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GSA TODAY

THE MEMBERSHIP PUBLICATION OF THE GEOLOGICAL SOCIETY OF AMERICA™

GSA Expands Publishing Horizons

Acquisition of Iconic Mountain Press Book Series

PAGE 4

GSA TODAY

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THE GEOLOGICAL SOCIETY OF AMERICA®

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GSA Acquires Mountain Press Series and Officially Enters the Field of Public Science

Bridgette Moore, *Chief Operating Officer and Director of Publications, Geological Society of America, Boulder, Colorado 80301, USA; bmoore@geosociety.org*

INTRODUCTION

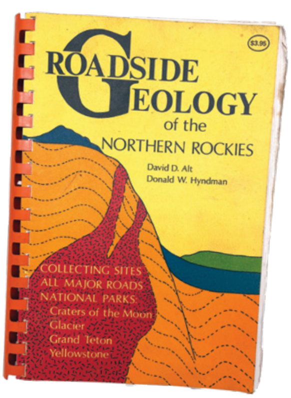
In an exciting and strategic move, the Geological Society of America (GSA) recently acquired the popular geology series developed and published by Mountain Press Publishing Company out of Missoula, Montana, USA. Written for the interested and geo-curious public, these books have been popular for decades, with more than a million copies sold. And, not surprisingly, more than 50% of Mountain Press titles have been written by GSA members—there's a natural synergy between the Mountain Press series and GSA. When they learned of this historic opportunity, GSA leadership moved decisively to enter the public-facing science market and bring the relevance, excitement, and diversity of the geosciences to a broader public audience. Moving the Mountain Press geology portfolio to GSA is a truly special initiative because we will immediately be able to put our science in front of more people and in places such as national parks, where the public comes to see the scenery. Earth and the geoscientists who study this dynamic planet have wondrous and important stories to tell about the past, present, and future—with GSA's new platform we'll be able to grow and amplify our message in significant new ways and reach so many more readers and potential future scientists.

A MISSION-DRIVEN DECISION

In the late 2010s, GSA leadership recognized that "in order to remain relevant and sustainable well into the future" transformational change was needed in the coming decade (GSA, 2019). GSA has been successful for more than 130 years, but changes in the geosciences and shifting membership trends (seen industry wide) require careful attention to our key programs and services as well as looking beyond our traditional offerings. In October 2022, GSA Council took a major transformational step by hiring our first nongeologist Executive Director and CEO, Melanie Brandt. The Council felt certain that, with Melanie's vision and experience, she could create new opportunities and growth at GSA as she had done for previous organizations in the areas of membership, events, and strategic and operational excellence.

GSA's Decadal Strategic Plan (2019) includes five strategic aspirations: (1) advance scientific discovery, rigor, and integrity; (2) support early career professionals and students; (3) host premier conferences and meetings; (4) influence geoscience policy and link geoscience to society; and (5) provide a sense of community and venues for networking. These aspirations are inspired by the actions GSA members want to see in their Society, including making our scientific offerings inclusive, investing in education, conveying geoscience to the public, and forging connections within all levels of the scientific community. The geosciences are critical for sustainability, yet both the public and policymakers are often woefully underinformed about Earth. GSA, with its mission of science, service, and stewardship, has a responsibility to both educate and inform. Public-facing science is critical for GSA's future success, as it is how we will attract a larger audience and grow their interest in Earth and its environment. Given our membership's expertise and passion for Earth, plus our long history of publishing impactful research, the Society is uniquely positioned to deliver high-quality geoscience to the public. A missing piece, up until now, was GSA's access to a broader audience. GSA meetings and publications are primarily for professional and student geoscientists; new advances and great science overall are discussed at our meetings and published regularly in our journals, but that's nearly invisible to the wider world.

Read GSA's strategic plan at **https://bit.ly/3AwHpXI.**

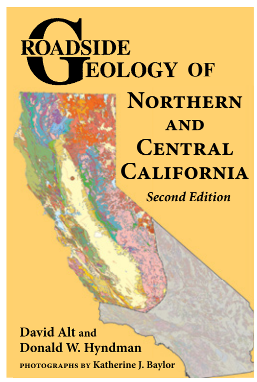


As John Rimel, publisher (and owner) at Mountain Press Publishing, states, "the earth sciences are so vital to understanding the issues…that are impacting our world," and outward-facing science offers a means to "translate…science to the layperson in a way that makes sense to them"

(Witherspoon and Rimel, 2020, p. 327). Many geologists are natural-born storytellers with fascinating field observations and experiences to share. When science is presented in educational, easy-to-understand ways, the public responds with enthusiasm. This is easy to see in Mountain Press's leadership in this field and continued popularity since the 1972 publication of their first *Roadside Geology* book. With our successful history of publications and mission of better serving society through geoscience, public science is clearly an area in which GSA should play a leading role. And, who better to partner with than Mountain Press?

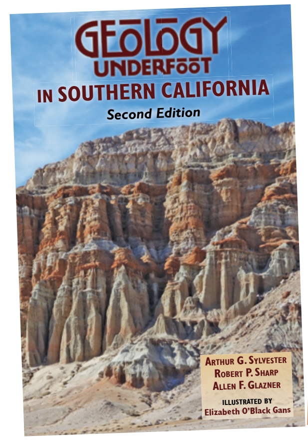
MOUNTAIN PRESS'S STORY

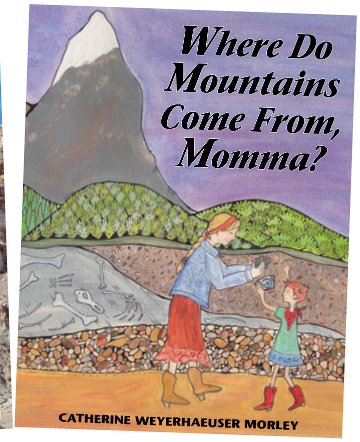
Founded as an offset printer in 1948 by David Flaccus, Mountain Press first began publishing books in 1964, and then found great success in the geosciences eight years later. In 1971, Flaccus was approached by David Alt and Don Hyndman about publishing their first foray into geology books for nonprofessionals. Although skeptical over whether the book would sell, Flaccus agreed, and Alt and Hyndman's *Roadside Geology of the Northern Rockies* was published in 1972. It sold through its entire first print run of 1800 books in just a few weeks (Witherspoon and Rimel, 2020) and had to be reprinted almost immediately. They went on to publish *Roadside Geology of Northern California* in 1975 and volumes devoted to Oregon, Washington, Montana, and Idaho through the late 1970s and '80s.



Alt and Hyndman set the tone and format for the series with their first two books, and their influence can still be seen in the books published today. As Hyndman related to William Witherspoon, they wrote for "an audience with little or no background in geology....Since we wanted to give our nongeologist readers a feel for the rocks and how they originated and evolved, we spent a lot of time and effort to make our own interpretations based on available information, and driving as many of the roads as we could" (Witherspoon and Rimel, 2020, p. 328–329). Subsequent authors have carried on the tradition of driving the roads and explaining the geological significance and wonders of specific locations to the general reader.

As the books grew in popularity, Alt and Hyndman were contacted by other professional geologists and potential authors who wanted to write their own volumes. The visionary pair ended up taking on editor roles for other books in the series and discovered most of their authors at GSA meetings. For a fascinating account of GSA member William Witherspoon's experience writing the *Roadside Geology of Georgia* (2013) and his deep appreciation of the work and guidance of Alt and Hyndman, see the more complete history of Mountain Press written by Witherspoon and Rimel (2020). Both Alt, who sadly passed away in 2015, and Hyndman were active contributors to the Society, and Hyndman, who has been a member since 1969, is also a GSA Fellow. Their contributions to public science and education, along with their traditional geoscience publications and careers, have left a lasting and incredibly wide-ranging legacy that continues to be applauded and honored today.





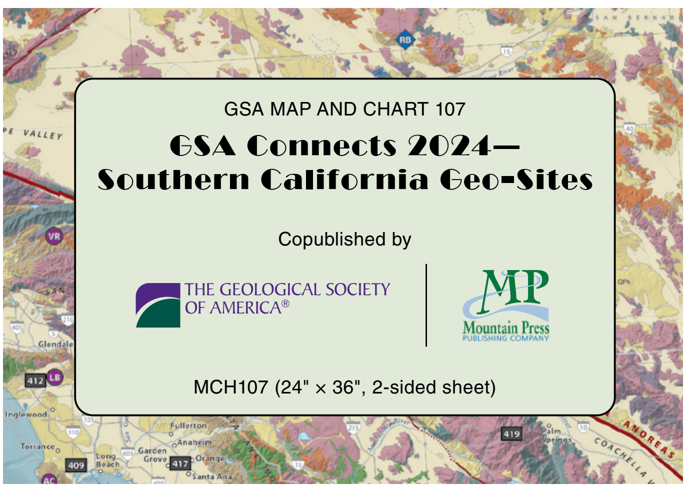
This legacy is evident in all of Mountain Press's geology series, which are written to educate and engage general readers. John Rimel took over as Publisher and co-owner with Chief Financial Officer Robbin (Rob) Williams in the early 1990s. Both originally joined the company as summer sales reps in 1977, and after a few detours for John, they ended up making Mountain Press their own. They worked closely with Alt and Hyndman to continue publishing award-winning titles, and introduced the *Geology Underfoot* series to readers in 1993 with *Geology Underfoot in Southern California* by Robert P. Sharp and Allen F. Glazner. Using vignettes instead of road guides, these works employ a "hands-on, get-out-of-the-car" narrative approach to the stories they tell. With each vignette focusing on an individual place or feature, usually in well-traveled and easily accessible areas, readers are encouraged to stop and closely examine the geological beauty right outside their car windows. These volumes are full of color images and maps and make perfect traveling companions.

Mountain Press added a third public-science series in 2010 called *Geology Rocks!* These volumes are known for their quick, one-page descriptions of individual settings that introduce geological concepts in an easy-to-understand way. The first in the series, *California Rocks! A Guide to the Geologic Sites in the Golden State* by Katherine J. Baylor (2010), set the tone for the rest, with directional maps, a clear geologic time scale for California events, and a simplified introduction to plate tectonics, alongside beautiful photos that easily convince readers to visit these locales. Over the years, Mountain Press has also published a variety of *Earth Science* series titles on specific topics like meteorites, geysers, and fossils throughout the United States, as well as educational geology for ages 4 and older in their *Young Readers* series. Their variety of books adds up to a fun

and unique portfolio favored by the public and professionals alike—tourists, locals, parents and educators, road trippers, beginning or future geologists, and GSA attendees at Connects and Section Meetings, where the Mountain Press booth is always a hub of buzzing activity.

GSA AND MOUNTAIN PRESS: HOW WE GOT HERE

Given their long and successful history with popular geology, Mountain Press was an ideal choice to advise GSA on developing public-facing science and geotourism-related publications. Certain that an opportunity existed for GSA to enter this field and that the timing was right to add public science to GSA's more traditional publications portfolio, Melanie reached out to John in May 2023. During that first conversation, she made sure to mention that GSA would like to be his first call if he ever considered selling Mountain Press (Brandt, 2024, pers. comm.). They continued their conversations from there, including discussions about possible joint publication projects. At GSA Connects 2023 in Pittsburgh, Pennsylvania, USA, they met with GSA President Chuck Bailey and me, where we began brainstorming ideas that resulted in the exciting new



map created for the next big meeting in Anaheim, California, USA, *GSA Connects 2024—Southern California Geo-Sites*, compiled and crafted by Chelsea M. Feeney with geological input from Chuck. Quite a success with attendees, the map showcased the 2024 meeting themes of "Water in Our Changing World" and "Life along an Active Margin," the meeting's dynamic field trips, and the geological expertise found in both organizations' publications.

