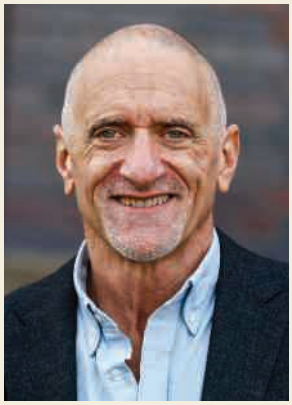
YALE EARTH & PLANETARY SCIENCES *NEWS*

Yale University | Department of Earth & Planetary Sciences FALL NEWSLETTER 2020

Chair's Letter



Dave Bercovici

Dear Friends, Family and Alumni of Yale Earth & Planetary Sciences,

Surely one of the first things you'll notice, especially you alumni, is that the department changed its name. On July 1, 2020 the department went from Geology & Geophysics to Earth & Planetary Sciences. This change has been brewing for decades, through many cycles of discussions, polls, and debates, and was finally made official this year. This is not the first time the department's name has changed. Yale is one of the first educational institutions in the country to teach the science of the Earth, starting in 1804 with a single faculty member, Benjamin Silliman, as professor of Chemistry and Natural History. In truth, departments at Yale didn't exist in the modern sense until 1920, when the Department of Geology was created. The Department changed its name to Geology & Geophysics in 1968 to include new faculty who studied the physics of the atmosphere, ocean and Earth's interior . But our field constantly evolves. Our new name reflects a broader, modern scope, beyond classical geology and geophysics, to include climate science, Earth system science, and planetary exploration (including new discoveries of other solar systems). The name strengthens our ties with other Yale departments and schools such as Astronomy, Ecology & Evolutionary Biology, and the newly named Yale School of the Environment (formerly Forestry & Environmental Studies, who changed their name at the same time we did).

Juan Lora, Assistant Professor

Since our last newsletter (in 2018) we have added two new faculty, Assistant Professors **Juan Lora** and **Lidya Tarhan**. Juan studies planetary atmospheres and climates, and is one of the principal investigators on the upcoming NASA Dragonfly Mission to the Saturnian moon Titan. Titan is one of the biggest moons in our solar system, is the only one with a thick atmosphere made of mostly nitrogen, and has a methane cycle similar to Earth's hydrological cycle, which carries water and heat around our planet. Juan also examines how a warming climate on Earth affects water transport through atmospheric rivers.

Lidya Tarhan, Assistant Professor

Lidya Tarhan works on ancient environments, and especially how the earliest animal life, at and before the time of the Cambrian explosion 540 million years ago, affected the marine environment and climate. In particular, she is an expert on "bioturbators", early animals who lived in marine sediments and whose motion not only

INSIDE THIS ISSUE

CHAIR'S LETTER

stirred and burrowed holes (and their fossil traces) in sediments, but changed how nutrients cycled through them. Lidya brings a multi-disciplinary toolset to bear on this problem, combining field work, sedimentology, stratigraphy, isotope geochemistry, and petrology.

Juan and Lidya have already made a major impact on the department and have received a number of honors and awards; we'll highlight their work in future newsletters. This year we highlight the research of another relatively recent hire, Assistant Professor Alan Rooney, who is a geochemist studying the timing and causes of major geological and climatological transitions, such the global "Snowball Earth" event nearly a billion years ago, as well as deglaciation during more geologically recent warming cycles, with relevance to our current climate. You can find out much more about the breadth of discovery by Alan and his group in these pages. (see page #)

The department as a whole has been a leading unit in the development of the Planetary Solutions Project, one of the Yale's major science priorities guided by Provost Scott Strobel. This initiative focusses on addressing our planet's future, given a changing climate, stressed resources, environmental degradation, and loss of biodiversity. The Planetary Solutions Project involves multiple departments across Yale, and the EPS department has been collaborating on its development since the beginning. EPS provides the scientific back-bone for understanding climate change, the water and carbon cycles, and climate mitigation approaches such as carbon capture and storage. We also have continued to explore new frontier areas of science with a series of exciting symposia, the first of which, on "Planet Formation and Evolution" was held in the spring of 2019; two future ones will cover "Climate and the Polar Regions" (delayed from spring of 2020 because of Covid-19) and "Co-evolution of Earth and Life" (hopefully spring of 2021 or 2022).

This last year has of course been challenging on several fronts. The Covid-19 crisis brought the entire university to a stand-still in March of 2020, and students and faculty have worked hard to adjust to the new way of working, teaching and learning. Kline Geology Lab has, for the most part, been kept to a skeleton crew of necessary staff and researchers, and our highest priority is their health and safety. The Department and the University are fully committed to weathering this crisis and supporting the well-being of all our citizens until the time, one day soon, when life returns to normal.

Yale, like campuses everywhere, has responded to the moment of national reckoning with the racial injustice that has plagued our country. EPS, along with our fellow Yale departments, has looked hard at ways of improving inclusion, equity and diversity in our discipline and in our own departmental community. Our departmental IDEA Committee, made up of faculty, students and researchers, has already developed community activities to facilitate education, outreach and progressive action, including town-halls, reading clubs, seminar series, and public lectures, in addition to participating in the broader university effort.

Our loyal department staff have, as always, continued to make the department run like clock-work with a renowned (within Yale certainly) collegial environment, despite all the recent challenges. While I can't mention everyone, I will highlight a few. First, Melissa Wojciechowski is our newest staff member (as of 2018) and is our lead Business Administrator. Melissa is a true gift to the department, keeping an iron grip on spend-thrift chairs (well, she's worked with just the one so far, so guess who?) while also being a hero and ally to us all. Becky Pocock, the Chair's Senior Administrative Assistant, has been a gem in the department since 2007, and has worked her magic and made us Chairs look good, much more, I'm sure, than we deserved. Becky is also 99% responsible for getting this very Newsletter completed, despite the distractions and procrastination of the current Chair. Dave Rossman, our Computer Support person has done a heroic job during the Covid-19 crisis of diligently keeping our computers running. And lastly, Pam Buonocore, our Operations Manager, has been the department rock (no pun intended, well maybe a little) for decades, holding together the department by sheer force of will (and anyone who knows Pam realizes how apt that description is). Pam is retiring at the end of this year, and we're not entirely sure what we'll do without her. To all the other staff members who

CHAIR'S LETTER

I'm not naming (and I'm sorry I can't), and especially those serving as essential support in our labs during the Covid-19 lock-down: the department could never work or thrive as it does without you!

I'll also note some other transitions in our department. First, Ron Smith, the Damon Wells Professor, retired this year, effective July 2020. Ron was a pillar of our department, starting at Yale in 1976, and serving as department chair from 1991 to 1997. He was an immensely popular instructor at Yale, as well as renowned and award-winning meteorologist. Because of Covid-19 we couldn't have a proper farewell celebration for Ron. So instead we managed a surprise Zoom party for him, with all the department and a wonderful showing from his former students, postdocs and colleagues; and surprisingly (to us), the surprise worked! With the number of faces and the lovely reminiscences of Ron's mentorship, friendship and adventures, it was as good if not better than we could have hoped. Ron will continue to be present in EPS as a research professor, but for the time being he and his wife Sigrid are enjoying their new boat!

George Veronis, Professor Emeritus and formerly the Henry Barnard Davis Professor, passed away in June 2019. You will find in this newsletter a memorial tribute to George (see page #), who was a giant in the field of physical oceanography, a founder of the renowned Geophysical Fluid Dynamics Summer School in Woods Hole, and a member of both the National Academy of Sciences and American Academy of Arts & Sciences.

Brian Skinner, Professor Emeritus and formerly the Eugene Higgins Professor, passed away in August of 2019. Brian was a pioneer in mineralogy and economic geology, and a highly influential educator and instructor, both with his incredibly popular introductory geology class (which inspired many Yale undergrads to become geology majors) and his famous series of textbooks. You will find an homage to Brian in these pages (see page #). Moreover, a group of friends, family, and alumni have been working with the Department to start a new fellowship in Brian's memory, already with amazing progress, and it's also described within this newsletter (see page #).

Lastly, I'll bid my own farewell as Chair of the Department. To all the family and friends of Earth & Planetary Sciences, Geology & Geophysics, Geology, and Natural History, it has once again been my pleasure and honor to serve our department, and especially the wonderful people in it.

Yukon Field Trip, June 2019, Investigating a dried riverbed near Kluane Lake – see page 40.

