References will be contacted and invited to submit letters of recommendation at the time of application.

Review of completed applications will begin upon receipt. To be guaranteed consideration, applications must be completed by August 15, 2016. The anticipated appointment for this position is as early as December 2016.

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### **ASSOCIATE PROFESSOR OR FULL PROFESSOR IN ENERGY GEOSCIENCE, JOINT APPOINTMENT: GEOLOGY & GEOPHYSICS DEPARTMENT AND THE ENERGY & GEOSCIENCE INSTITUTE, UNIVERSITY OF UTAH**

The Department of Geology and Geophysics (GG) and the Energy & Geoscience Institute (EGI) at the University of Utah invite applications for a position equally split between GG and EGI, to begin Fall Semester 2017. The position in GG will be at the Associate Professor or Professor level with the possibility of tenure at appointment; the position at EGI will be at the level of Senior Research Scientist. The successful candidate will bring expertise in energy geoscience, and will develop a strong, externally

funded, and internationally recognized research program involving students and supported by industry and government resources. We seek experts with skill sets that can be broadly applied to current and future energy systems, including hydrocarbon and renewable energies, as well as allied fields in carbon science measurement and mitigation such as carbon capture and storage or other geo-engineered solutions. Candidates must have a completed Ph.D. at the time of appointment and a strong record of research and publication. The appointee will participate in collaborative, bridge-building efforts between GG and EGI and will have offices at both locations. More information can be found online at [www.earth.utah.edu](http://www.earth.utah.edu) and [www.egi.utah.edu](http://www.egi.utah.edu).

To apply, upload a letter of application, curriculum vitae, names and contact information for three references, and statements of research and teaching interests to <http://utah.peopleadmin.com/postings/52704>. Review of applications will begin July 15, 2016, but applications may be considered until the position is filled. Questions should be addressed to Cari Johnson ([Cari.Johnson@utah.edu](mailto:Cari.Johnson@utah.edu)) and Ray Levey ([RLevey@egi.utah.edu](mailto:RLevey@egi.utah.edu)).

The University of Utah is an Equal Opportunity/Affirmative Action employer and educator. Minorities, women, and persons with disabilities are strongly

encouraged to apply. Veterans preference. Reasonable accommodations provided. For additional information, see <http://www.regulations.utah.edu/humanResources/5-106.html>. The University of Utah values candidates who have experience working in settings with students from diverse backgrounds, and possess a strong commitment to improving access to higher education for students from historically underrepresented groups.

### **STRAT/SED, GIS, GEOMORPHOLOGY, 1.5 YEAR FULL TIME, CASTLETON UNIVERSITY**

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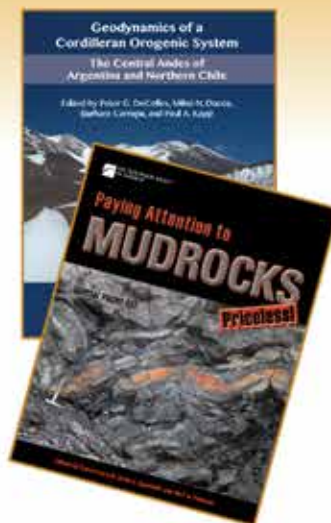
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It has been a year and a half since I stepped into my new role as president of the GSA Foundation (GSF), and during that time, our efforts have focused on exciting areas inspired by a variety of initiatives within GSA. I am pleased to provide an update on the GSA Foundation staff and the roles each of us play in our mission to develop and provide funds to support the goals and programs of the Geological Society of America.

As president, I continue to oversee the development goals and operations of GSAF. Interfacing with GSA's leadership to align funding priorities remains a vital, guiding force for the Foundation's work, while heading a new fundraising initiative to propel GSA and its membership toward a strong future for the entire geoscience community.

**Debbie Marcinkowski's** role has expanded to Director of Development. While maintaining a corporate relations priority and a reporting line to GSA's executive director, Debbie focuses on overall development strategies and communications. She will also lead increased efforts to establish foundation relationships as funding sources to GSA. Debbie's background is in corporate partnerships with the Wolf Trap Foundation for Performing Arts, Conservation International, and as Associate Director of Strategic Alliances & Global Partnerships for the Global Alliance for Vaccines and Immunization. Her master's degree is in nonprofit management.