As we worked on this project together, we continued discussing future possibilities for the complementary strengths of Mountain Press and GSA. And we were all impressed to discover that 52% of Mountain Press authors are GSA members, and 60% are GSA authors! The books in the *Roadside Geology*, *Geology Underfoot*, and *Geology Rocks!* series are natural extensions of GSA's science with an emphasis on field experiences, and they are well suited for helping fulfill a strategic objective—providing the public with a greater understanding and appreciation of geoscience wonders. Perfect for students, educators, enthusiasts, and families out for a weekend trip, these books, with their lower price points, accessible writing, and wealth of knowledge, are remarkable resources for inspiring future scientists and Earth stewards.

Inspired by the ways in which their works filled in the missing areas in our own publications, we visited Missoula (first Chuck in March, followed by Melanie and me in May) to spend time with the Mountain Press staff and see their operations and inventory. The discussions naturally turned to the potential for GSA to continue Mountain Press's legacy and expand our own by moving into public-science publications. While also enjoying the beauty and local geology of Missoula, which is an amazing destination for enthusiasts, we all came to the same exciting conclusion: Mountain Press was ready for their geology titles to gain a new home, and GSA was ready to provide that home. When considering the change, John Rimel's enthusiasm was contagious and shared by all. He stated, "we are thrilled to partner with GSA, and are confident that they are the perfect organization to continue these beloved and essential series" (Rimel, 2024, pers. comm.).

Over the course of the summer, we completed the due diligence process, relying heavily on insights and guidance from Howard Fisher, Douglas Pfeiffer, and Caroline Cook of The Fisher Company, a boutique mergers and acquisitions advisory firm to the publishing industry; Michael S. Blake of High Score Strategies, an appraisal and valuation firm; and Jonathan Kirsch, a copyright, trademarks, and publishing attorney. This is a strategic fit for both GSA and Mountain Press. Howard commented, "For GSA, this acquisition provides a strong foundation for extending awareness of the organization and its brand through publications that reach both youth and adults. Certainly, this will stimulate more interest in geology for amateurs and potentially careers going forward. For Mountain Press, the partnership with GSA will ensure a strong future for the list of titles and its authors" (Fisher, 2024, pers. comm.).

On 21 September 2024, at GSA Connects in Anaheim, the GSA Council acted decisively—to purchase the offered Mountain Press geology titles, diversify GSA publications, and begin an exciting new journey into public science. The conference room that evening buzzed with excitement, and it was very difficult for us all to remember that the whole topic was confidential! The rest of our time together at Connects was filled with enthusiastic side conversations and thrilled smiles. As Melanie describes it, "GSA leadership recognized the need to be bold and embrace new growth to ensure the Society's sustainability in light of evolving industry-wide membership trends and demographics, shifting dynamics in academic publishing, and the increasing importance of public engagement in science. This acquisition offers an exciting opportunity to attract potential members and future conference attendees, all while enhancing our public outreach and broadening the scope and impact of geoscience" (Brandt, 2024, pers. comm.).

On 30 October 2024, GSA and Mountain Press signed a purchase agreement that serves the best interests of both organizations, and GSA acquired a total of 102 titles, including all books in the *Roadside Geology*, *Geology Underfoot*, and *Geology Rocks!* series, and select titles from the *Earth Science* and *Young Readers* series. The purchase included all associated copyrights, licenses, agreements, saleable inventory, works in progress, pending book orders, original artwork, digital files, distributor and vendor lists, and sales and marketing materials. In essence, Mountain Press transferred all the elements required for GSA to continue effectively publishing these titles. Incoming GSA President Nathan Niemi enthusiastically stated, "I'm thrilled that these highly regarded series will be under the stewardship of GSA. Thematically, these books are a natural fit for GSA and will immediately expand our footprint in public science communication" (Niemi, 2024, pers. comm.).

Mountain Press also agreed to continue distributing these books, ensuring a smooth transition for their long-time vendors, customers, and booksellers. And, GSA welcomed several current Mountain Press employees as contractors, with the strong possibility of joining our publications staff soon. Their experience and expertise are invaluable throughout the transition period and beyond for the continued success and growth of these series as GSA publications. Mountain Press will continue publishing their popular nongeology titles, and John and Rob have assured us that they remain a phone call away for ongoing advice and guidance.

THE FUTURE OF PUBLIC SCIENCE AT GSA

With this unprecedented acquisition, GSA has taken a giant step forward in the realm of geoscience education through public-facing science. We now have a clear, well-established path to reach so many more readers. Instead of waiting for them to find us, most often after they have already discovered a love of rocks elsewhere, GSA is striving to meet the public where they are—in a bookstore or museum, at a national park, online shopping as they prepare for a road trip, or in a classroom where they could become geo-curious for life! It is incredibly important to capture the imaginations of students and nonprofessionals and create a sense of excitement about the natural world that will inform their decisions and impact their lives. We plan to do just that by combining the complementary strengths of our newly acquired series with our expertise in scholarly publications, meetings, and membership.

GSA's members and authors are not only writing these books—they are also reading them and recommending them to their students, family, and friends. With their help and engagement in GSA's new venture, and with the overall membership's dedication to GSA's mission, we have a solid foundation upon which to grow and develop new and revised volumes. We are particularly excited about the prospects of working closely with existing authors; discovering new voices, audiences, and topics; and of course, talking to and hearing from our readers! Thanks to Council's leadership, GSA is now on a path to engaging and educating the public, nurturing a wider interest in sustainability and Earth stewardship, and giving back to society through advancement of the geosciences. As Chuck's presidency comes to a close, he leaves us with the perfect summation and the start of a lasting legacy: "Over the past year, GSA's gone from aspiring to do more public science to a place where that's a reality—I'm stoked because GSA now has the potential to expand its impact by engaging with the public in tangible and meaningful ways for the betterment of our planet" (Bailey, 2024, pers. comm.).

Coming Soon!

Expected to be available in late December, GSA's first publication in the series presents a fascinating and accessible look at the well-exposed geology in Arizona's mountains and deserts.

Enjoy a member discount of 20% off GSA's new public science titles with code **2024GSAMember20**

ACKNOWLEDGMENTS

Many thanks go to Chuck Bailey for his full support and infectious enthusiasm for public science; to Melanie Brandt for not only having a transformative idea but actually making it happen every step of the way; to the GSA Council for their vision, trust, and unwavering belief in GSA staff and our shared mission; to Howard, Douglas, and Caroline at The Fisher Company, alongside publishing attorney Jonathan Kirsch, for their incredible patience, wisdom, organizational skills, and willingness to Zoom with little notice; to Jennifer, Chelsea, Jeannie, Adam, and Anne at Mountain Press for their fantastic work in the past, present, and future; to the GSA Publications and Marketing staff for their constant help, excitement, and can-do attitudes; and to John Rimel and Rob Williams for their friendship, years of GSA support, publishing acumen, visionary work in public science, and most of all, for trusting us with their precious books. We promise to make you proud!

REFERENCES CITED

Feeney, C.M., and Bailey, C.M., 2024, GSA Connects 2024—Southern California Geo-Sites: Geological Society of America and Mountain Press, GSA Maps and Charts MCH107, 24" × 36", 1 2-sided sheet.

Geological Society of America, 2019, Decadal Strategic Plan: Geological Society of America, https://rock.geosociety.org/net/documents/gsa/about/2019-strategic-plan.pdf (accessed 27 October 2024).

Witherspoon, W., and Rimel, J., 2020, Commercially successful books for place-based geology: Roadside geology covers the US, *in* Sadry, B.N., ed., The Geotourism Industry in the 21st Century: The Origin, Principles, and Futuristic Approach: Apple Academic Press, p. 325–352.

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https://bit.ly/3XMpfIV

Now Accepting Nominations for 2025!

Honor those who have made remarkable contributions in the geosciences by nominating a colleague for a medal, award, or recognition.

GSA FELLOWSHIP
Deadline: 1 Feb. 2025
View election requirements at **www.geosociety.org/Fellowship.**

GSA AWARDS
Deadline: 15 Feb. 2025
View nomination requirements at **www.geosociety.org/nominate**.

GSA President Chuck Bailey presents the 2024 Doris M. Curtis Outstanding Woman in Science Award to Gabriela Aylin Farfan.

J. David Lowell Field Camp Scholarships

GSA and the GSA Foundation are excited to offer J. David Lowell Field Camp Scholarships for summer 2025! These US$2,000 scholarships give students the chance to attend the field camp of their choice. Applications are reviewed based on diversity, financial need, and merit. Field camp is a key part of a geologist's education—apply today and take the next step in your geoscience journey!

Deadline: 9 April 2025

Learn more at **https://bit.ly/JDavidLowell**

Questions? Contact Rebecca Taormina, rtaormina@geosociety.org

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Left: Kylie Wilson, a 2024 J. David Lowell Field Camp Scholarship recipient, at Idaho State University.

POLICY

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Application deadline: **15 Jan. 2025**

Apply at: **www.geosociety.org/csf**

Mount Kailas: Center of the Universe

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

Mount Kailas, an isolated peak in western Tibet (Fig. 1), represents the earthly manifestation of mythical Mount Meru, the center of the universe, for the 1.7 billion followers of four religions (Hindus, Buddhists, Jains, and Bonpos). As such, it is circumambulated by thousands of religious pilgrims every year. The 6638-m-high mountain consists of Oligocene–Miocene Kailas Formation conglomerate, an unusual rock formation that contains clues to the evolution of the India-Asia collision zone that formed the Himalaya Mountains, the tallest topography on Earth, and that uplifted the Tibetan Plateau (DeCelles et al., 2011). The geoheritage significance of Mount Kailas, possibly Earth's most sacred mountain, is second to none.

Figure 1. The north face of Mount Kailas viewed from Dira-puk Monastery. The mountain consists of Oligocene–Miocene Kailas Formation conglomerate, which unconformably overlies the Paleogene-aged Gangdese granite that comprises the two foreground peaks. Attribution: Lon Abbott and Terri Cook.

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PARALLELS BETWEEN MOUNT KAILAS AND MOUNT MERU

Te Mahabharata, an epic poem written between the third century BCE and the third century CE, contains Hinduism's most sacred text and describes the cosmography of the universe, with Mount Meru at its center. The Hindu gods live on Meru's summit, and the mountain shines "like the morning sun and like a fire without smoke" (Allen, 1982, p. 19).

For Hindus and Buddhists, Mount Meru is transcendent, the temple at the center of the universe. Diverse religious structures and practices symbolize it. Architecturally, it is represented by the Shikhara, the spire at the center of a Hindu temple, and by the dome-shaped Buddhist stupa. In religious art, the mandala, which is used to focus meditation, often represents the universe with Mount Meru at its center, and in yoga, the central channel of psychic energy that runs along the practitioner's spinal column symbolizes the mountain (Johnson and Moran, 1989).

Mount Meru's geography is key to the identification of Mount Kailas as its earthly manifestation. It is bounded to both north and south by three mountain ranges. Meru towers above its neighbors and has four distinct faces, one each of crystal, ruby, gold, and lapis lazuli. A "stream that washes away all sin, the river Ganga" (Allen, 1982, p. 21–22) falls from the big toenail of the God Vishnu's left foot to the summit of Mount Meru, where it divides into four mighty rivers that flow to the four quarters of the Earth and purify it.