FACULTY RESEARCH

Alan Rooney and the lab's ThermoFisher Thermal Ionization Mass Spectrometer "Talisker"

The history of life on Earth is much more than just the story of biological innovation and opportunism. Integral to the story are the forces of plate tectonics, the changing chemical budgets of our atmosphere and oceans, highly dynamic climate states and catastrophic impacts. The ability to "tell time" in the geosciences is critical to understanding this rich tapestry. Our lab employs geochronology and isotope geochemistry to understand the temporal linkages and interactions between tectonics, crustal evolution, geochemical cycles, the cryosphere and life on a range of time scales. In particular, the Rooney Group employs the rhenium-osmium (Re-Os) geochronometer and radiogenic systems such as Rb-Sr and Sm-Nd and the platinum-group elements (PGE) to interrogate the rock record. Although it had its beginnings as a geochronometer for sedimentary rocks at Yale in the 1980's, the Re-Os geochronometer is a relatively new technique that has tremendous potential to provide a temporal framework for the biological innovations, climatic catastrophes and geochemical upheavals that punctuate the Proterozoic (2500-541 Ma [million years ago]) and Phanerozoic eons (541 Ma-present).

By combining fieldwork, sedimentology and stratigraphy with isotope geochemistry and geochronology, the Rooney Group examines the rock record during critical transitions in Earth history. Near term research interests are centered on three main areas: 1) refining Earth history records, particularly Archean and Proterozoic tectonic reorganizations and eukaryotic diversification and radiations in the Paleozoic; 2) combining geochemical proxies with microfossil and sedimentological analyses from modern-day glaciated regions to better understand the external and internal forces acting on ocean-ice sheet dynamics and; 3) integrating the Re-Os geochronometer into the EARTHTIME organization and leading international efforts for inter-laboratory standardization and the development of data-reduction software.

EARTH HISTORY RESEARCH

The Lomagundi-Jatuli Carbon Isotope Excursion

The Great Oxidation Event (GOE) was an irreversible increase in the presence of oxygen in the Earth's atmosphere during the early Paleoproterozoic (approximately 2.3 billion years ago) and was a critical transition in the lead-up to the evolution of macroscopic life. The Lomagundi-Jatuli event, the largest and longest-lived positive carbon isotope excursion in Earth history, followed the GOE, and may have lasted as long as 260 million years. These carbon isotope signals indicate high amounts of primary productivity in the oceans, which would result in an increase in carbon burial. The amount of carbon burial required to generate this long-lived carbon isotope excursion would result in large-scale oxygen production, and thus may be expected to coincide with dramatic changes in chemical weathering and nutrient fluxes to the oceans, ultimately providing an ideal environment for evolving eukaryotes. Determining the tempo of the Lomagundi-Jatuli event and deciphering the resultant impact on global redox conditions and biological processes is critical for efforts to unravel the evolution of complex life. However, despite decades of investigation, the temporal framework for the Lomagundi-Jatuli event is extremely limited. As a result, major questions remain unanswered regarding the duration and synchroneity of the carbon isotope excursion. Collaborative research with a former lab member

Isolation of osmium (the 2nd rarest element in Earth's crust) in the Rooney Group Clean Lab using the solvent-extraction technique

FACULTY RESEARCH

Annie Bauer (now an Assistant Professor at University of Wisconsin, Madison) centers on generating absolute age constraints using Re-Os on globally distributed sedimentary sections for this critical interval. These age constraints will help to understand the interplay between chemical weathering, ocean redox chemistry, biogeochemical cycles and the evolution of aerobes in the Paleoproterozoic.

Calibrating the Neoproterozoic Sedimentary Record

The Neoproterozoic was a dynamic interval of Earth history in which significant changes to the biosphere were inherently linked to tectonics. Set against the backdrop of the rifting Rodinia supercontinent, isolated basins with diverse redox states and changes in the continental weathering flux have been invoked to explain turnover in primary production and eukaryotic diversification during this interval. Furthermore, enhanced CO2 drawdown due to weathering of rift-related basalts has long been proposed as a mechanism for initiating the Neoproterozoic Snowball Earth events. Despite the broad appeal of the Neoproterozoic, fundamental research has been hindered by the lack of a temporal framework primarily due to the lack of materials suitable for traditional geochronometers e.g., U-Pb on zircon. Re-Os geochronology, in conjunction with radiogenic isotope paleoweathering proxies, has the potential to illuminate both the timing and causes of Neoproterozoic events.

Graduate student **Alexie Millikin's** research focuses on applying these tools to the sedimentary record in Svalbard, where a combination of tectonic processes and recent glacial erosion have exposed a near-complete and well-preserved record of nearly the entire Neoproterozoic. This record provides unparalleled opportunities to investigate the coevolution of the biosphere and earth system during this interval. Current research goals center on providing radiometric ages to resolve questions surrounding the tempo of eukaryotic evolution, and investigating the causes of the Snowball Earth events.

To go from a precise numerical date to a geologic age requires a robust stratigraphic framework. As such, all labwork done in the Rooney Group is accompanied by extensive field-mapping and stratigraphic logging. To provide the strongest geologic context, the group collaborates with paleontologists, sedimentologists, and structural geologists from various universities and international governmental agencies who have complementary research interests. Postdoctoral researcher **Tim Gibson** is working on refining the stratigraphic correlations of Neoproterozoic stratigraphy across Svalbard and Northern Canada.

Expanding Re-Os– Geochronology of Banded Iron Formations

Banded iron formations are distinctive sedimentary rocks that were deposited almost exclusively in the Archean and Proterozoic eons. These enigmatic units represent a fascinating record of changes in ocean and atmospheric chemistry, Earth's oxygenation history and global climate change in "Deep Time." However, our understanding of their formation is hampered by the lack of age constraints for many of them. Graduate student **Alexie Millikin** is actively working to expand the use of the Re-Os geochronometer to date iron formations. Because of their use as regional marker-beds, radioisotopic ages from iron formations would greatly improve stratigraphic correlations and enhance our capacity to parse out the sedimentary record, especially in the Deep Time where biostratigraphy is of limited utility.

Rooney Lab members in the mass spec suite (L-R: Alan Rooney; Lexie Millikin; Erica Evans and Sierra Anseeuw)

Paleozoic Glaciations & Biodiversification: Interrogating the Role of Tectonics

The Great Ordovician Biodiversification Event (GOBE) and Ordovician Radiation define a critical interval for Earth's biosphere, during which life expanded and diversified concomitant with increases in ecosystem complexity. These changes occurred against a backdrop of ocean oxygenation, intensification of continental weathering and tectonic shifts. It has been suggested that tectoni-

FACULTY RESEARCH

Graduate student Erica Evans isolating and purifying rhenium prior to column chromatography and analysis via mass spectrometry

cally-mediated global cooling and formation of ice in the southern hemisphere drove establishment of thermohaline circulation and increased nutrient flux to continental shelves, priming the planet for rapid biodiversification.

However, establishing the precise timing and duration of the physical drivers that drove this state shift in earth's systems has remained elusive. For this project, graduate student Erica Evans is working to: 1) leverage the Re-Os and U-Pb geochronometers to refine age constraints for siliciclastic sections which contain essential biotic and geochemical records and, 2) generate high-resolution Os and Nd chemostratigraphic data through the GOBE and Hirnantian Glaciation in order to interrogate the role of tectonics and continental weathering as drivers for the expansion, proliferation and contraction of life through this interval. Current efforts are focused on generating data from the western margins of Laurentia and Baltica, utilizing a combination of drill core and outcrop sampling from sections exposed in the Yukon Territory (Canada), Nevada (USA) and Scania (Sweden).

Tracing the Ice: Deciphering the Dynamics of Ice Sheet Loss in a Warming World

Polar ice sheets wax and wane with Earth's climate, playing a critical role in global sea level, ocean circulation and weather patterns. Despite intensive research, a key limiting step in predicting the effects of global climate change depends on accurately forecasting rates of ice sheet loss. In many current predictions, sea level rise will have catastrophic environmental and economic consequences, however, many of these models have large uncertainties for sea level rise. A more precise and mechanistic understanding of ice sheet dynamics is urgently required to understand sea level rise in a warming world. The Pliocene epoch, 5.3 to 1.8 Ma, is a robust analog for modern and near-future climate conditions. Studies on the Mid-Pliocene Warm Period (3.3-3.0 Ma) reveal that polar ice sheets possibly underwent rapid and catastrophic collapses, under a climate state with atmospheric CO2 comparable to today's values (>400 ppm), and global temperatures similar to those predicted for the end of this century by the Intergovernmental Panel on Climate Change. Classically, studies of paleo-ice sheet dynamics rely on oxygen isotope proxy data from microfossils in sediment cores. However, oxygen isotope data has several shortfalls; measurements are often taken at sites far from the highly dynamic ice sheet margin, and the implications for ice volume are complicated by factors such as salinity and variable ocean chemistry. Thus, an inability to acquire empirical data addressing the relevant mechanisms and time-scales of Pliocene ice sheet loss has resulted in poorly constrained ice sheet and sea level models.