**Bill Tortorici** joined the team this spring as Assistant Director of Development and works primarily with individual donors. Bill will focus on high-quality communication with donors, ensuring that GSAF's appreciation of all contributions is conveyed in meaningful ways. His work will ensure that donors clearly see the

impact of their gifts to GSA's mission, while increasing support to GSA programs for both annual and special campaigns. Bill brings relevant experience from previous roles as Director of Membership and Annual Fund with the Denver Zoological Foundation and in memberships with Chicago's Shedd Aquarium and the Center of Science and Industry-Toledo.

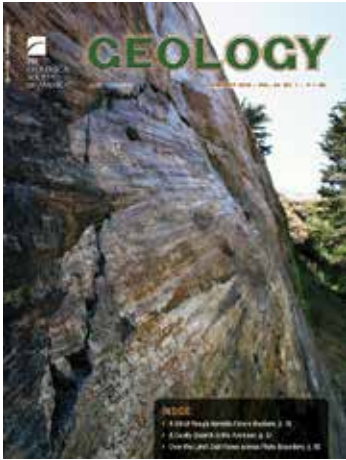
**Terry Archambeault** is another new face in the Foundation. Before joining the team last summer, he held a database position with the Pontifical North American College Office of Institutional Advancement in Washington, D.C. Terry is helping us to better streamline data management and volunteer committee coordination, and he organizes some of the Foundation's donor events. Terry has a master's of Divinity from Yale University and previously held an internship in the U.S. House of Representatives.

Many of you know both of the Foundation's longest-serving staff members. **Geni Klagstad**, who began as Foundation Assistant in 2007, has been GSAF's Office Manager for nearly five years. In addition to maintaining all financial transactions of GSAF, she is the liaison in transferring funds raised in support of GSA programs. **Jo Bell**, Database Administrator, has been part of the team for 22 years. Jo maintains database records, processes all of your generous gifts, and makes sure that donors receive tax receipts and acknowledgments. She regularly updates record information, while assisting in the preparation of revenue and giving reports.

The entire team will be at GSA's Annual Meeting in Denver, and we look forward to meeting and talking with many of you at the GSAF booth.



Terry Archambeault, Debbie Marcinkowski, Jack Hess, Geni Klagstad, Joan Bell, and Bill Tortorici.



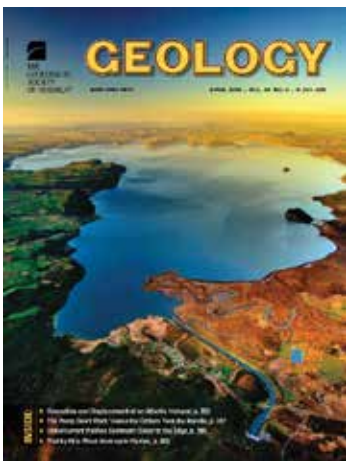
## FREE *Geology* for all GSA Members

While GSA has delayed its plan to make the journals open access (see Open Access, p. 50, this issue), all GSA memberships will include free online subscriptions to *Geology* beginning in January 2017. Print subscriptions will continue to be available for a fee.

In the meantime, GSA will continue its hybrid open-access approach, which includes gold (author pays) immediate open access and 12-month green (repository) open access. For more information on publishing options and costs, go to [www.geosociety.org/pubs/openAccess.htm](http://www.geosociety.org/pubs/openAccess.htm).

To browse a list of open-access articles and book chapters, go to [www.gsapubs.org/cgi/collection/gsa-oa](http://www.gsapubs.org/cgi/collection/gsa-oa). In addition, *GSA Today*, book front matter and all *Geology* Research Focus, comment, and reply articles will continue to be freely accessible.

If you are interested in supporting GSA's transition to open access, please contact the GSA Foundation ([gsafweb.org](http://gsafweb.org)) to learn more about the new Author's Fund.