The geography of Mount Kailas bears an uncanny resemblance to that cosmography. It is hidden behind ranks of mighty mountains. It dominates its surroundings; it is crowned by a dazzling white ice cap; its four walls face the points on the compass; and it is shaped like a Buddhist stupa. On its south face, the intersection of the nearly horizontal conglomerate layers with a vertical gully is interpreted by devotees as an auspicious ancient symbol of spiritual strength (Johnson and Moran, 1989). Most significantly, the Ganges, Indus, Tsangpo/Brahmaputra, and Sutlej, the Indian subcontinent's four great rivers, the mouths of which lie almost 2500 km apart, all originate near each other, flowing in different directions like spokes on a wheel, with Mount Kailas as the hub. It's no wonder Mount Kailas became the center of the universe for followers of all four religions (Allen, 1982).

THE STORY OF MOUNT KAILAS EPITOMIZES THE KEY GEOHERITAGE CONCEPT THAT A PLACE'S GEOLOGIC HISTORY GOVERNS, IN PART, WHY HUMANS VALUE IT.

CIRCUMAMBULATION OF MOUNT KAILAS

Religious pilgrims (Fig. 2) from the four faiths have been circumambulating Mount Kailas (or Kailash in a more recent transliteration of the Sanskrit) for at least 1000 yr; the faithful believe that a single circuit erases the sins of a lifetime (Johnson and Moran, 1989).

For Tibetan Buddhists, the mountain plays the central role in the triumph of Buddhism over Bonpo, the ancient shamanistic religion practiced by most Tibetans prior to the thirteenth century CE. The story goes that the Buddhist yogi Milarepa engaged in a protracted duel with the principal Bonpo shaman over possession of the holy mountain. Finally, the two agreed they would both ascend the mountain at dawn the next day, and whoever reached the summit first would win the mountain. At sunrise, the Bonpo shaman flew toward the summit, carrying his shamanistic drum, but Milarepa remained deep in meditation and did not move. Buddhists thought all was lost, but at the last minute Milarepa soared past the shaman to reach the summit first. In the legend, the vertical gash down Kailas' south face was gouged by the shaman's drum, which he dropped in his alarm (Johnson and Moran, 1989).

The 50-km-long, clockwise pilgrimage circuit around the sacred mountain (Fig. 3) begins in the town of Darchen at 4575 m elevation and ascends the valley west of the mountain, passing two monasteries. The path then crosses the 5636-m-high Drolma La pass and descends another valley east of the mountain, passing yet another monastery. The circumambulation typically takes three days to walk, but many Tibetan pilgrims take weeks because they prostrate themselves, laying down on the ground and praying every step of the way to gain extra merit.

Figure 2. Religious pilgrims circumambulating Mount Kailas. Two of them are prostrating themselves in prayer. Attribution: Lon Abbott and Terri Cook.

A BLANK SPOT ON WESTERN MAPS

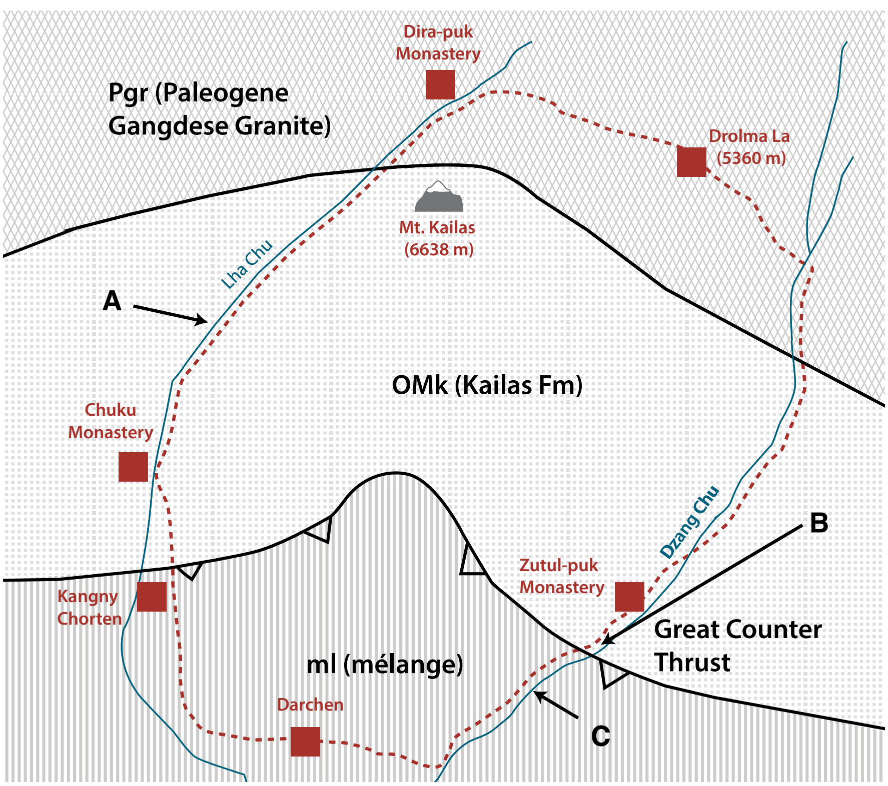
Although the legend of Mount Kailas and the headwaters of the four great rivers diffused throughout Asia centuries ago, it was little known in the West. In 1580, the great Mughal Emperor Akbar invited Jesuit missionaries from Portuguese-held Goa to visit his court. There, the missionaries heard stories of people living near Mount Kailas and its equally sacred companion, Lake Manasarovar, whose religious practices sounded strikingly Christian.

A widespread European legend held that a wealthy Christian king, Prester John, lived somewhere in India; the Jesuits concluded that Prester John's kingdom lay waiting to be discovered at the lake. In 1624, Father Antonio de Andrade, the head of the Jesuit mission to the Mughal court, led an expedition to find the lake and its inhabitants. He eventually reached the then-powerful Tibetan Kingdom of Guge, the capital of which stood near the lake. In 1625, Andrade founded the first Christian church in Tibet, but he didn't find any Christians, and as the years passed, details of his exploits were forgotten. However, they did fuel rumors in the West of a sacred mountain at the hub of the regional drainage network and an adjacent sacred lake somewhere in the blank spot between China and India that existed on western maps (Allen, 1982).

Throughout the nineteenth century, the British and Russians vied with each other for influence in Central Asia, a contest known as "the Great Game." Considering the high geopolitical stakes, many western explorers tried to fill in that blank spot, but the terrain was unforgiving, and entry to Tibet was forbidden. Finally, during an expedition between 1905 and 1908, the Swedish explorer Sven Hedin succeeded in locating the sources of the four great rivers and became the first Westerner to complete the circumambulation of Mount Kailas (Allen, 1982).

GEOLOGY WORTHY OF A SCIENTIFIC PILGRIMAGE

In 1936, Augusto Gansser, the first known geologist to explore the area, disguised himself as a religious pilgrim to successfully skirt the prohibitions to entry imposed at the time by both the Indian and Tibetan authorities. Gansser's description of the fundamental geologic relationships in the Kailas region remains unchanged to this day (Heim and Gansser, 1939). He observed three main belts of rock arranged from north to south (Fig. 3).



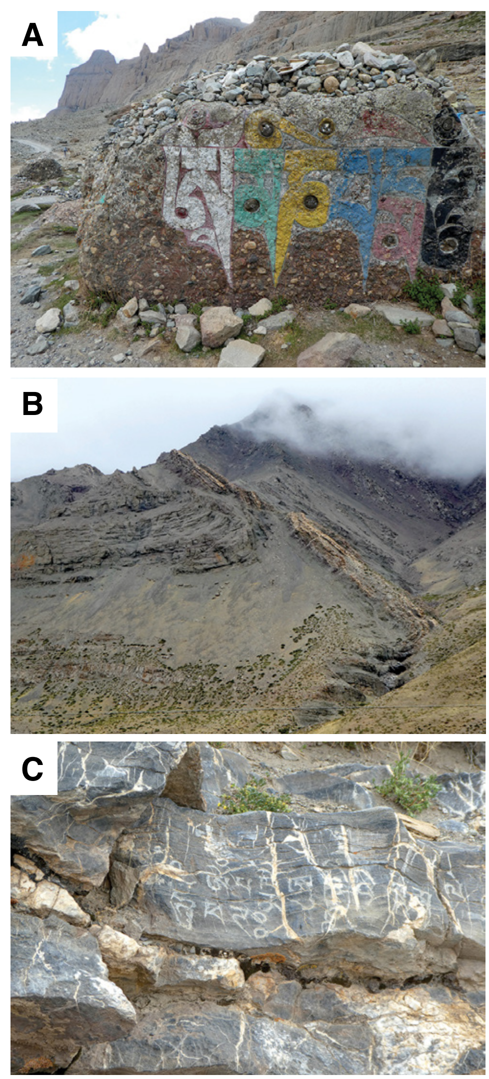


Figure 3. Schematic geologic map of the pilgrimage route around Mount Kailas. The circuit begins in Darchen and moves clockwise around the mountain. Pilgrims begin their trek in mélange (ml) that was thrust up and over the Kailas Formation (OMk) along the Great Counter thrust until they cross the thrust near the Kangny Chorten. They then traverse exposures of Kailas Formation (A) during most of their ascent up the Lha Chu valley before crossing the unconformity onto the Gangdese granites a short walk below Dira-puk Monastery, where most spend the first night. On day 2, the route stays on the granite across the Drolma La pass and then returns to the Kailas Formation on the descent to the Zutul-puk Monastery. On day 3, visitors are treated to an excellent view of the Great Counter thrust (B) and exposures of the mélange (C) on the return to Darchen. Photos by Lon Abbott and Terri Cook.

Mount Kailas rises in the middle belt, composed of Kailas Formation conglomerate; the rock north of the mountain is granite (Figs. 1 and 3). To the south, a jumble of sedimentary and low-grade metasedimentary rocks intermixed with blocks of serpentinite forms a mélange that was thrust northward over the Kailas Formation along a fault Gansser named the Great Counter thrust (Fig. 3; Heim and Gansser, 1939). In spotting serpentinite, he had discovered the ophiolites of the Indus-Tsangpo suture, which mark the boundary between India and Asia along the length of the collision zone.

> FEW PLACES ARE VALUED MORE THAN MOUNT KAILAS, AND IT IS THE GEOLOGIC EVOLUTION OF THE INDIA-ASIA COLLISION ZONE THAT HAS IMBUED THE MOUNTAIN AND ITS SURROUNDINGS WITH THE UNIQUE GEOGRAPHY THAT HAS INSPIRED RELIGIOUS PILGRIMS FOR OVER A THOUSAND YEARS.

Subsequent work, much of it conducted during a multidisciplinary study by University of Arizona researchers, has added detail to the geologic framework Gansser deduced during his extraordinary geologic pilgrimage (DeCelles et al., 2011, 2016; Carrapa et al., 2014; Leary et al., 2016). The rock of the northern belt, the Gangdese granite, forms the roots of a continental margin volcanic arc that was active between 120 and 50 Ma as Indian plate oceanic lithosphere subducted northward beneath the Asian continental margin. When collision began ca. 55–50 Ma, activity in the arc ceased, and it was uplifted and eroded. That erosion exposed the granite, which, along with its volcanic carapace, supplied the bulk of the detritus to the Kailas Formation, which unconformably overlies the granite. The Kailas Formation was deposited 26–21 Ma, revealing that, by then, km-scale exhumation had exposed the granitic roots of the Gangdese arc.

The Kailas Formation, which is about 4 km thick, was deposited in a rapidly subsiding basin that spans the length of the India-Asia suture zone (1300 km). The Kailas Formation conglomerate was deposited in alluvial fans and braided rivers, but the formation fines southward and contains lacustrine mudstone and coal, which indicate the Kailas Basin was warm, humid, and likely deposited at low elevation (DeCelles et al., 2011). The question arises: What processes could create a low-elevation basin in the heart of the collision zone and subsequently elevate it to its current height of 4500–6500 m?