An overarching goal of the Rooney Group is to revolutionize our understanding of ice sheet dynamics using osmium isotopes to generate unparalleled empirical records with the critical resolution necessary to capture the mechanisms and dynamics of Pliocene ice sheet loss.

Specifically, we will measure the rates of ice sheet collapse with unprecedented temporal resolution; deconvolve the links between northern and southern hemisphere ice sheet fluctuations; and uncover the nature of ice sheet loss during a period of warming oceans and rising atmospheric CO2. This work represents a cutting-edge application of osmium (Os) isotope profiling, leveraging the lab's analytical strengths and mechanistic understanding of Os isotope systematics to address the fundamental and urgent question of how ice sheets behave in evolving climates. The Rooney Group laboratory is uniquely positioned to pursue the trace (femtogram) isotopic measurements using novel methodologies that we are developing at Yale. This research program will deliver the first direct evidence of past ice sheet coverage and past episodes of ice sheet retreat – when, where, and how rapidly – providing highly informative empirical data to enable predictions for coming decades and centuries. The outcome will be a major advance toward answering longstanding questions: ***Does ice sheet destabilization occur linearly***

FACULTY RESEARCH

or exponentially – is it gradual or pulsed? How do collapsing ice sheets in opposite hemispheres influence one another? Which ice sheets are most susceptible to rapid collapse? The research is grounded in three fundamental principles: 1) the Pliocene is a robust analog for Earth's future climate; 2) Os isotope signals are transferred into the sedimentary record during intervals of glacial advance and retreat and; 3) drill cores of marine seafloor sediments adjacent to retreating ice sheets can retrieve these Os signals, providing highly-resolved (potentially decadal-scale) records of ice sheet dynamics.

Mid-Pleistocene Transition

The nature of what type of material lies beneath an ice sheet has a large control over the rates of erosion and flow. Determining how changes in basal substrate from bedrock to regolith or from regolith to bedrock can drive increases in mass loss is difficult due to the limited accessibility of basal ice interfaces, and lack of preservation of older subglacial deposits. In order to address how basal conditions affect ice movement, graduate student **Erica Evans** is working to test the hypothesis that the Mid-Pleistocene Transition (an enigmatic change in ice sheet volume that occurred between 1.2 Ma-650 ka) was triggered by the removal of deformable regolith by ice sheets thus exposing hard, crystalline bedrock beneath, which permitted Northern Hemisphere ice sheets to become thicker and therefore less responsive to shorter-term orbital forcing. This project leverages analysis of osmium isotope ratios from IODP sediment cores from the North Atlantic in conjunction with studies of basal bedrock geology.

Data generated from this project will shed light on how substrate conditions influence the pace and tempo of ice sheet movement on millennial and centennial timescales. Nadia Grisaru's undergraduate thesis work characterizing the osmium isotope composition of bedrock from the Canadian Shield complements this research by refining estimates of the integrated Os isotope composition of weathered material delivered to ocean basins during glacial erosion.

OSMIUM IN THE MODERN ENVIRONMENT

The use of Os isotopes as a paleoweathering proxy in deep-time research requires knowledge of how this element behaves in the modern environment. **Trina White**, an undergraduate doing her senior thesis in the Rooney Group, is working to characterize the Os concentration and isotopic composition of sediments and porewaters from Long Island Sound, as well as seaweed samples from the Arctic, to better understand how complexation, with and degradation, of organic matter affects Os.
As our current understanding of the fluxes contributing to the Os isotopic mass balance in modern and ancient seawater has been predominantly determined through observational data of modern natural systems, our understanding of how Os becomes mobile into fluids is limited.
Flint postdoctoral fellow **Drew Syverson** uses experimental isotope geochemistry to elucidate how physiochemical processes govern the fate of dissolved Os upon water-rock alteration of continental and oceanic crust. These data are integral to mass-balance models for elemental budgets during intervals of enhanced continental and/or reverse weathering.

Fieldwork in Svalbard, 2018. Group members Lexie Millikin, Tim Gibson and Alan Rooney alongside colleagues from Dartmouth College and Oxford University.

IN MEMORIAM

Brian Skinner (December 15, 1928 – August 21, 2019)

Eugene Higgins Professor Emeritus in the Department of Geology & Geophysics

Brian was a pioneer in mineralogy and economic geology and a legendary educator who inspired numerous students to pursue geology with careers in academia, government and industry. He was a Professor at Yale since 1966, served as Department Chair soon after arriving, from 1967-1973, and became the Eugene Higgins Professor of Geology & Geophysics in 1972. Brian John Skinner was born in Wallaroo, South Australia on December 15, 1928. He earned a Bachelor's degree in geology and chemistry, with a minor in physics, from the University of Adelaide in 1950, and then went to Harvard where he earned a PhD in geology in 1955; during that time he met and married Catherine Wild, who we all know as our own Cathy Skinner. Brian was then a Lecturer in Crystallography back at the University of Adelaide from 1955-1958 (during which time Cathy completed her PhD) before returning to the US as a Research Geologist at the USGS, where he became the Chief of the Branch of Experimental Geochemistry and Mineralogy from 1962-1966. In 1966, Yale recruited him away from the USGS with an eye to his heading the Department of Geology & Geophysics. Brian's scientific career was both eclectic and prolific. He was one of the worlds leading experts on the crystallography and geochemistry of metallic ores. While his work was invaluable in the mining industry, he also wrote extensively about resource management and sustainability. He was an expert on sulfide mobility from ores to brines to lava lakes in Hawaii, did extensive work on the mineralogy of sea floor rocks, and performed some of the first analysis of lunar rocks returned from the Apollo 11 mission. Brian was the author of numerous papers and notably the author or editor of some 20 books.

His textbooks included ones on economic geology and resources, and several famous and popular introductory texts such as "Blue Planet," "The Dynamic Earth," and "An Introduction to Physical Geology," which were read by thousands of students over the years. Brian was an immensely popular instructor, especially for his class G&G 110 Introduction to Geology (and various incarnations thereafter), for which he was filmed as part of the "Great Teachers Series." He served the scientific community as President of the Geochemical Society (1973), the Geological Society of America (1985) and the Society of Economic Geologists (1996), and as Editor of the journal, Economic Geology. His honors included Fellowship in the GSA, the Mineralogical Society of America, the Connecticut Academy of Science and Engineering, the Silver Medal of the Society of Economic Geologists, the Geological Association of Canada Medal, the Neil Miner Award from the National Association of Geology Teachers, and two honorary doctorates, from the Colorado School of Mines and the University of Toronto. With Brian's passing, Yale and the geological community lost a scientific leader and a beloved educator. But we are proud and lucky to have been able to call Brian Skinner our colleague and friend.

Dave Bercovici
Chair, Yale Earth & Planetary Sciences

MEMORIES OF BRIAN SKINNER

By some of his Students and Friends

I am so sad to learn of Brian's passing back in August.

Even though our lasting friendship and his wonderful mentorship dates a ways back in the Holocene, I had not checked in with him for some time nor did I factor in the layers of sediment that undoubtedly had formed since our last get together. Brian was one of the best teachers a young, bright-eyed Freshman G&G student could hope to have at Yale. He was so inspiring and exciting to have as a professor and even more fun out on a field trip. Although the equally amazing John Rodgers was my thesis advisor, Brian took great interest in my topic which covered the bedrock, glacial and industrial history and ecology of

IN MEMORIAM

Canaan Mtn here in NW CT. Another dear professor, Robert Gordon, eventually wrote a book as well that covered some of that early history of the colonial iron works.

Brian and Catherine along with John Rodgers were regular visitors to my home town of Norfolk for many years after I graduated Yale, and we enjoyed the Yale Summer Music Concerts often preceding the evening's event with a fun picnic supper on the lawn beforehand.