# Publications Highlights

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*Back for an encore in 2016 is the highly successful workshop for early-career geoscientists on the process of preparing and publishing papers.*

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**Publishing your work is important, but how do you go about it?** This workshop, led by experienced GSA science editors, will focus on the process of preparing your research for submission to scholarly journals. Presentations by the editors will be followed by roundtable discussions, with time set aside for Q&A.

### Before You Begin

**You have a big pile of data and lots of good ideas. How do you parse all that into discrete, coherent papers?** Knowing how to frame and structure your work for publication is fundamental. Find out what editors and reviewers look for, such as whether the paper fits the scope of the journal to which it is submitted, and whether the stated aims of the paper match the results and interpretations reported.

### Writing and Revising

**The aim of this workshop isn't to address the writing process itself, but to focus on the bigger creative picture.** How do you frame your paper to meet the journal's aims and the reviewers' expectations? Find out what makes a well-prepared manuscript—including an attention-getting cover letter, an introduction that serves its purpose, and well-thought-out figures and tables that communicate your ideas.

- Get advice on what to include, what to leave out, and how best to structure your manuscript;
- Learn how to avoid frustrating your paper's reviewers; and
- Learn how to submit your paper online and what to expect during the review and publication process.

### Reviewing: Be a Part of the Scholarly Community

**Peer review is integral to publishing, so both reviewing and being reviewed are essential parts of your role as a scientist.** As an early-career author, what kind of criticism should you expect, and how should you respond to critical reviews? Reviewing the work of others is also a great way to discover what works in a paper and what does not, and it teaches you the things to avoid in your own writing. Hear from experts on what constitutes a good review and how you would benefit from being a reviewer.

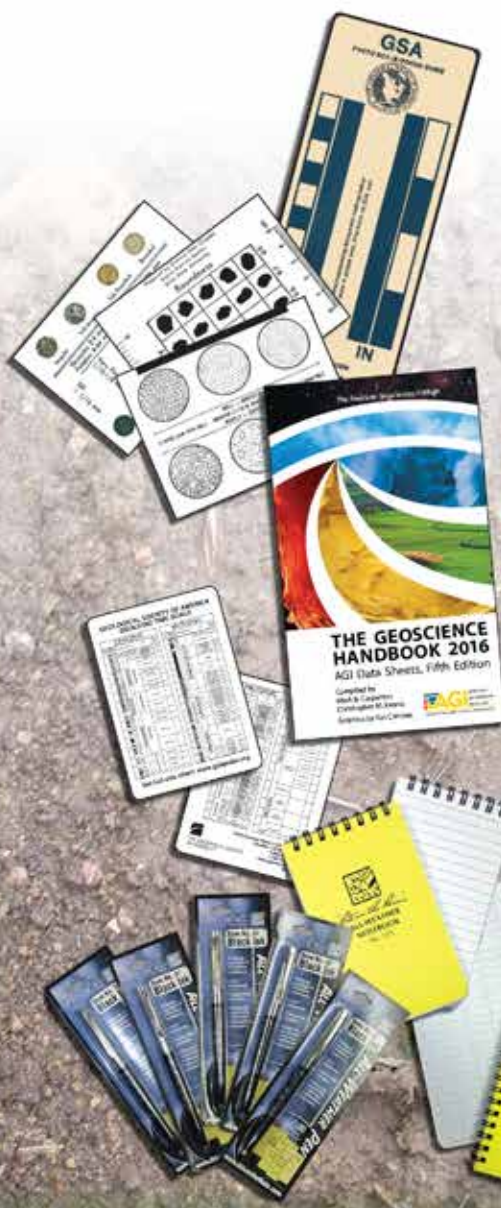
### Apply to Attend

Space is limited for this class. Please complete the **online application** to apply before 1 Aug. 2016. Applications are welcome from anyone interested in participating, but preference will be given to graduate students nearing completion who are actively working on manuscripts for publication, post-docs, early-career faculty and researchers, and people getting back into research after a hiatus.

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