TWO HYPOTHESES FOR HOW THE KAILAS BASIN ROSE

Low-temperature thermochronology is an important tool for answering this question. Those data indicate dramatic Miocene vertical movements of the Kailas Basin; the Kailas Formation was buried 4–7 km and then exhumed by a comparable amount by 18–15 Ma, a mere few million years after its deposition (Carrapa et al., 2014).

The Arizona team concluded from their work that low-angle subduction of the Indian continental lithosphere caused a high relative rate of plate convergence between ca. 45 and 26 Ma, creating the south-verging Tethyan thrust belt south of Mount Kailas, which is composed of sediments derived from the Indian continental margin. Transfer of those comparatively low-density rocks to the upper plate increased the Indian plate's density, causing it to "roll back" to a steeper subduction angle. Rollback triggered a long, narrow belt of margin-parallel extension in southern Tibet, forming the Kailas Basin. When that dense slab broke off ca. 20 Ma, strong compression resumed, thrusting the mélange of Tethyan thrust belt rocks and Indus-Tsangpo suture zone ophiolites northward over the Kailas Formation along the Great Counter thrust (Fig. 3) and triggering surface uplift that raised the Kailas Basin to its current height (DeCelles et al., 2011; Leary et al., 2016).

Peter Molnar, who spent decades pondering Tibet's uplift history, and to whom this article is dedicated, proposed an alternative hypothesis. He argued that widespread removal of Tibetan mantle lithosphere about 20 Ma triggered regional uplift far beyond the Kailas Basin confines (Molnar and Stock, 2009). Mantle lithosphere is inherently unstable because it is denser than the underlying asthenosphere; numerical models indicate it will typically "drip" off and sink where convergence has thickened it (Houseman and Molnar, 1997).

If all of Tibet except the Kailas Basin was already high before 20 Ma, as some paleoelevation studies suggest (e.g., Garzione et al., 2000; DeCelles et al., 2007), a mantle drip could not have been the cause of surface uplift (the basin is too narrow). However, paleoelevation studies using different techniques often reach different conclusions, fueling controversy (e.g., Heitmann et al., 2021). Su et al. (2019) argued that northern Tibet's Lunpola Basin, which currently stands 4600 m high, was lower than 2300 m at 25.5 Ma. If so, the widely separated Kailas and Lunpola Basins both rose rapidly after 25–20 Ma, making lithospheric removal an attractive mechanism.

The story of Mount Kailas epitomizes the key geoheritage concept that a place's geologic history governs, in part, why humans value it. Few places are valued more than Mount Kailas, and it is the geologic evolution of the India-Asia collision zone that has imbued the mountain and its surroundings with the unique geography that has inspired religious pilgrims for over a thousand years. It is fitting that studies teasing out the nuances of the mountain's unusual geology are shedding light on the collision's geodynamic evolution. This completes a cycle of scientific inquiry akin to the spiritual cycle completed by religious pilgrims, as scientists continue their quest to comprehend the geologic processes that have made Mount Kailas the center of the universe for more than 1.7 billion humans.

DEDICATION TO PETER MOLNAR (1943–2022)

We dedicate this article to Peter Molnar, a giant of earth science and dear friend. Abbott was influenced from his earliest college days by Peter's work. He was hardly alone; Molnar is one of a handful of geoscientists to have been awarded the Crafoord Prize—the Nobel Prize equivalent for earth science and three other non–Nobel Prize disciplines. Peter's wide-ranging and incisive analyses of the tectonic processes that raise mountains and the interactions between the solid earth and the atmosphere that sculpt topography have left an indelible mark on our discipline. Mountains were Peter's passion, and they motivated his science. Dearest of all to him were the mountains of Tibet, and Mount Kailas is special. In 2013, he realized a lifelong dream and circumambulated Mount Kailas (Fig. 4) with a group of family and close friends, many of them geoscience luminaries in their own right. Abbott had the great privilege of coteaching undergraduate classes with Peter that explored the geoheritage of the world's mountains, including Mount Kailas. He witnessed firsthand Peter's knack for enhancing critical-thinking skills in the next generation and inspiring them with his passion. Thank you, Peter, for all you have done for our community.

Figure 4. Peter Molnar crossing the Drolma La pass while completing the Kailas pilgrimage circuit in 2013. Attribution: Peter Molnar collection.

REFERENCES CITED

Allen, C., 1982, A Mountain in Tibet: Kolkata, India, Rupa and Co., 254 p.

Carrapa, B., Orme, D.A., DeCelles, P.G., Kapp, P., Cosca, M.A., and Waldrip, R., 2014, Miocene burial and exhumation of the India-Asia collision zone in southern Tibet: Response to slab dynamics and erosion: Geology, v. 42, p. 443–446, https://doi.org/10.1130/G35350.1.

DeCelles, P.G., Quade, J., Kapp, P., Fan, M., Dettman, D., and Ding, L., 2007, High and dry in the central Tibetan Plateau during the Oligocene: Earth and Planetary Science Letters, v. 253, p. 389–401, https://doi.org/10.1016/j.epsl.2006.11.001.

DeCelles, P.G., Kapp, P., Quade, J., and Gehrels, G.E., 2011, Oligocene–Miocene Kailas Basin, southwestern Tibet: Record of postcollisional upper-plate extension in the Indus-Yarlung suture zone: Geological Society of America Bulletin, v. 123, no. 7–8, p. 1337–1362, https://doi.org/10.1130/B30258.1.

DeCelles, P.G., Casteneda, I.S., Carrapa, B., Liu, J., Quade, J., Leary, R., and Zhang, L., 2016, Oligocene–Miocene Great Lakes in the India-Asia collision zone: Basin Research, v. 30, p. 228–247, https://doi.org/10.1111/bre.12217.

Garzione, C.N., Dettman, D.L., Quade, J., DeCelles, P.G., and Butler, R.F., 2000, High times on the Tibetan Plateau: Paleoelevation of the Thakkhola graben, Nepal: Geology, v. 28, no. 4, p. 339–342, https://doi.org/10.1130/0091-7613(2000)28<339:HTOTTP>2.0.CO;2.

Heim, A., and Gansser, A., 1939, Central Himalaya: Geological Observations of the Swiss Expedition 1936: Delhi, India, Hindustan Publishing, 247 p.

Heitmann, E.O., Hyland, E.G., Schoettle-Greene, P., Brigham, C.A.P., and Huntington, K.W., 2021, Rise of the Colorado Plateau: A synthesis of paleoelevation constraints from the region and a path forward using temperature-based elevation proxies: Frontiers in Earth Science, v. 9, https://doi.org/10.3389/feart.2021.648605.

Houseman, G.A., and Molnar, P., 1997, Gravitational (Rayleigh-Taylor) instability of a layer with non-linear viscosity and convective thinning of continental lithosphere: Geophysical Journal International, v. 128, p. 125–150, https://doi.org/10.1111/j.1365-246X.1997.tb04075.x.

Johnson, R., and Moran, K., 1989, Tibet's Sacred Mountain: Rochester, Vermont, Park Street Press, 127 p.

Leary, R., Orme, D.A., Laskowski, A.K., DeCelles, P.G., Kapp, P., Carrapa, B., and Dettinger, M., 2016, Along-strike diachroneity in deposition of the Kailas Formation in central southern Tibet: Implications for Indian slab dynamics: Geosphere, v. 12, no. 4, p. 1198–1223, https://doi.org/10.1130/GES01325.1.

Molnar, P., and Stock, J.M., 2009, Slowing of India's convergence with Eurasia since 20 Ma and its implications for Tibetan mantle dynamics: Tectonics, v. 28, TC3001, https://doi.org/10.1029/2008TC002271.

Su, T., Farnsworth, A., Spicer, R.A., Huang, J., Wu, F.X., Liu, J., Li, S.F., Xing, Y.W., Huang, Y.J., Deng, W.Y.D., Tang, H., Xu, C.L., Zhao, F., Srivastava, G., Valdez, P.J., Deng, T., and Zhao, Z.K., 2019, No high Tibetan Plateau until the Neogene: Science Advances, v. 5, https://doi.org/10.1126/sciadv.aav2189.

Charles S. Fletcher: A Key Man in Harvard Geology Lab

Tim Fedak*, [1]

Charles Spurgeon Fletcher (1896–1970) was a fourth-generation African Nova Scotian who developed technical expertise in the processing of polished ore samples and shared his knowledge widely through his work in the Laboratory of Mining Geology at Harvard University.

GROWING UP AMONG THE GYPSUM

Charles Fletcher was born in Windsor, Nova Scotia, a great-grandson of Isaac Fletcher, one of 2,000 Black American refugees who settled in Preston, Nova Scotia in 1815. Charles was named after the English Baptist preacher and abolitionist Charles Spurgeon, evidence of the importance of faith and social justice to his father and mother.

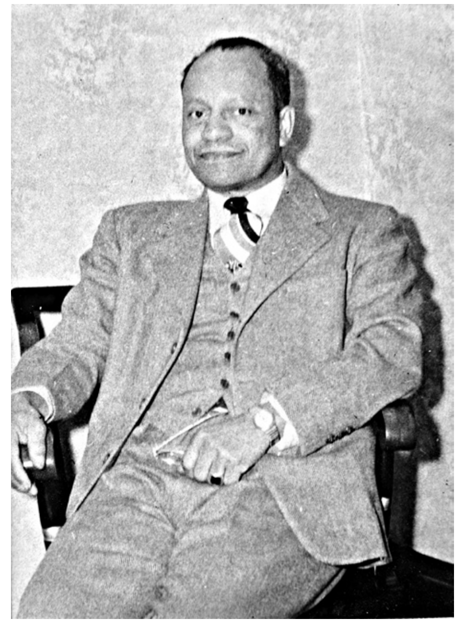
When Charles was a young boy, his family lived outside of Windsor in Newport Station, where the local school was not well supported and was frequently closed. At the age of 15, Charles was doing odd jobs and working alongside his father as a laborer in the Newport gypsum quarry. Charles' sister Mabel later recalled, "They would leave home about 5 o'clock in the morning. They would walk and come back by 12 o'clock. By that time they would have completed their work for the day" (States, 2002).

An image from the report "Gypsum of Canada" published in 1913 by the Geological Survey of Canada shows workers at the Newport Plaster Mine in Avonport.

In the early 1900s, more than 350,000 tons of the gypsum were exported to New England through the Minas Basin and Bay of Fundy. In August 1913, a field excursion to the Atlantic Provinces following the International Geological Congress included a stop at the gypsum quarries in Newport Station. A photo of the Newport gypsum quarries, showing men loading "white rock" into a horse-drawn cart, may include Charles or his father and clearly shows the physical challenges involved in mining the gypsum. Charles' older brother Clement served in the Canadian Expeditionary Forces in World War I, and it seems Charles continued working in the gypsum quarry through the war, helping to support his family.

LYDIA AND A NEW LIFE IN BOSTON

In December 1920, Charles married Lydia Pleasant, the daughter of a Baptist preacher from Weymouth, Nova Scotia. Earlier that same year, Lydia was listed among the registrants of the first Congress of African Baptist United Association held in Halifax. This was an important event for the African Nova Scotian community, with presentations from prominent African Baptists about the social goals and objectives to support Black populations across Canada. Lydia's brother Wallace served in the Canadian Expedition Force, No. 2 Construction Battalion, the only Canadian battalion composed of Black soldiers to serve in World War I.



Charles Fletcher sitting in the chair given to him by Harvard University upon retirement.

Shortly after Charles' father died in 1926, Charles and Lydia moved to Cambridge, Massachusetts, where Charles began working as a butler for Louis Graton, a professor of geology at Harvard University. After demonstrating interest in the geology lab, Charles began working as a preparator of ore samples at the Harvard Laboratory of Mining Geology in October 1928. For over thirty years, Charles worked in the lab and became internationally recognized for his knowledge in preparing polished thin sections of ore samples.