If I had one funny story to tell and there are many, it was when I was researching the thorny issue of disposal of spent nuclear fuel for a paper in graduate school at Yale's School of Forestry& Environmental Studies. I decided Brian would be a good sound voice to help me illustrate why bedrock disposal and interstate shipments could be so problematic. Little did I know that he had long before served on a presidential science advisory committee on that very subject, and his recommendation to that committee was that they could dispose of all of the country's nuclear waste in the seismically stable and very ancient crystalline rock formations right here in Connecticut. I was shocked to hear that though I knew he was probably right depending on which formations one chose to drill into! When I asked him what the response to that suggestion was, he simply said the committee discarded it outright because his estimate of the drilling costs to dispose at necessary depths (>2 miles) would have required billions of dollars even in the 1970's. His take on the whole problem in a nutshell was that no one in Washington DC wanted to face up to the costs associated with spent fuel and spend the necessary amount of money to put the waste deep enough into stable bedrock for all time. His take on it was that until they were willing to spend the necessary money, it won't ever get done.

Brian always went right at the obvious truth and reality of any situation. He was a pragmatic and patient man who had a contagious zest for understanding and sharing his knowledge of the many wonders of this world. His devotion to Catherine and his family was rock solid and never wavered. We have lost a great man, but his teaching, his legacy, and fundamental truths will live on forever in our hearts.

STARLING CHILDS '76 G '80

Brian Skinner was my PhD supervisor. After I left Yale our friendship grew during his trips to Australia. Brian was a rare gem-quality individual and, like a well-formed crystal of a rare mineral, there were many well-formed and sparkling faces to his character.
One face was his scholastic brilliance, highlighted by his first-class Honors Bachelor's degree in geology and chemistry from Adelaide University and his PhD from Harvard. Another was his athleticism that led to the famous Australian Antarctic explorer, Sir Douglas Mawson, Brian's Geology Professor at Adelaide University, advising him to follow in his footsteps and become an Antarctic explorer as he had the necessary intellect and physique. Brian didn't follow this advice much to the benefit of all who knew him at Yale. Another face was his talent for administration which first shone brightly at the USGS in Washington DC, and later at Yale as Chairman of G&G for ten years. Another face was showmanship – those of my era at Yale will never forget G&G's 1976 Grad Student Skit night when, in the year of the USA's bicentenary, Brian arranged for all the faculty to come in appropriate period costume and be led into the main lecture theatre by the New Haven Fife and Drum band. Showman Brian had the temerity to come finely-attired as George 3rd of England, with Cathy by his side dressed even more splendidly as Queen Charlotte.

Curiosity was a critical face. Brian had an insatiable and eclectic curiosity that was aided by a keen observational eye. A hand lens accompanied him 24/7 and was used not only to inspect rocks and minerals, but also to study in detail everything from a faulty ballpoint pen to the head of an ant that had just bitten him while picnicking in the Australian bush. Outdoors, Brian's binoculars competed with his hand lens. They were used primarily for birding and geology and for whatever else caught Brian's attention. When he didn't fully understand his observations, he'd ask anyone within earshot for explanations, irrespective of whether they were friends, students or total strangers. Responses not to Brian's liking, particularly those coming from strangers, often led to "interesting" incidents! One I remember well

IN MEMORIAM

occurred during a visit to Canowindra in central New South Wales where many species of Devonian fish fossils have been unearthed and are displayed in the local Age of Fishes Museum. While viewing an exhibit comprising a huge slab of local sandstone studded with many 10's of fossil fish Brian asked a nearby museum volunteer what had caused such a massive fish-kill. Her reply was that the fish habitat was an ancient river in which the water level begun falling, trapping hundreds of fish in a muddy water hole that eventually dried up, killing all the fish. By then Brian was on his hands and knees examining the host sediments with his hand lens. He looked up and said "... that's utter nonsense – just look at the grain size of the sediments and this cross-bedding." The volunteer stood her ground and repeated her explanation, paraphrasing the story given on the poster behind the specimen. Later the volunteer came up to me and asked "Who does that bloke think he is doubting my explanation?" I said, "don't worry about him – he's just a famous geologist who loves a good argument." She smiled and said "Well I'm a retired kindergarten teacher and I sometimes had to deal with kids just like him!"

A major face on the Skinner crystal was generosity. Over the years many people have been the beneficiaries of Brian's interest, support, advice, enthusiasm and attention. Brian gave generously of his time to students, post-docs, and colleagues, many learned and professional societies, as well as to his family, and a large circle of friends and acquaintances across the world.

All of Brian's character traits came together at Yale to form a rare gem of an educator. His G&G 110 "Rocks for Jocks" class was always popular as were his more advanced resource-focused undergraduate classes. His graduate classes were comprehensive and demanding, but always interesting. He challenged us to be original thinkers, to develop new ideas and to quantitatively test them. The textbooks he authored and co-authored extended his educational influence around the world.
I treasure the memories I have of Brian and am very grateful for the many ways he contributed to my development.

NEIL WILLIAMS '76

Professor Skinner, Brian as he insisted I call him over the past several years, has always been and will always be my favorite professor. He teased me for three years about playing football while sharing his immense knowledge of economic geology, which I use to this day. I will miss him greatly.

KEN JENNINGS '76

I owe my career to Brian Skinner. When I took his introductory geology class in 1975, I was an unenthusiastic physics major. Brian turned me on to the wonders of geoscience, and it's been a great ride ever since, although it took me awhile to settle on my own speciality of seismology.

PETER SHEARER '78

At the end of my senior year in 1979, I was approached by Brian, asking if I'd like to participate in a research study based on his paper "A Second Iron Age Ahead?" Little did I know how important this was, or how wide the repercussions would be in dealing with such a subject. I embarked, for a year, as a research assistant to help with a look into a possible 50-year supply and demand model for the element copper. Rounding out the participation in this study were three other professors, Tjalling C. Koopmans, William D. Nordhaus, and Robert B. Gordon. Well, what can I say, how can I sum up my participation in such an endeavor with, from
my stature, such giants? It turned out that the "four horsemen," as Tjalling jokingly nicknamed the group, went on to write a book based on this research titled "Toward a New Iron Age?: Quantitative Modeling of Resource Exhaustion" (1987).

And so, I'd like to note how this is an example of how Brian, I felt, was so prescient about things he was very curious about, and how he passed this curiosity and wonder on to those who were taught by and/or worked with him. There isn't a day I don't think about my participation in this study and all that it has taught me. There were other smaller activities he asked me to participate in as a result of this study, but none made a stronger impression than the work with this group. And I believe it made a strong enough impression on

IN MEMORIAM

Bill Nordhaus that it's effect lasts to this day. I'll never forgot how Brian commented, during an initial meeting, on how in our presence was a Nobel laureate (Tjalling) and how he believed that it was just a matter of time before another member (Bill) would have that honor bestowed on him. It turns out, some 40 years later, he was absolutely right!

I have great memories of my time at Yale and particularly within the G&G community that existed at that time. Everything was so new to me. And Brian encouraged me to revel in that newness and to further explore things that were discovered as a result. It is remarkable, after all these years, how that thinking and attitude have stood the test of time. Even now, things are unfolding whereby Brian's insights from early on are proving to be quite foretelling relative to some very important present day investigations. Brian was fond of saying he thought that "geologists would lead the way" to help uncover answers to some of our most pressing issues. There is still much to learn and ponder but in the long run, I believe he will be proven correct, again."

ROBERT G. ORTEGA '79

As a soft rocks undergrad who migrated from paleontology to neontology early in my career, I will always remember Brian's remarkable kindness (with a strong dose of sharp humor), and passion for all things crystals, minerals and rocks. This passion, instilled a lifelong love of geology, and gave me a sense of the movement of time that has served me well across a career in animal behavior, ecology and conservation.

JOSHUA GINSBERG '80

My deepest condolences to the Skinner and Yale-Geology families for the loss of Brian. I am where I am - with a passion for the science and a satisfying career - because of Brian. Brian's class came at a pivotal time in my Yale journey. I was a dissatisfied biology major, but I really didn't know where to turn scientifically. His physical geology class dropped from the sky for me. It had rigor and Brian's Australian accent made it sound like a swashbuckling enterprise. Furthermore, Brian always leavened his class and interactions with students with humor. His last lecture in the class made a lasting impression on me. He talked about the idea of a "support square"- the part of the earth that each of us draws on to provide water, food, energy, minerals, and recreation. He made it clear that this support square could be defined rigorously, and that the number of squares available to humanity was finite. This link to environmental science came way ahead of its time. To me, this was a lesson that a good scientist works with the facts in a way to make them relevant to all of us. I never talked politics with Brian, but I doubt that he was accused of being a tree hugger - all the more reason to admire his prescience. I should also mention the sequel to that last lecture. Brian invited all of us into the faculty lounge where cases of Swann's lager sat on the tables (this was in the days of the 18-year-old drinking age). Deal sealed. Brian also got me my first real job in geology, by connecting me with Skip Hobbs, who he had stayed in contact with over the years. That job helped to convince me to deepen my love for earth science by pursuing a PhD. It was very satisfying to return to Yale some years later for an alumni event on the same speaking bill as Skip, and to look into the audience and see Brian listening. I feel extraordinarily lucky to have encountered a scientist with Brian's perceptiveness and engagement.