A KEY MAN AT HARVARD

Although Charles did not write about his accomplishments or details of his methods, a personal account was published in the afternoon edition of the *Boston Globe* on 29 November 1954. The article was one in a significant series written by Benjamin M. Dames, without which we would know very little

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about Charles' work and contributions (Dames, 1954).

In the article, Charles said, "I have always been mechanically inclined, and evidently my interest was showing because Prof. Graton offered to teach me the principles of grinding and polishing on a two-week trial basis. I am now entering my 27th year with the Department of Mining Geology."

Charles perfected the use of the Graton-Vanderwilt polishing machine, developed in the Graton laboratory, to mechanically grind and polish samples of ore for study under the microscope and in thin section. He carefully observed and modified the process, using innovative materials and techniques to improve the results of the polished samples.

Charles also reflected in the *Boston Globe* article about the dangers involved in the occupation. "The men and women engaged in grinding usually suffer painfully from irritation through nostrils caused by the fine dust-like particles that fly off the work and float in the air. Even though it may be diamond or gold dust it loses its value when it settles in one's stomach," he joked. He admitted that these difficulties had been mitigated in recent years by using damp cloth mouthpiece air blasts to dispose of the dust.

The impact of Charles' work can be traced through publications that documented techniques of processing ore samples (Kennedy, 1945) and in acknowledgments in many publications that used his polished samples (Short, 1948; Teitel, 1948; Webb, 1955). In a summary of the methods developed in his lab, Dr. Louis Graton (1937) said that "the operation of polishing mechanically on metal laps is an art, not a fool-proof process. Its present state results from investigations ... and from the accumulated experience and steady interest of C. S. Fletcher."

NOVA SCOTIA AND THE ATOMIC AGE

After a visit home to Windsor in 1954, Charles became well known locally as an accomplished member of the Harvard laboratory. A publication by Nova Scotia historian Florence Anslow (1962) suggested Charles was involved in a highly secret uranium project during World War II, and that Charles handled specimens from all over the world. This does seem possible, as James Conant, the president of Harvard University from 1933 to 1953, was also the Chair of the National Defense Committee overseeing the Manhattan Project.

Charles working to prepare an ore sample for polishing. Photo from *Boston Globe*, 29 November 1954.

I HAVE NOW GOTTEN OVER THE THRILL OF ENTERING MY LABORATORY AND SEEING FOREIGN PROFESSORS, ENGINEERS, GEOLOGISTS, ETC., ... SEEKING ANSWERS WHICH I AM DELIGHTED TO SHARE.

Charles Fletcher loading the Graton-Vanderwilt polishing machine at the Laboratory of Mining Geology at Harvard University. Photo from *Boston Globe*, 29 November 1954.

Charles also used his expertise to prepare polished sections for researchers in his home province of Nova Scotia. Dr. Gregory Douglas completed his Ph.D. at Harvard in the mid-1920s before becoming a professor of geology at Dalhousie University in Halifax, Nova Scotia, from 1932 to 1957. Douglas tried to bring the Harvard techniques of ore polishing to Dalhousie but found students struggled to get suitable results. Douglas then arranged for all polished sections studied at Dalhousie to be prepared by Charles at Harvard, a testament to his skills. Charles said that even after polishing over 100,000 specimens, his technique was still improving (Milligan, 1995).

In the biographic article published in the *Boston Globe*, Charles noted, "I have now gotten over the thrill of entering my laboratory and seeing foreign professors, engineers, geologists, etc., examining the machines and polished specimens, seeking answers which I am delighted to share. I can recall discussing the grinding and polishing process to interested persons through interpreters."

Charles and Lydia became American citizens in 1935, but they never forgot their home in Nova Scotia. They maintained a summer property in Weymouth

Falls that they visited frequently. Charles was an African Nova Scotian who did not have the privilege of completing his school education, but through his experience working in the gypsum quarries and his mechanical abilities, he established a successful career as a key man in the Laboratory of Mining Geology at Harvard University. Throughout their lives, Charles and Lydia were active and supportive members of their community; Lydia was recognized in newspapers as an active supporter of NAACP. In 1940, they adopted their niece, Cecilia, and raised her as their own daughter. Today, Cecilia's children continue to live in Charles and Lydia's Cambridge residence and visit the family vacation property in Weymouth, Nova Scotia. Charles' granddaughter, Brenda Stuckey, has been instrumental in the research and development of this profile.

Charles Fletcher was an innovative technologist, carefully observing material features and customizing precision machinery to process material samples of interest to geologists. From regular summer visits with family and friends to Nova Scotia, Charles is remembered as a kind and thoughtful man. He is respected in the community as having attained great success in the Department of Mining Geology at Harvard University. Charles passed away in 1970, but his name lives on as a Rock Star.

REFERENCES CITED

Anslow, F., 1962, Historic Windsor: A Town and County Abounding in Interesting Events: self-published.

Dames, B. M., 1954, Ex-Butler is Key Man in Harvard Geology Lab: The Boston Daily Globe, 27 November 1954, afternoon edition.

Graton, L., 1937, Technique in mineralography at Harvard: The American Mineralogist, v. 22, no. 5, p. 491–516.

Kennedy, G.C., 1945, The preparation of polished thin sections: Economic Geology, v. 40, p. 353–360, https://doi.org/10.2113/gsecongeo.40.5.353.

Milligan, G.C., 1995, On the Rocks: The Training of Geologists at Dalhousie: Halifax, Nova Scotia, Dalhousie University, 164 p.

Short, M.N., 1948, Microscopic determination of the ore minerals: U.S. Geological Survey Bulletin 914, 343 p.

States, D.W., 2002, Presence and perseverance: Blacks in Hants County, Nova Scotia, 1871–1914 [Masters' thesis]: Halifax, Nova Scotia, Saint Mary's University.

Teitel, R., 1948, The Beryllium-Iron System: United States Atomic Energy Commission Report, 89 p.

Webb, W.W., 1955, Oxidation studies in metal-carbon systems [Ph.D. thesis]: Cambridge, Massachusetts Institute of Technology, 129 p.

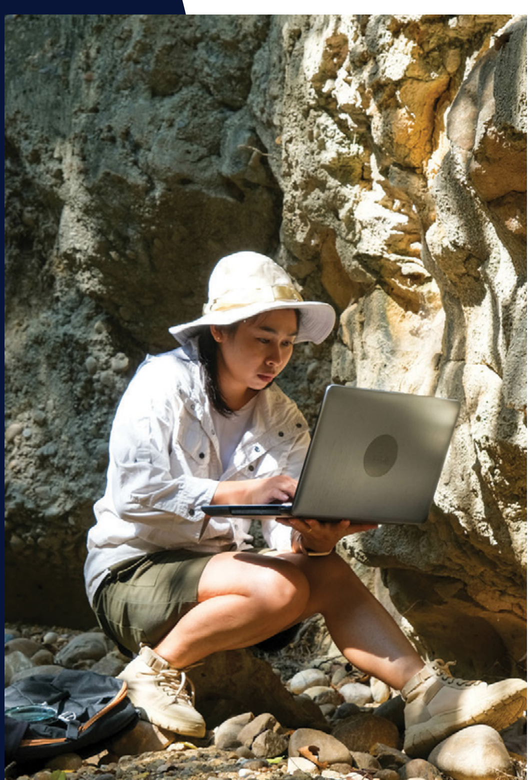

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Figure 1. The Mt. Holmes intrusive center in the Dzil Bizhi 'Adani (Diné/Navajo), Untarre (Southern Paiute), or Henry Mountains (English) of central Utah. Photo by Ellen M. Nelson.

Henry Mountains, Utah: The Construction of Mental Models and the Role of Geological Exemplars

Basil Tikoff*,[1] and Thomas F. Shipley[2]

Geology logline: *The development of the mental model for a laccolith was constructed from field evidence in the Henry Mountains.*

Cognitive science logline: *New spatial hypotheses can require forming a new category, which will be particularly easy to see in some spaces.*

They are the Dzil Bizhi 'Adani ("Nameless Mountains") in the Diné/Navajo language and Untarre in the Southern Paiute language. They were renamed the Henry Mountains in English by A.H. Thompson of the second Powell expedition of 1871–1872 (Fig. 1). Located in central Utah—an area that was and still is inhabited by Ute, Southern Paiute, and Diné people—the Henry Mountains consists of five major mountains: Mt. Ellen, Mt. Pennell, Mt. Hillers, Mt. Holmes, and Mt. Ellsworth (Fig. 2). Each of these mountains is an intrusive center of Oligocene age, with one major igneous body surrounded by a series of smaller, satellite igneous bodies. The intrusions occurred during a time of tectonic quiescence on the Colorado Plateau, such that the intrusion geometries are not affected by regional deformation. The intrusions, mostly porphyritic diorite with a fine-grained groundmass, were emplaced into the nearly flat-lying stratigraphy of the Colorado Plateau at ~2–4 km depth.

G.K. Gilbert arrived in the Henry Mountains in 1875, following the direction of his supervisor J.W. Powell to survey them "without restriction as to my order or method." In his report, Gilbert (1877) provided the evidence that he accumulated, which ultimately resulted in a new explanation for

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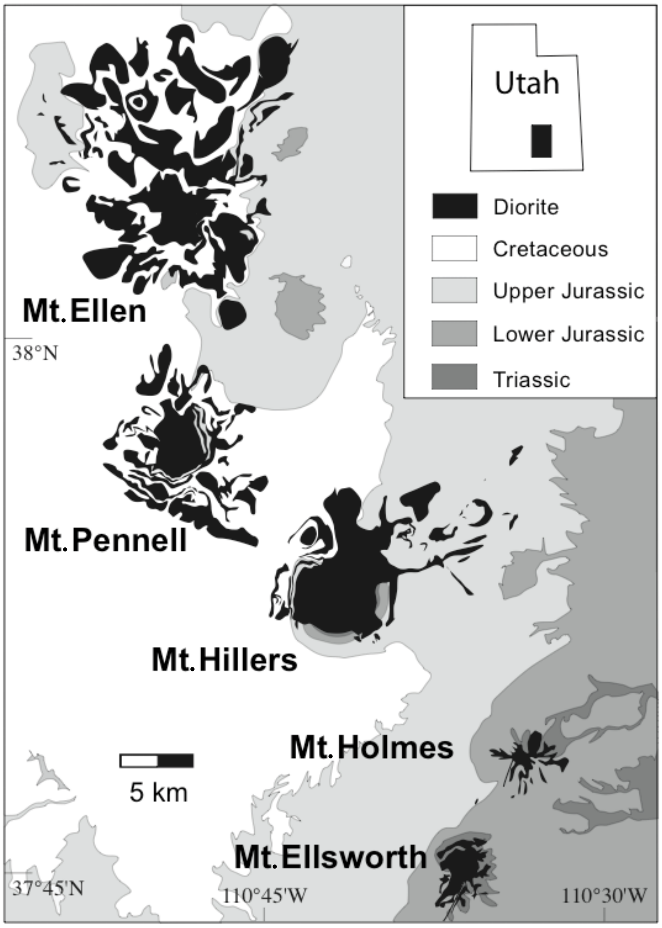

Figure 2. A geological map of the intrusive centers of the Henry Mountains, Utah. Modified from Horsman et al. (2005).

mountain formation. His field notes, which were subsequently published (Hunt, 1988a), provide insight into his thought processes as he worked through the challenges of this place. Here Gilbert made observations that, when aggregated, led him to conclude that there was a new and previously unrecognized category of intrusive igneous structure. Gilbert called the idea of a conformable igneous intrusion with a flat-bottomed and rounded top a *laccolite*; we now use the term *laccolith*. His report thus added a new member to geologists' mental library of 3-D geological structures.

It is worth being clear that psychology does not currently have a satisfactory explanation for how the mind comes up with truly new ideas. It is not for lack of trying; hundreds of articles have been written on this subject. On a personal note, Tim's mother spent most of her professional career as a psychologist trying to understand how children come up with new categories by induction. Nevertheless, by articulating what is known about the cognitive foundations of Gilbert's achievement, we can highlight what a geological exemplar such as the Henry Mountains can simultaneously reveal about the workings of the mind and of the world.

Nowhere in the Henry Mountains is a laccolith revealed in its entirety. The lithologies of the igneous and sedimentary rocks were familiar to Gilbert, although the spatial juxtaposition of the two rock types was not. A major question for Gilbert's 1875 expedition was whether the magmatic bodies of the Henry Mountains were extrusive (lava) or intrusive (Hunt, 1988a). This ambiguity arose due to: (1) the fine-grained nature of the groundmass of the igneous rock; and (2) the sedimentary-igneous contact, which had the same orientation as the bedding of the adjacent sandstone. The sedimentary–igneous relation was visible on the domed tops (upper contact) of the igneous intrusions because the physical setting on the Colorado Plateau region allowed the sandstone to erode and the slightly harder igneous rocks to remain. The bottom contact of a *major intrusive center* is not exposed, although locally conformable and subhorizontal bottom contacts of *satellite intrusions* are observed. One such bottom contact is well exposed in the aptly named "secret nap-spot gorge" of the satellite Maiden Creek sill (Horsman et al., 2005). Thus, reasoning by analogy over different spatial scales from the satellite intrusions to the main intrusion (Tikoff and Shipley, 2024: *GSA Today* October issue), one could reasonably extrapolate flat and conformable bottom contacts for the major intrusive centers.

The spatial relations among the rocks present compelling spatial logic when pieced together, although the lack of an exposed intrusion bottom contact also requires a significant mental extrapolation. How might Gilbert have put together the pieces? If Gilbert had a preexisting mental model of laccoliths, he could have used it to infer the internal form from the fragmentary observations at outcrops. However, there is no evidence that he had a preexisting mental model. Rather, his mental model of a laccolith was built from filling in surfaces between outcrops, akin to how the visual system fills in parts of objects that are occluded to "see" whole objects (Kellman and Shipley, 1992).

A single laccolith would be sufficient to add a new form to a geologist's mental library of structures. The series of laccoliths in the Henry Mountains allowed Gilbert to conclude this form was a category of forms, and that all intrusions have some set of defining characteristics as well as some aspects that vary across individual members. We will employ an analogy to make this point clear. Consider the category of "dog." The shape and color of individual dogs vary widely across the category. Variation in these and other attributes inform the observer about the spatial tolerances of the mental model of "dogness"—much like the category of unconformity (Shipley and Tikoff, 2024: *GSA Today* November issue) tolerates changes of orientation. Cognitive research on learning categories identifies two distinguishable, but not mutually exclusive, processes. A category may be formed in the mind by definitional rules (e.g., the category "siblings" is defined by a specific familial relationship, such as being part of the same litter) or by extracting a central tendency from multiple instances (e.g., a retriever is likely closer to the prototype of a dog than much larger or smaller dogs).

Many of the intrusions of the Henry Mountains are members of the "laccolith" category. Similar to the "dog" category, "laccolith" has definitional features and a central tendency. Laccoliths are defined by the geometry of an igneous intrusion into sedimentary rock, but laccoliths have different sizes and compositions. By seeing multiple examples, the mind can construct a constellation of memories in multidimensional feature space with a central tendency of this "laccolith" category. These characteristics of the mental library allow geologists to go beyond what they have seen. For instance, Torres del Paine in Patagonia, Chile, is readily classified as a laccolith by geologists empowered by mental models derived from the Henry Mountains (e.g., Leuthold et al., 2012).

The optimal order for presenting examples to teach a new category is an open question in cognitive science (Nosofsky et al., 2018). Plausible models of category formation, however, suggest that initial examples should include items that are near the center of the category. Further, initial examples should show some of the natural variation in the category. It is likely that what makes the Henry Mountains a type locale is that this collection of laccoliths—both the main intrusive centers and the satellite intrusions—satisfies both criteria. Nevertheless, the development of a new category would be challenging if the first example did not stand out clearly from other observations. For example, once a geology student has learned the basic rock category of "schist," it may be important to introduce a gneiss that completely lacks biotite. It is easiest to see something new if it clearly differs from previously observed examples and is not within the range of variability.

The recognition of the new geological form, with its variations, brought to Gilbert's mind a second idea—a new way to form mountains. Gilbert illustrates his model for intrusion and subsequent erosion of a laccolith in his 1877 report (Fig. 3). The presence of the form inside a mountain demands an explanation for how it got there. The geometry of the overlying sedimentary beds suggested they were raised as the igneous rock came in and thus were uplifted to form a mountain with an igneous core. Gilbert not only recognized this as the simplest explanation for the field observations but also used physics/hydraulics arguments to demonstrate the feasibility of this type of intrusion (Gilbert, 1877, p. 87–91). Once it is allowed that intrusive igneous rocks—without regional deformation associated with plate boundary interactions—are capable of mountain formation, the process also becomes a type of mental model.

The Henry Mountains are a geological exemplar of laccolith emplacement. Geological exemplars are places where the outcrop relations are clear and readily graspable by the mind. What are the characteristics, in addition to good exposure of the rocks, that make specific field areas so tractable to creation of new mental models? We suggest that it is likely that these locales are where confounding variables can be reduced and/or some type of spatial gradient is available that reflects a gradient in the operation of some process (e.g., erosion). In the Henry Mountains, the exemplar status results from the lack of regional deformation (lack of confounding variables), a well-known stratigraphy (lack of confounding variables), and the erosional differences arising from the N-to-S age progression of the five igneous intrusions (presence of a gradient). To clarify the last point, the northernmost Mt. Ellen intrusive center exposes an eroded igneous core, while the southernmost Mt. Ellsworth intrusive center only exposes dikes and sills fed by the underlying buried laccolith into the domed sedimentary rocks at its crest.

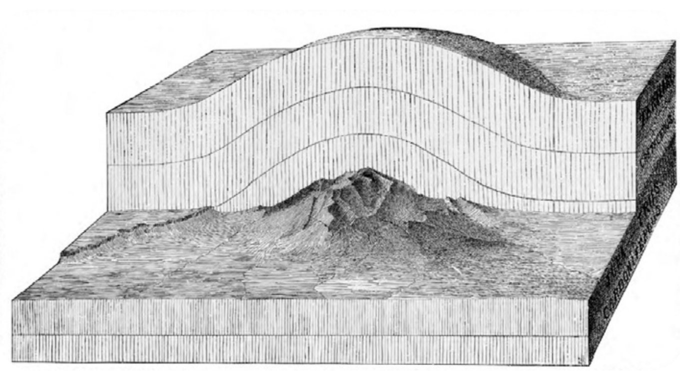

Figure 3. An interpreted laccolith without erosion (back) and with erosion (front) of the Mt. Ellsworth intrusive center, Henry Mountains, Utah. It is the frontispiece from Gilbert (1877).

It is common to see field exemplars referred to as "natural laboratories" in the geological literature. That term is likely meant to convey that these special areas reveal processes with particular acuity, as if they were extracted for analysis in a lab. However, this attempt to form a category from two distinct concepts (a natural field area and a scientific laboratory) obscures the role of the mind in geoscience. The term "natural laboratory" has three distinct problems. First and foremost, it is incoherent, as it does not describe an aspect of reality or scientific process. No field area is a laboratory, in which variables can be controlled and systems can be manipulated wholescale. The incoherence of the phrase is further revealed when considering field areas that are not "natural laboratories"; they are neither "unnatural laboratories" nor "natural non-laboratories." Second, the term inherently downplays the importance of fieldwork by lauding a specific region or outcrop as having the exalted status of "laboratory," implicitly suggesting that laboratory data would be better than field data as an object to study. Critically, the term "natural laboratory" was originally used to undermine the empirical geological data used to support continental drift by geodesists who incorrectly interpreted their theory-driven geophysical arguments to be incompatible with moving continents (see Oreskes, 1999). Finally, the term "natural laboratory" is epistemologically backward, as pointed out by Oreskes (1999): Geological concepts emerge from observations of the Earth that may be taken into the lab for study. The only arbiter of how the Earth works is the Earth itself, and fieldwork is the most direct form of obtaining that information.

The motivation to include this discussion is to make two important points about how the mind works. First, a new mental model is an accomplishment of the mind from patterns given by the Earth. In these cases, evidence comes from the coordination of object and process, which is not analogous to collecting evidence in a laboratory. Second, any well-exposed field area that clearly records a structure or process (a geological exemplar) is important for forming a mental category.

Geological exemplars are useful for teaching, introducing concepts with particular clarity even as they contribute to refining geological concepts. First, geological exemplars are often used as proving grounds for new theories that lump or split categories by thinking about geological features in a new way. The Henry Mountains were reinterpreted as geological stocks (Hunt et al., 1953), which would imply a deep vertical root rather than a flat-bottomed contact. Additional data supported Gilbert's laccolith hypothesis (Jackson and Pollard, 1988a); however, a subsequent Discussion and Reply suggest the issue has not been fully resolved (Hunt, 1988b; Jackson and Pollard, 1988b). Second, geological exemplars are revisited when new conceptual models are offered and guide scientists to look for previously ignored patterns. The Henry Mountains played this role in determining incremental emplacement of igneous intrusions into the upper crust. Prior to ~2000, most plutons were generally thought to result from the injection of a single batch of magma from the lower crust. However, the satellite intrusions of the Henry Mountains were shown to consist of a series of horizontal sheets, which amalgamated to form a pluton (Morgan et al., 2008). These sheets can be recognized by bulbous terminations along their margins, internal fabrics, and sometimes interleaved sediments between different sheets (Horsman et al., 2005). In fact, Gilbert had previously made a similar interpretation in his fieldbook: "A division in the trachyte indicates that it was injected at two times" (reported in Hunt, 1988a, p. 82).

The exercise of considering how and why the geologist's mind makes a discovery at a geological exemplar can be revealing. Note that this exercise is not exactly the same as recounting the history of the original discovery, which would necessarily focus on social answers to questions such as "why there," "why then," and "why was Gilbert so effective at seeing these relations?" Despite Gilbert's published field notes on the Henry Mountains, we will never know exactly what was going on in his mind. However, as geologists, we are always asking the same pattern-and-process question as Gilbert: "What does the Earth's pattern here tell us about the geological process (or processes) that caused them?" It might be productive for practitioners to also ask: "What does the Earth's pattern here tell us about the process of geological thinking?"

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REFERENCES CITED

*** denotes suggested further reading**

*Egger, A.E, and Carpi, A., 2023, Description in Scientific Research: https://www.visionlearning.com/en/library/Process-of-Science/49/Description-in-Scientific-Research/151 (accessed October 2023). Egger and Carpi (2023) use G.K. Gilbert's field notes in the Henry Mountains as an example of scientific description.

Gilbert, G.K., 1877, Report on the Geology of the Henry Mountains: Washington, D.C., U.S. Geographical and Geological Survey of the Rocky Mountain Region, 160 p., https://doi.org/10.5962/bhl.title.51652.

Horsman, E., Tikoff, B., and Morgan, S.S., 2005, Emplacement-related fabric and multiple sheets in the Maiden Creek sill, Henry Mountains, Utah, USA: Journal of Structural Geology, v. 27, p. 1426–1444, https://doi.org/10.1016/j.jsg.2005.03.003.