TIM HERBERT '80

I was a graduate student with Brian Skinner from 1975 to 1979. It was clear to me right from the beginning that Brian was a man of exceptional intellect and geological experience, as well as someone who knew how to "get to the point" quickly and effectively. He had a reading group with three of us grad students early in my time at Yale, where we had quite a demonstration of his ability to dissect examples of the published literature. That was one example of why he was renowned for his work as editor of the journal Economic Geology. It was also a reminder to us always to be ready to back up our opinions with solid evidence!
Having seen how Brian, as journal editor, interacted with the top people in the field of economic geology, I wondered how he dealt with

IN MEMORIAM

the undergraduates to whom he was teaching an introductory geology course or our undergraduate majors in the department. For me, struggling to survive my first year of graduate school, here was an unexpected find. The undergraduate majors AND the students in the intro geology class really resonated with Brian. He took the majors seriously, helped them make decisions about courses to take and graduate programs to consider. Many of those young students who spoke particularly highly of Brian were women, some of whom I met again in later years when we all were in academia. He certainly helped me when I was ready to enter the job market.

Among his many talents, Brian was a superb teacher of both upper-level graduate and introductory-level undergraduate courses – a combination that one does not see often enough. The fruits of his teaching talents were disseminated more widely, in that he authored and co-authored several popular textbooks. I came to appreciate those particular talents as the years went by in my own academic career, which involved a considerable amount of teaching. I regret that I don't think I ever made a special point of telling him that.

JILL DILL PASTERIS G '80

I was a geology major at Yale, graduating in 1981 and it was my good fortune to be a JE'er when Cathy was Master of the College because I got two-for-one so to speak! I am currently a faculty member and chair of the geology department at Vassar College.

When Steph called to tell me Brian had passed it was just before classes began at Vassar. It took only a moment to realize that on the very first day of my Intro Geology course I would show my students a white garnet. Why? From my undergraduate days in Kline Geology, I remember clearly that minutes after a mineral identification test in his mythic introductory course, Brian was jumping out of his skin to know if we had guessed what was the dense, white, dodecahedral mineral he had slipped into the lot. He delighted in finding out if we had outsmarted him by determining that this usually red mineral had manifested itself in an unusual way. His playful self was amused by our guesses and he used them to convey to us with his sparkling enthusiasm the diverse beauty of Earth's minerals. He was an extraordinarily inspired teacher. Nearly 40 years after graduating from Yale, I still want to do for my students what Brian did for me—nurtured a sense of wonder about the Earth. On my desk at Vassar, is a sample of Botswana kimberlite which Brian gave me that I cherish. I look at it every day before I go into class and it incites me to try to bring some of Brian into my classroom.

From the outset of my undergraduate career Brian made me feel worthy of his teacherly attention. I felt that he expected great work from me and because of that he boosted my confidence. And I am not the only one who felt this coming from Brian. Upon learning of Brian's death I contacted other former students who had the good luck to study with him. In the words of one, he blew on sparks of interest in geology and flames caught. Supportive, encouraging, out-of-his-way helpful, he was a mentor who believed in us, offered the soundest advice, and ultimately impacted our lives to degrees beyond measure. We reminisced about what a jokester he was. He told me that the pointy end of a rock hammer is good for nothing but picking one's teeth. He told New Haven residents whose backyard outcrops we examined that we were looking for gold. We all recalled his extraordinary warmth which facilitated contagious connections with other Skinnerites. He organized dinners for us and if we were going to Australia he extended invitations to visit with his mother and brothers.

Speaking personally, Brian showed me that the relationship between a student and teacher can grow over a lifetime so that the one-time student comes to depend on the teacher not only for seemingly unlimited letters of recommendation and professional validation but for personal sustenance. Brian supported me during a MeToo moment in graduate school by listening to and believing me. At a time when LGBT people were not so welcomed in our society, he and Cathy embraced me when I came out to them and in 1993 introduced them to my wife--as Lassa had urged, knowing that Brian and Cathy would lovingly accept me for who I am. I don't know if he would have owned the moniker but to me, that

IN MEMORIAM

boisterous, strapping Aussie was an early feminist who nurtured me as an aspiring scientist and educator. Perhaps it stemmed from watching the tribulations and successes of Cathy, my other precious mentor, and his obvious pride in, and love for, his daughters.

How Brian made room for me in his already full and rich life I'll never know. I think he had a generous spirit. He has always felt like my guardian angel. It is one of my greatest good fortunes to have had him as an integral part of my life for 42 years. I admired, respected and loved him and I will always carry him in my heart.

JILL SCHNEIDERMAN '81

Brian Skinner had a profound, positive influence on the trajectory of my life. At the end of my freshman year, I had no idea what I wanted to major in. I was interested in science, and had taken freshman Bio, but that track seemed very pre-med and not a path I wanted to take. A senior on the hockey team, Greg Coyes, suggested I take the intro Geology class sophomore year to see if I liked it. Greg had majored in Geology. Well, "Rocks for Jocks," the intro course, was taught by Brian. To my surprise, I loved it. It was a large and unruly class that fit Brian's boisterous, energetic style perfectly. The hook for me was Brian's passion. It was clear he loved the subject to his bones and he projected that to the class. At the end of that course, I spoke to Brian about geology as a major and he convinced me to go for it. Later, Brian became my senior adviser and guided me through writing my senior thesis. Later still, when I was out in the working world, Brian wrote letters of recommendation for me - getting my first job in the oil industry and for my application to business school. Whenever I reached out to Brian over the years, he was always there. How would I describe Brian? Kind, tough, blunt, supportive, brilliant, caring and most of all funny. He always had a twinkle in his eye and a ready comment to lighten any situation. Brian was one of those truly remarkable people you meet only a few times in your life.

BLAIR WHEELER '81

I have 2 distinct memories of Dr. Skinner. In probably 1980, I was taking his Intro to Geology course (the famous "Rocks for Jocks") which predictably had quite a few football players in it. We often watched movies in that class, but one day, he introduced the movie by saying, "You think your football is tough? THIS is football!" and proceeded to play a movie about Australian rules football where the players crushed each other, all without any pads!
My second memory is that party that he held at the end of the semester with the barrel full of Foster's beer for everyone!
What a great man who made science FUN!

ANNE KENNERLEY '83

How sad to hear of Professor Skinner's passing. He seemed as enduring as the subject he taught. Anyone who had him as a professor will remember the excitement and fun he brought to the study of geology – not to mention the Foster's Lager he brought to the final exam!

My most enduring memory, though – perhaps even stronger than his pronunciation of the rock BASSalt – is of his slide shows. Every third or fourth slide would show his wife, Catherine (then master of JE College and a renowned geologist in her own right), standing beside some outcropping or other to provide scale. Each time she'd appear, he'd say, "And there's my wife ...," followed a few moments later by the inevitable, "... in her salad days."

It's an expression I don't think I've ever heard anyone else use, but it always made me smile. As I think back on Professor Skinner, it will be in his salad days that I remember him. I think he'd like that.

GERRY O'REILLY '83

I am glad I got to drop into the department in recent years to reconnect with him, and to remind him of his great support to me my senior year and update him on my career after Yale.

I did drop in this Spring and his light was off in his office, and regretted missing him.

IN MEMORIAM

He was a great man, and I am very grateful I had him as my advisor

CHRIS USHER '83

Brian Skinner is why I am a geology major. I walked into "Rocks for Jocks" in search of a painless way to meet a distributional requirement. I walked out of that first lecture seeing the world, starting with East Rock, differently.

KATE KRESSMANN KEHOE '84

I remember him vividly, both as a professor and as a wonderful presence in Jonathan Edwards College. He really loved life at Yale.

On one field trip to a shopping center somewhere near campus to look at some rock formations, he was showing us, and happily showing off, his talent for throwing his rock hammer spinning end-over-end up into the air and catching it on the way down with no apparent damage.

In the College, JE Fellows dinners often seemed to end up with Professor Skinner in the common room with anyone who walked by to join him drinking the Australian beer and eating raw oysters he had brought along for the occasion.