* Horsman, E., Broda, R.J., Gwyn, N.Z., Maurer, E.A., Thornton, E.D., and Ward, M.D., 2018, Progressive construction of laccolithic intrusive centers: Henry Mountains, Utah, U.S.A, *in* Breitkreuz, C., and Rocchi, S., eds., Physical Geology of Shallow Magmatic Systems: Dykes, Sills, and Laccoliths: Cham, Switzerland, Springer, p. 327–347, https://doi.org/10.1007/11157_2016_18.

Hunt, C.B., 1988a, Geology of the Henry Mountains, Utah, as recorded in the notebooks of G.K Gilbert, 1875–76: Geological Society of America Memoir 167, 229 p.

Hunt, C.B., 1988b, The laccolith-stock controversy: New results from the southern Henry Mountains, Utah: Discussion: GSA Bulletin, v. 100, no. 10, p. 1657–1658, https://doi.org/10.1130/0016-7606(1988)100<1657:TLSCNR>2.3.CO;2.

Hunt, C.B., Averitt, P., and Miller, R.L., 1953, Geology and geography of the Henry Mountains region, Utah: USGS Professional Paper 228, 234 p., https://doi.org/10.3133/pp228.

Jackson, M.D., and Pollard, D.D., 1988a, The laccolith-stock controversy: New results from the southern Henry Mountains, Utah: GSA Bulletin, v. 100, no. 1, p. 117–139, https://doi.org/10.1130/0016-7606(1988)100<0117:TLSCNR>2.3.CO;2.

Jackson, M.D., and Pollard, D.D., 1988b, The laccolith-stock controversy: New results from the southern Henry Mountains, Utah: Reply: Geological Society of America Bulletin, v. 100, no. 10, p. 1658–1659, https://doi.org/10.1130/0016-7606(1988)100<1657:TLSCNR>2.3.CO;2.

* Kellman, P.J., and Shipley, T.F., 1992, Perceiving objects across gaps in space and time: Current Directions in Psychological Science, v. 1, p. 193–199, https://doi.org/10.1111/1467-8721.ep10770407.

Leuthold, J., Müntener, O., Baumgartner, L., Putlitz, B., Ovtcharova, M., and Schaltegger, U., 2012, Time resolved construction of a bimodal laccolith (Torres del Paine, Patagonia): Earth and Planetary Science Letters, v. 325–326, p. 85–92, https://doi.org/10.1016/j.epsl.2012.01.032.

Morgan, S.S., Stanik, A., Horsman, E., Tikoff, B., St. Blanquat, M., and Habert, G., 2008, Emplacement of multiple magma sheets and wall rock deformation: Trachyte Mesa intrusion, Henry Mountains, Utah: Journal of Structural Geology, v. 30, p. 491–512, https://doi.org/10.1016/j.jsg.2008.01.005.

Nosofsky, R.M., Sanders, C.A., and McDaniel, M.A., 2018, Tests of an exemplar-memory model of classification learning in a high-dimensional natural-science category domain: Journal of Experimental Psychology: General, v. 147, p. 328–353, https://doi.org/10.1037/xge0000369.

Oreskes, N., 1999, The Rejection of Continental Drift: Theory and Method in American Earth Science: New York, Oxford University Press, https://doi.org/10.1093/oso/9780195117325.001.0001.

Shipley, T.F., and Tikoff, B., 2024, Siccar Point, Scotland, and the role of mental models: GSA Today, v. 34, no. 11, p. 36–40, https://doi.org/10.1130/GSATG103GM.1

Tikoff, B., and Shipley, T.F., 2024, Shark Bay, Australia, and the centrality of analogical thinking: GSA Today, v. 34, no. 10, p. 26–29, https://doi.org/10.1130/GSATG102GM.1.

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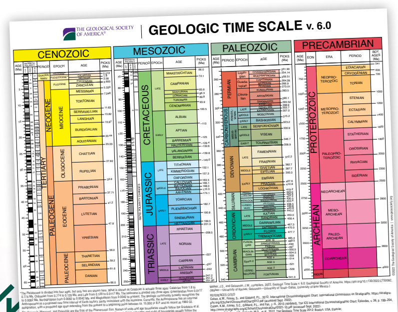

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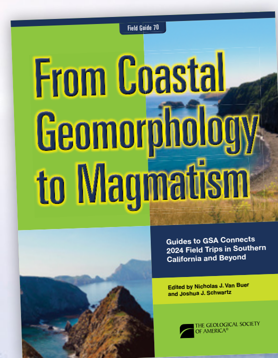

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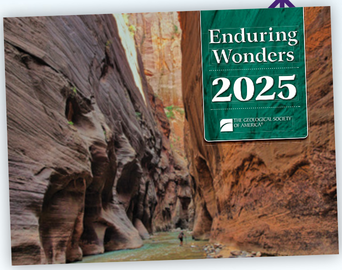

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Austin Keirs*
Teagan Maher
Vanessa Mendoza
Tomas Urbina*

Yale University
Gryphen Goss
Uthara Vengrai*

GSA International Graduate Student Research Grants

FAROUK EL-BAZ STUDENT RESEARCH GRANTS
Asil Newigy, University of Potsdam
Abdullah Tarek Mohammad Ibrahim, Western Michigan University

Division Graduate Student Research Grants

CONTINENTAL SCIENTIFIC DRILLING DIVISION
Continental Scientific Drilling Division Student Research Grant
Justin Delgado, CUNY Graduate Center
Bryce Hall, Auburn University
Michelle Landry, University of Alberta
Laura Lopera, University of Pittsburgh
Zohreh Kazemi Motlagh, New Mexico Institute of Mining and Technology
María de los Angeles Verde Ramírez, Universidad Nacional Autónoma de México (UNAM)
Matthew Wagoner, California State University, Chico

GEOCHRONOLOGY DIVISION
Sam Bowring Geochronology Research Grant
Samuel Kwafo, University of Florida

GEOPHYSICS AND GEODYNAMICS DIVISION
Allan V. Cox Research Award
Sapana Regmi, Utah State University

Geophysics Student Research Grant Award
Alex DiMonte, Utah State University
Laurie Zielinski, Dartmouth College

HYDROGEOLOGY DIVISION
Dr. Thomas C. Winter Graduate Student Research Award
Sam Carter, University of Utah

Hydrogeology Division Student Research Grant Awards and Travel Grants
Kwaku Asiedu, University of Georgia
Lindsey Cromwell, University of Florida
Cameron deFebry, University of Texas at Austin
Eric Levenson, University of Oregon
Tal Shutkin, Ohio State University

KARST DIVISION
John W. Hess Research Grant
Bryce Belanger, Vanderbilt University

MINERALOGY, GEOCHEMISTRY, PETROLOGY, AND VOLCANOLOGY DIVISION
Ian S.E. Carmichael Research Award
Aaron Ashley, Florida State University

Lincoln S. & Sarah W. Hollister Graduate Student Research Award
Sithari Nanayakkara Keppiti Duwage, University of Minnesota Twin Cities
Ahmed Abdelrahman, Oklahoma State University

Lipman Research Award
Lindsey Abdale, University of British Columbia
Benjamin Amundsen, Northern Arizona University
Kayla Aughenbaugh, Western Washington University
Brady Bailey, Ohio University
Guillaume Bats, Institut national de la recherche scientifique (INRS)
Verenice Becerril-Gonzalez, Oregon State University
Catriona Breasley, University of British Columbia
Saisha Brody, Western Washington University
Sarah Brooker, University of Texas at Austin
Abigail Chobany, University of Nevada, Reno
Rye Cox, Northern Illinois University
Emily Cunningham, University of Utah
Archie Dasgupta, University of Rochester
Ethan Dreger, California State University, Sacramento
Lütfi Ersay, Institut national de la recherche scientifique (INRS)
Wyatt Everhart, Kansas State University
Nicole Guinn, University of Houston
Stacy Henderson, Montana State University
Luan Heywood, University of Washington
Will Hunt, University of Missouri
Crystal Luna, Louisiana State University
Teagan Maher, Western Washington University
Seija Meaux, Louisiana State University
Camila Mejia, New Mexico State University
Vanessa Mendoza, Western Washington University
Reed Mershon, University of Hawai‘i at Manoa
Joshua Munro, The University of Texas at Austin
Adriana Piña Paez, California Institute of Technology
Yuly Paola Rave-Bonilla, University of South Florida
Felipe Rebelo, California State University, Northridge
Mahinaokalani Robbins, University of Hawai‘i at Manoa
Dylan Spence, University of British Columbia
Annabel TePoel, Northern Illinois University
Daoheng Wang, University of Minnesota, Twin Cities

James B. Thompson, Jr. Graduate Student Research Grant in Metamorphic Petrology and Geochemistry
Sebastian Barkett, Rensselaer Polytechnic Institute
Akshay Jayachandran, University of Connecticut
Elena Lee, University of Michigan

QUATERNARY GEOLOGY AND GEOMORPHOLOGY DIVISION

John A Black Award
Copeland Cromwell, University of Florida

Peter Birkeland Soil Geomorphology Research Award
Christopher Baish, Michigan State University

The Donald R. Coates Geomorphology Research Grant
Paloma Olarte, University of Florida
Brooke Santos, Indiana University

Denton, Andrews, Porter Glacial Geology Award
Yoram Terleth, University of Idaho

Robert K. Fahnestock Award
Pedro Silvestre de Oliveira, CUNY Graduate Center

Arthur D. Howard Student Research Award
Peter Galloway, Dartmouth College

J. Hoover Mackin Student Research Award
Anthony Giang, Simon Fraser University

Marie Morisawa Research Award
Emma Tombaugh, Utah State University

Troy L. Péwé Award
Alejandro Alvarez, University of Alberta

Stanley A. Schumm Research Grant Award
Josie Welsh, University of Colorado Boulder

Shroder Mass Movement Research Grant
Bailey Nordin, Dartmouth College

The Richard B. and Cynthia W. Waitt Award for Field-based Research in Physical Volcanology and/or Surficial Geology
Verenice Becerril-Gonzalez, Oregon State University

STRUCTURAL GEOLOGY AND TECTONICS DIVISION

Structural Geology and Tectonics Division Student Research Grant Award
Gombodorj Batsukh, Indiana University
Boyd A., University of Oklahoma
Jeni Chan, Western Washington University
Ishmael Cobbinah, University of Minnesota, Twin Cities
Corey Flynn, University of Colorado Boulder
Austin Keirs, Western Washington University
Terry Lee, University of Nevada, Reno
Ana Perez, Colorado State University
Starla Toto, Stanford University
Daniel Vega, Idaho State University