JOHN KURTZ '84

"Focus, Tim!" "Focus, Ellery!" I can still hear Professor Brian Skinner's words booming from the front of the G&G 110 classroom where he stood at the screen showing slides of scientific phenomena and his adventures and travels in geology. Did he mean literally focus on the slides on the screen? That was, of course, the literal meaning. But as an undergraduate in this highly popular class, encountering for the first time what I would later discover to be Brian Skinner's unique and unmistakable blend of intensity and joviality, seriousness and humor, competitiveness and kindness, and what seemed an unshakable pride in the quality, meaningfulness, and beauty of the natural world and his presentation of its wonders, I could not help wondering just a bit: was he really asking for focus on the part of his students on these beautiful manifestations of the natural world, and these reminiscences of scenes of his own vast and varied experience that he wanted to share in all their clarity with a new generation of students?

Fast forward to the end of the semester -- the last meeting of this highly popular class. I do not recall his exact words, but as Professor Skinner brought this wonderful experience -- its many explorations of the "Dynamics of the Earth," including field trips, slides, serious science mixed with a few humorous reminiscences and stories -- to a close, he invited all the students to an optional meeting in the faculty lounge to chat, reflect on the class, and socialize. Most of us in the presence of this veteran "Giant of Geology" were so young we had never legally had alcohol, but it is rumored that even some Australian lager was offered there. Many of us took Professor Skinner up on his offer in that lounge and met not only with him, but with several other professors, graduate students, and staff whom he had also invited, all sharing their comaraderie (which Professor Skinner said was almost a prerequisite to being a proper geologist), and their experiences with us. At this meeting, encouraged by the experience in G&G 110 and curious to learn more, when I asked Professor Skinner a question about taking further 200-level classes, including Mineralogy, he smiled and his face seemed to light up just a bit. He called over a young man - Professor Jay Ague - to help explain and encourage me to take it. Between Professors Skinner and Ague's inspiring (at times humorous) and encouraging words, I was sold on mineralogy and, in fact, had decided to major in geology so I could learn more about the processes and materials of the planet (and perhaps find ways to improve them if I could) and share in the joy and satisfaction ("pleasant and rewarding challenge," as Professor Skinner would later put in a letter to me) of these two great scientists and the others present.

The mineralogy class (G&G 220) did not disappoint for Professor Skinner co-taught this with Professor Ague - and this duo was made up of two of the best professors I ever had at Yale. As I shared with Professor Skinner in a letter a few years ago when he took emeritus status, it seemed to me that he and his young protégé were, at times, in a friendly competition to see who would teach the class better. Since each was such an

IN MEMORIAM

expert in his field, and since they worked together and collaborated seamlessly, this benefited the students and made for a great class. (It was a no-brainer I'd go on and take "Petrology" with Professor Ague and "Mineral Deposits" with Professor Skinner later on, both of which turned out to be great courses as well.)

In the interest of time and space, I will not go in to detail how Professor Skinner was a great professor and mentor to me (frankly, at times I feel I should have consulted him more on some matters, including his strong encouragement for me to pursue science as a career). He was a role model and instrumental to my Yale experience. I will just mention two kind and generous things he did for me that illustrate his character and magnanimity.

The first was in 1991 when as an undergraduate senior, I challenged myself by taking a specialized upper-level (graduate) geology class, "Mineral Deposits," with Professor Skinner which few (in fact no) undergrads but me dared to take. I knew I was in over my head when equations, locales, and substances I didn't even know existed came up more frequently than ones that were familiar. So though I considered myself a dedicated student, (and did eventually graduate with academic honors) I knew earning a top grade in this class was going to be a tall order.

When Professor Skinner, who with all his encouragement could only provide me enough guidance to write some decent papers and earn an A- grade in the class, issued the grade report, apparently at the same time he took a most unexpected and encouraging step. In my mailbox, completely unexpected and unsolicited, was an official commendation from Professor Skinner, cc-d to my residential college dean. Surprised, I opened it and found that Professor Skinner had written highly encouraging words to the effect that I had distinguished myself in a class with more experienced graduate students and deserved recognition and commendation. Though it is just a piece of paper, I feel this shows his dedication to me and all of his students' success. He maintained very high standards, but didn't want me to be discouraged by not always maximally meeting those high standards, and to keep challenging myself and try even harder next time to get everything in top form.

For a second and final of many generous acts by Professor Skinner which I could describe, fast forward three years to 1995. I found myself teaching a summer course in geology to "gifted and talented" middle school students as part of the Duke TIP program in North Carolina. Duke gave me leeway to design and develop from scratch, using resources from the Appalachian State University's geology department, a 3-week intensive classroom and field-trip based course. I modeled the class on many of my Yale courses (slightly shortened and simplified for the younger audience), including G&G 110. When a textbook was needed, we went with The Dynamic Earth by Brian J. Skinner and Stephen Porter. The class was a large success -- the students enjoyed it greatly, it received favorable reviews, and I was invited back to give the class a second time. For the final exam, I asked the students to write a letter to the textbook's author, Professor Skinner, about the class, the text, and some aspects of what they had discovered and learned. With their permission, I sent their letters to Professor Skinner, who responded with an encouraging letter to me and a request for the names and addresses of the students so he could write back to them. And write them back he did, offering congratulations to them, support for me, words of wisdom and encouragement in their lives and studies, etc. It was a wonderful moment for them to be hearing from this luminary scientist, professor, and author -- and to continue the chain of contacts into a new generation. I could tell Professor Skinner hoped they would be included as new scientists.

In his words of encouragement and in recalling his own life, I remember that Professor Skinner's letter to the children included this idea (I am paraphrasing, but I believe quoting it almost exactly): He said that he had been fortunate to live a life of "pleasant and rewarding challenge." He spoke highly of this idea and commended it to the kids.

From my experience, I believe that Professor Skinner exemplified that ideal in everything he did and taught at Yale. Work and life should be pleasant -- because we are seeking answers, because we are asking good questions, because we are channeling and bringing forth the best in ourselves -- in short because of the challenge. In his phrase, "pleasant and rewarding challenge," I believe Professor Skinner crystallized an aspect of his wisdom and the character of a great teacher -- who makes others better by asking them to strive for their own personal best, not to seek a life per se of comforts and convenience, but to exert effort, develop skills and knowledge, and seek pleasure and reward in challenge.

IN MEMORIAM

Now that my own daughter is at Yale, I can sense the wisdom of Professor Skinner's words and example. She has challenged herself at every opportunity (in keeping with Professor Skinner's formula, in as pleasant a way as possible while still meeting goals), and she has a great deal of camaraderie, friendliness and competitive fire. As much as, or more than yours truly, who homeschooled her practically since birth using the best of my Yale education (partly imparted by Professor Skinner), like the undergrads and grad students and younger professors he mentored, like many of the kids he encouraged (with the letters to my students 20 years ago) she has not only a taste for academic rigor, a will to constant self-improvement, and scientific mindset . . . but also, what is it called?. . . . "Focus!"

Professor Skinner was without a doubt one of the very best professors I had at Yale. I hope this message serves as a tribute from a grateful former undergraduate student for the time and experience of learning, growing, and finding pleasant and rewarding challenge from this luminous scientist and educator, who I know was respected and will be missed by all.

KENNETH A. QUITTMAN '92

I'm very saddened to learn of Professor Skinner's passing. He was one of my favorite professors while I was a Geology major in the mid-1990s.

It struck me that he genuinely believed in all of his students' capabilities to learn and grasp even the hardest of concepts. For me, that was using the petrographic microscope and interpreting my findings. When it finally clicked for me late in the semester, Professor Skinner offered me the opportunity to work with him over summer break to analyze quarry samples for Gallaudet University. I was thrilled to be given his trust that I could handle the work and he did so with just enough oversight to ensure the scientific findings would be my own (but still helpful to the client). He was truly a pleasure to learn from and his dedication to his students and their progress was unfailing.

I send along my condolences to his family, friends and colleagues. He is fondly remembered.

JESSICA CARDON '96

I was deeply saddened to learn of Dr. Skinner's passing. I have many fond memories of his environmental issues seminar, but even fonder memories of field trips into outstate Connecticut, when he and Cathy would host our group at their beautiful home. His common sense approach to economic geology planted the seeds of my own views on energy and the environment. He will be missed.

BEN STEWART '97

On a field trip to look at rocks on a nearby beach in Connecticut with a crew of geology undergrads, Brian tripped and fell, hitting his head on a boulder and ending up with a decent gash. All the students gasped and offered to take him to the hospital. He said, "Not necessary! It's nothing worse than I've seen in the wars!" And he continued the field trip with a bloody forehead like nothing had happened.

AVERY WHITMARSH '00

Dr. Skinner, or BJS as we affectionately referred to him, was my senior thesis advisor during the 2000-2001 academic year. At times, my thesis partner and I were not the most dedicated students and did our best to avoid the possibility of checking in with him at 3:30 tea or elsewhere in the hallways of KGL. When he was out of his corner office, he stuck a post it note on his door 'BJS away!' In those pre-social media days, we emailed each other regular 'BJS away!' status updates so as to know with what degree of stealth we needed to operate while in the building.

At the end of my senior year, he addressed me in his well-known direct way: 'well, Alena, not everyone was meant to read the rocks.' Despite my less than stellar performance as a geology student, he remained a mentor and an inspiration to me for many years after. I'm sad to hear of his passing - I'd have loved one final check-in to make up for those I avoided!

ALENA BARTOLI '01

Right...in 1972 Brian blew on the spark started by Dick Armstrong for my interest in geology, and the flame caught. He was always cheerful and sup-

IN MEMORIAM

portive. He set up my post-senior year at the University of Adelaide, complete with invitations to visit with his mother and his brothers. Supportive, encouraging, out-of-his-way helpful. A role model and a "friend in a high place" who helped me feel important.

PAUL K. LINK

Although I do not qualify as an undergraduate nor a graduate student of Brian Skinner, I do quality as someone who had a 17-year working relationship with him as a member of the editorial staff of Economic Geology.

Room 305, KGL, was the home of Economic Geology for 27 years, with Brian Skinner as editor. When I was hired in 1978 as a copyeditor of the journal, Brian had already served for 10 years. The journal was founded at Yale by Waldemar Lindgren, in 1905. By 1907 eight issues were published annually, which continues to be the publication schedule. It is remarkable that Economic Geology has only had six editors since its founding; with the exception of the 2nd Editor, Alan Bateman, Brian is the longest-serving editor of the journal. Many changes took place during Brian's tenure as editor:
1. Economic Geology became an international journal—to be sure there might have been a disproportionate number of Australian special issues, but we can forgive him for that!
2. As the scope of the journal became more international, so, too, did the editorial board.
3. The growth of the journal was phenomenal. In 1968, the year before Brian became editor, the total number of pages published annually was 979. By 1985, the annual number of pages published had reached 2,000 where output continued until Brian resigned in 1995.
4. Under Brian's leadership the transition to online copyediting took place. He not only insisted on the transition but supported the editorial staff through the challenges of that significant change.

Following Brian's resignation, he suggested that the New Haven editorial staff continue to copyedit the journal and assisted us in contracting to do the work. Copyediting Economic Geology has always been both challenging and satisfying, and I continue to copyedit part-time, now in my 41st year!

Well after he resigned as editor, I often sought Brian's help with scientific-related problems, and less than a month before he passed away, he was very helpful in working through issues in a poorly written paper.

I would like to share some personal thoughts about my long working relationship with Brian.

I am grateful for Brian's leadershipÐI admired his ability to keep the larger picture at the forefront and at the same time pay attention to important details, get to the heart of the issue, not sweat the small stuff but put into action the ways and means to get the task accomplished. His method of assigning responsibilities and not only allowing, but insisting that we work independently, was just one of the ways he developed the best in all of us. Very soon after I began my work, Brian taught me a very important lifetime lesson; every request for help, large or small, was given Brian's attention and responded to in a timely manner. He was always honest and forthright when that was needed, he was patient when that was needed, he was generous and thoughtful at all times.

Through the years his energy, his creativity, his willingness to take a minute to listen and help-whether it be about a "well (water!) problem," a "mortgage problem," the "formation of a small business," or the "best shrubs for difficult yards," was a source of inspiration and help to me.

Last but not least, Brian's delightful sense of humor always got our attention I will never forget the morning he appeared at the door of 305 KGL with the greeting "Good morning wenches!" His ability to share a good story not only was the occasion for a hearty laugh but often did much to lighten a difficult day.

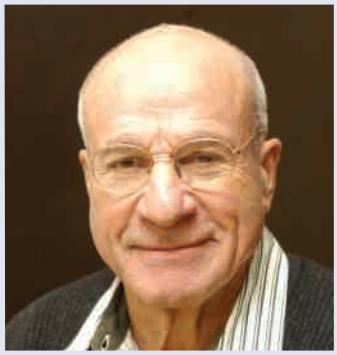
One sometimes unknowingly makes significant decisions in lifeÐsuch was mine when I decided to join the staff of Economic Geology.

We will miss Brian, but all that he was to each of us will always be part of our lives!

MABEL J. PETERSON
Production Editor, Economic Geology

IN MEMORIAM

George Veronis (June 3, 1926 - June 30, 2019)



Professor Emeritus in the Department of Geology & Geophysics

George was one of the giants in the field of physical oceanography and geophysical fluid dynamics. He was a Professor at Yale since 1966, Department Chair from 1976-1979, head of the Applied Mathematics Program from 1979-1993, and named the Henry Barnard Davis Professor of Geophysics and Applied Science in 1985.

George Veronis was born on June 3, 1926 in New Brunswick, New Jersey. After his service in the US Navy submarine program in the Pacific during World War II, he attended Lafayette College to study mathematics, and then went to Brown University to get a PhD in Applied Mathematics in 1954. After his PhD, he held research positions at the Institute for Advanced Study at Princeton, the Woods Hole Oceanographic Institution, and at MIT, before joining the Yale faculty in 1966.

George's research contributions included fundamental and seminal studies impacting both physical oceanography and fluid dynamics, especially in the first theoretical models of ocean circulation and western boundary currents (e.g., the Gulf Stream), finite amplitude theories for thermal convection, and a large body of work in double-diffusive convection. He was the editor of the Journal of Marine Research for 37 years, and a co-founder (in 1959) and director of the Geophysical Fluid Dynamics Summer Program at the WHOI, for which he shared the AGU Award for excellence in Geophysical Education in 2008. George's many honors included being elected a member of the American Academy of Arts & Sciences in 1963, a Fellow of the American Geophysical Union in 1975, a member of the Norwegian Academy of Science & Letters in 1981, and a member of the US National Academy of Sciences in 1994.
Although our Department, Yale and the scientific community are that much less with his passing, one could not ask for a fuller life than the one enjoyed by George Veronis.

David Bercovici
Chair, Yale Earth & Planetary Sciences

MEMORIES OF GEORGE VERONIS

By Some of His Students, Postdocs and Friends

George has been a key mentor to me. His enthusiasm for geophysical research was simply contagious. Every time I think of him I recall an exciting and extremely intelligent man who happened to treat me very well for some reason. I remember him as a generous soul and a very cultivated man. I owe him a lot. In particular, after less than one year as a graduate student he managed to have me go to the Geophysical Fluid Dynamics at Woods Hole for the summer and what an important experience that was! Also, after my advisor left before my thesis writing was completed, George took me under his wing and provided me with his own resources to complete my thesis writing. This help was precious indeed as those were the days before we all had a computer to produce our publications. The way George treated me inspired me to gain confidence in myself in spite of my many shortcomings. From him I learned to treat my own students as younger colleagues, no less. Interestingly I was not an oceanographer or a GFD'er. Thanks in large part to what George taught me, I nevertheless ended up loving to work on fluid dynamics whenever I had a chance in spite of the sometimes great differences between ordinary fluids and ionospheric plasmas. As far as I am concerned, our world has lost a great man in George Veronis.

JEAN-PIERRE ST-MAURICE, G '75

As a grad student at Yale from 1971-76, my wife Margaret and I got to know George and Kim socially through the many G&G parties and picnics we all attended. Our friendship grew after I returned to Australia to take up a research position at the Australian National University's Research School of Earth Sciences in Canberra. Not long after we had settled into our ANU apart-

IN MEMORIAM

ment George and Kim moved into a neighbouring apartment during what was to become one of George's many visits down under to work with the Geophysical Fluid Dynamics Group at ANU.

During these visits, which spanned several decades, I discovered that George was a man of many talents. He was as an excellent cook, a lover of fine wine and an interesting conversationalist. He discussed topics as diverse as growing up in an immigrant Greek family; the many achievements of the Geophysical Fluid Dynamics Summer Program at the WHOI, a program which he was very proud of; and the politics of the Greek Orthodox Church. George loved the outdoors and his stylish sunhats were always decorated with a striking bird feather. A strong common interest was birding and we shared many ornithological adventures around Canberra, Connecticut and Cape Cod. George's favourite bird was the Scarlet Tanager.
As an economic geology student at Yale I took no courses with George but he enriched my life in ways I never anticipated when I arrived there. George was a special friend, a great scientist, Yale Professor and a proud and generous Greek American and he will be sorely missed.
Margaret and I pass on our heartfelt condolences to Kim and the Veronis family.