2024 AGeS-Grad Awardees

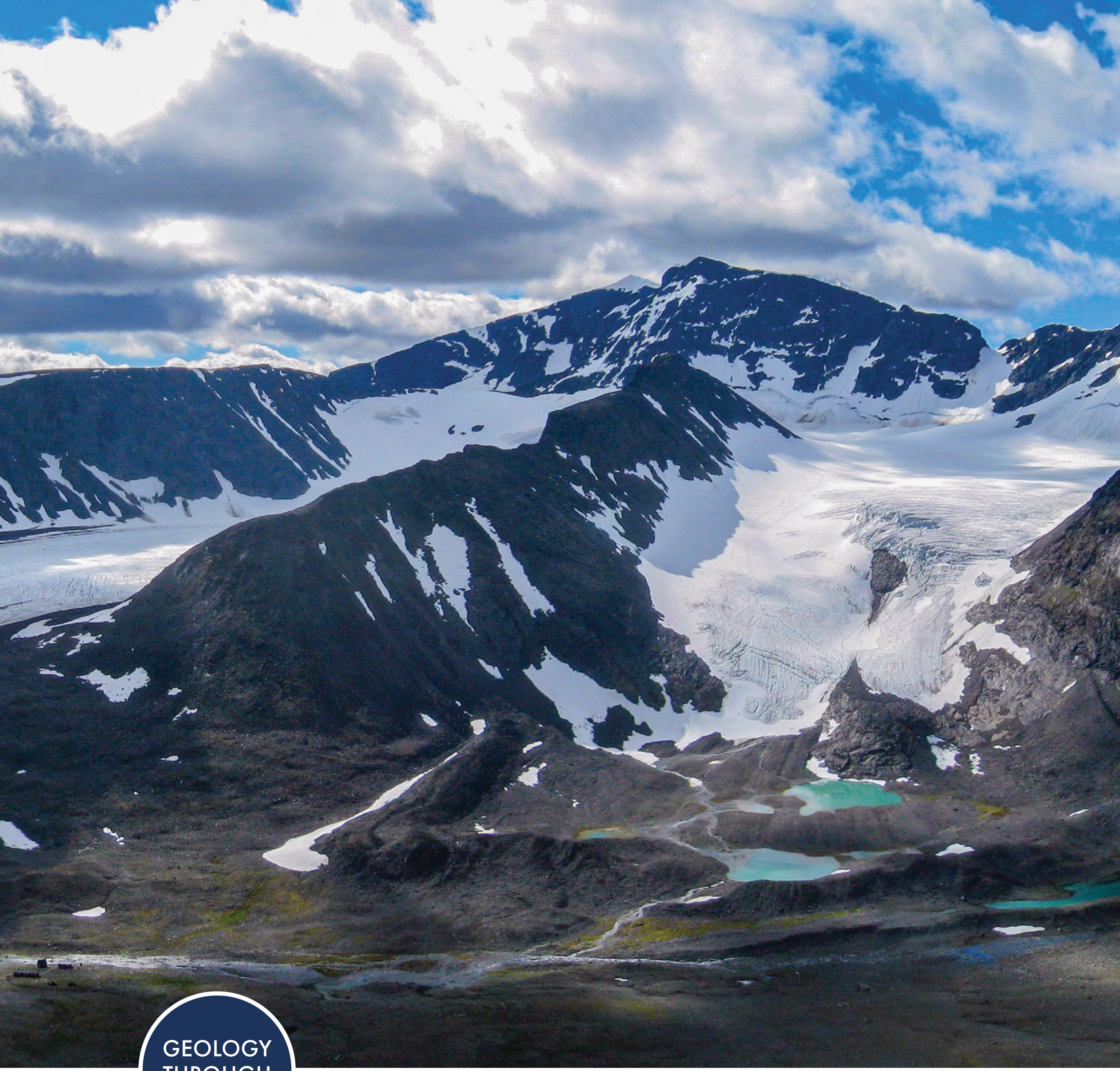
The AGeS-Grad program is a collaborative strategy for supporting community access to geochronology data and expertise. This microfunding opportunity enables graduate students to develop the scientific rationale for projects involving geochronology and then provides them with hands-on experience acquiring data in labs, all while being mentored by geochronologists.

In 2024, 22 AGeS-Grad awards were made. The 2024 AGeS-Grad program was supported by the National Science Foundation under the following awards: EAR-2218547, EAR-2218544, and EAR-2218504. AGeS-Grad will be accepting student proposals from 1 December 2024 through 1 February 2025. For more information, see https://www.colorado.edu/program/agesgeochronology/ages-grad.

STUDENT	PROPOSAL TITLE	INSTITUTION	TECHNIQUE
Ayodele Anne Abayomi	Refining the chronostratigraphy of late-Quaternary Texas coastal sediments to examine climate controls on sediment flux	The University of Texas at Dallas	Luminescence
Nicole Aikin	Canyon Chronicles: Tracing Orogenic Construction through Garnet Geochronology	University of Washington	Lu-Hf, Sm-Nd, Rb-Sr, Pb-Pb
Yuly Paola Rave-Bonilla	Newly identified monogenetic volcanoes in Antioquia, Colombia: The possibly northernmost monogenetic volcanic field of Andes Cordillera.	University of South Florida	$^{40}Ar/^{39}Ar$
Hannah Cothren	Developing a high-precision age model for the appearance of animal-life in Newfoundland, Canada	University of Washington	U-Th-Pb
Ella Davis	Timing of Metamorphism and Deformation in the Southern Extent of the Northern Highlands Terrane, Scotland	Virginia Tech	U-Th-Pb

(continued)

STUDENT	PROPOSAL TITLE	INSTITUTION	TECHNIQUE
Aniket Dhar	Speleothem Growth Dynamics in Stalagmites from Belum Caves, Southern India across Marine Isotope Stages 6-10	University of Arizona	U-Th-Pb, Q
Anthony Fuentes	Towards Resolving the Red Bed Controversy: Developing the Capacity for Detrital Hematite U/Pb Geochronology	University of California Berkeley	U-Th-Pb, Sed
Adit Ghosh	Investigation of soil erosion rates in the Channel Islands to quantify a baseline to underpin soil sustainability studies in Southern California	University of Southern California	Cosmogenics
Mikala Hammer	$^{40}Ar/^{39}Ar$ dating of cryptomelane to constrain manganese enrichment in the Emily Deposit, Cuyuna Range, Minnesota	University of Minnesota Twin Cities	$^{40}Ar/^{39}Ar$
Kristen Hashberger	Stratigraphy and Provenance of the Baca Formation in the Baca and Carthage–La Joya Basins, Central New Mexico	New Mexico Institute of Mining and Technology	U-Th-Pb, Sed
Cassandra Kenyon	OSL provenance in Colombia’s Magdalena Valley: shedding light onto Eastern Cordilleran uplift and development of the Magdalena River	University of Oklahoma	Luminescence
Elisha Miller	How Do Surficial Processes Influence Rift Evolution? Rates of Uplift and Erosion from Lake Tanganyika	University of Oklahoma	Cosmogenics
Kabir Mohammed	Tonian flasks: The age of a key microfossil assemblage from southern Kazakhstan and implications for Neoproterozoic eukaryote radiation	Johns Hopkins University	Re-Os
Keanu Montanez	Assessing the timing and degree of contact metamorphism in the Funeral Mountains	Northern Illinois University	$^{40}Ar/^{39}Ar$
Emma Morrison	Can U-Pb zircon geochronology on gabbro intrusions in Timor Leste distinguish whether they are part of an ophiolite or from pre-collisional rifting?	Brigham Young University	U-Th-Pb
Jada Nimblett	Geohazards associated with the Platanar-Porvenir volcanoes, Alajuela, Costa Rica	Georgia State University	Cosmogenics
Bailey Nordin	Targeting changes in sedimentation across a warming Arctic periglacial fan using Optically Stimulated Luminescence (OSL) dating	Dartmouth College	Luminescence, Q/Sed
Aurora Rosenberger	Investigating temporal connections between normal faulting, ductile stretching, and detachment faulting in the Snake Range core complex, Nevada	Washington State University	(U-Th)/He
Supratik Roy	Interrogating timescales of regional metamorphism during Phanerozoic v. Paleoproterozoic orogenesis	Johns Hopkins University	$^{40}Ar/^{39}Ar$
Rachel So	A U-Th chronology of evaporites in a hypersaline lake: Constraining lake level history at Great Salt Lake over glacial cycles of the last 280 ky	University of Southern California	U-series, Lakes
Anna Strickland	Petrochronology of enigmatic metatrondhjemite and restite blocks enclosed in subduction melanges: Insights into potential fossilized slab melts	University of North Carolina at Chapel Hill	U-Th-Pb
Zachary Walton	Alteration in Ultramafic Lamprophyres and its Control on Rare Earth Element Distribution in Western Kentucky	University of Kentucky	U-Th-Pb



GEOLOGY THROUGH THE LENS

Frozen Giants

View across the Tarfala Valley in 2008: Kebnekaise, the highest peak in Sweden, is a glacier (in distance on skyline) perched on metadolerite and amphibolite. These mafic rocks originated as Iapetus sea floor at about 600 Ma and were subsequently metamorphosed at about 480 Ma at 10 kbar or more. The other visible glaciers are Storglaciären (on left) and Isfallsglaciären (on right).

Graham Baird is a Professor of Geology at the University of Northern Colorado.

Want your photo to be featured in *GSA Today*? Email submissions to gsatoday@geosociety.org.

Celebrating a Year of Generosity: Reflecting on Milestones and Building a Stronger Future for GSA

As we approach the close of 2024, it's important to pause and reflect on what we've accomplished together and what lies ahead. In fiscal year 2024, which ended on 30 June, the Foundation was fortunate to receive nearly $2.9M in donations, thanks to the generosity of thousands of individual GSA members, foundations, and corporate partners. Contributions ranged from $1 to over $1M, each a testament to the unwavering dedication of our supporters.

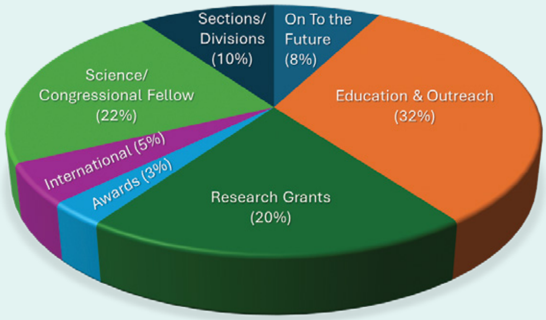
This year, we proudly transferred more than $1.3M to GSA, directly supporting programs including outreach and education, student travel, research grants, the Congressional Science Fellow, and numerous other initiatives. This brings our total financial support for GSA programs to a remarkable $6.1M in the past five years alone.

In fiscal year 2024, the foundation's net assets increased by $4.1M, bringing our total assets to $36.1M—a reflection of the incredible generosity and trust placed in us by our donors. In addition, with the creation of several new endowment funds, we now manage over 120 unique funds. We invite you to explore https://gsa-foundation.org/funds-and-awards/ to learn more about these many funds and their impact.

As we look ahead, we're excited about the continued development of additional endowment funds and are actively pursuing new strategies to expand support for GSA programs. But we can't do it alone. Your ongoing support is crucial to ensuring a bright future for all GSA members, from students just beginning their journeys to lifelong members.

As the year comes to a close, we encourage you to consider making a year-end gift, even a stretch gift, to help close out the year on a high note and usher in a successful 2025. If you have any questions, please feel free to contact Interim Executive Director Neil Fishman (nfishman@geosociety.org) or visit https://gsa-foundation.org/ for more information.

On behalf of the entire GSA Foundation, including the members of the Board of Trustees and our staff, we extend our deepest gratitude to each of you and remind you that the Foundation is your trusted partner. Your support has made this year a success, and we look forward to continuing this journey together. We wish you a joyful, fulfilling, and productive new year ahead.



Fiscal year 2024 GSA Foundation support, by programmatic area. Percentage is of the $1.3M transferred to GSA.

GSA Foundation Board of Trustees (left to right): Katy Sementelli, Nelia Dunbar, Dave Szymanski, Lydia Fox, Steve Wells, Ben van der Pluijm, Rebecca Caldwell, Terry Briggs, George Davis, and Lauren Heerschap. Not pictured: Braimah Apambire, Farouk El-Baz, and Laura Pommer.

2025 CALENDAR

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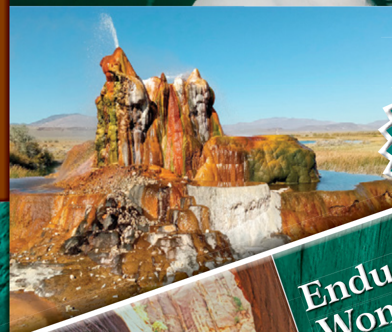


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