NEIL WILLIAMS G '76

George Veronis was one of the top theoretical oceanographers in the world. His contributions covered diverse subjects, and his intellectual leadership was remarkable. He fit in well at Yale, and clearly enjoyed the sort of cross-disciplinary interactions that flourish in such a diverse department.

When I met George on my initial visit to Yale, I was greatly impressed by the sort of work he did (just what I wanted to do!) and by the way he made me feel welcome. After I settled in at Yale, I found George to be a fine teacher with high standards that I struggled to meet. In the years since I left New Haven, George has been a warm friend and supporter. It is hard to express the depth of my debt to George for the way he made me find the path within myself. The growth that I underwent with him is hard to comprehend.

KENNETH BRINK, G' 77

I was a physics grad student in the 1990s with a G&G advisor, Barry Saltzman. It was sometimes challenging to transition between disciplines, but mathematics is a great unifying language and George's mathematically rigorous, but still light-hearted style of teaching, helped me a lot. Although he was not on my thesis committee, he was always available to discuss my methods of analysis and simulation and offer constructive criticism. Even when I was a postdoc at NCAR, we corresponded sometimes about technicalities of the IPCC reports and test cases for numerical simulations. My memories of him will continue to inspire my research and teaching.

AIMÉ FOURNIER, G' 98

I was lucky to be one of the last to take George's Yale GFD course, but it wasn't until later that year at the Cambridge GEFD summer school that I realized his substantial presence in the field. There, when we were presented with the Boussinesq approximation I mentioned to a rather stunned course mate that Veronis had actually been my GFD teacher, just the year before. To me George was a quiet-giant, intellectually speaking — someone whose generosity and patience made room for the mundane struggles of a young student. During scientific discussions, the glint of a smile and gleam in his eye were reassuringly suggestive that from his perspective I was on the right track; yet enough mystery remained such that I was never quite sure he wasn't simply amused by my bumbling course to rather straight-forward answers.

ERIK S. THOMSON, G '10

I am so sorry to hear that such an influential and kind person in our field has passed.
I will always remember emailing George Veronis from a hospital bed in DUH, explaining that I had fallen seriously ill between semesters but that I was interested in enrolling in his spring GFD course. To my surprise, he responded that he would come chat with me in person--he then dug himself out of his snowed-in driveway, came to campus, and walked the five flights of stairs up to my room in the health center. Our conversation

IN MEMORIAM

set the course for much of my later professional life, as he urged me to strengthen my applied math skills and also to apply to REU programs. While I didn't end up taking the GFD class that spring, it is because of George Veronis' patience and willingness to trek to campus and chat with a sick undergrad about her future that I have been able to pursue oceanography. Professionally, I will always be in awe of his contributions to our field, and personally, I will always be grateful to him for encouraging me along my career path.
Sarah Dewey '10

The Earth has truly lost one of its influential scientists and a person who inspired many with his love for oceanography, fluid dynamics, and applied mathematics. Even in his 90's an image of George was that of a strong man, with a deep soothing voice and a warm smile, a modest man who respected people around him and who would sit in the far corner of a lecture room while having encyclopedic knowledge of the subject and only occasionally giving insightful comments aimed at helping speakers straighten their ideas. He was a gentleman with the highest moral values and had a captivating personality that always made it interesting to have discussions with him, regardless if they were on a scientific topic or not. George had a unique gift of bringing people together, whether through his GFD Summer School at Walsh Cottage, at relaxed (and at times not so relaxed!) softball games in Woods Hole, at dinner gatherings or casual discussions in a hallway or over a blackboard. He was a remarkable teacher who knew the material inside and out with an unshakable foundation and had a good habit of giving insightful answers to any of the raised questions. While taking his GFD class as a graduate student, I quickly got fascinated with the subject and to this day continue research in this direction. I must also mention that English writing had a special place in George's heart and on many occasions, he helped me and other students with language issues and emphasized the importance of explaining ideas clearly. His selfless willingness to help people around him was something to admire. George will always be a role model for me.

GEORGY MANUCHARYAN, 'G 14.

I was lucky to be one of the three students taking his GFD class right before his retirement. In his last class, he wrote down equations about double diffusion on the blackboard and conducted the experiment showing salt-fingers. After finishing the experiment, he quietly said that it was his last at Yale. I witnessed the great man's last teaching moment. He was a mentor and teacher. He encouraged me to continue theoretical research in geophysical fluid dynamics. I will always remember his answer when I asked if there are systematic ways to find the relevant length and time scales in fluid dynamics. I expected his wisdom or professional advice. Instead, he smiled and answered, "Young man, life isn't that easy." Even now, I am writing down equations on paper with a pencil following his legacy. I will deeply miss him.

WOOSOK MOON '14

I first met George when, as a very green British graduate student, I attended the 1966 GFD Program at Woods Hole. On this and later visits to the program it was wonderful to see the way in which George combined tough scientific questioning with great collegiality and generosity. I also came to admire and appreciate his long service as the editor of the Journal of Marine Research. His dedication and fairness in dealing with authors, referees, and associate editors were exemplary. George's well-deserved recognition through various awards is well documented but, in serving with him on a couple of awards committees and in other situations, I also came to see the effort that he put into supporting and recognizing other scientists. His passion and concern for other people carried over into his involvement in social issues; I remember him telling my wife and me about Avaaz, https://secure.avaaz.org/page/en/ If the reader of this is not already a supporter, think about becoming one in memory of George! He was a wonderful person as well as a great scientist.

CHRIS GARRETT, *University of Victoria*

I was shocked to hear of George's passing - I felt as though he would live forever. Even though George was one of the giants of GFD, I think of him as a long-time friend who always gave kind and honest advice. I'm sure he will keep watch over Walsh Cottage from above, and perhaps

IN MEMORIAM

leave some kindly worded criticisms on the blackboard in the middle of the night!

BARRY RUDDICK, *(co-principal lecturer with George and Raymond Schmitt)* **GFD '96**

My first encounter of George Veronis was when he was an invited speaker at the very first meeting I attended, in 1977, of the Division of Fluid Dynamics of the American Physical Society. It was clear that he had thought through the subject thoroughly and wanted to present it in particular detail. Fast forward to February 1979 when I interviewed for a faculty position at Yale. George was the last visitor on my schedule and B.-T. Chu took me to see him at his office. He was gracious in how he explored the limits of my knowledge, which made the conversation a lot of fun. The job was offered barely three weeks later (and I accepted it within a week), and knew from B.-T. that George had blessed it with enthusiasm. My admiration for George is somewhat influenced by a sense of gratitude that went with this knowledge, so I cannot pretend to present a balanced account. But I knew George well. For many years as colleagues, we met about once every two weeks or so in either the GFD seminars in George's department or Fluid Mechanics seminars in Engineering and Applied Science (where I was stationed), or simply for lunch. We had no agenda for most of those meetings and explored many inconsequential things. I absorbed the enormity of George's work slowly, as if by osmosis, and was simply fortunate to have had colleagues like him and Barry Saltzman who expanded my horizons considerably. Some of my students took George's courses.

George and I were separated by more than twenty years in age and he was an established professor before my career started, so we were not exactly friends in the traditional sense. But we shared many traits. It always seemed to me that George was underappreciated by the powers at large at Yale. Part of the reason was that George was not a showman and did not make a big deal about his work which was at the center of the development of quantitative science of the flow in the atmosphere and oceans. Part of the reason may also have been that George was quite open with his criticism of certain colleagues and administrators. I remember a time when he was made to wait in the outer office of the Provost for the better part of an hour, at which point he simply walked out and never went back, to the detriment of the issue he wanted to raise; and he never forgave that particular Provost for this ungracious treatment. Administrators are often too busy to go past the immediate persona, but my theory is that George was not fond of the university administration regardless of who was in power, but a few things kept him at Yale nevertheless.

Those few things were his loyalty to his department and some of his colleagues whom he admired; he was deeply committed to the University's Applied Mathematics Program, which he managed single-handedly with no help but occasional hostility from others. Finally, his leadership role in the GFD Program of the Woods Hole Oceanographic Institution gave him the much-needed vent. At Woods Hole, he thoroughly enjoyed the opportunity to meet established as well as younger colleagues and learn about their work. It was through George that I was introduced to the GFD crowd such as Willem Malkus, Ed Spiegel, Melvin Stern and Lou Howard.

One of the strongest character traits of George was his commitment to the tasks he undertook: He was the director of the GFD Program at Woods Hole for some 50 years, the editor of Journal of Marine Research for some 37 years and the director of the Applied Mathematics Program for some 15 years. George and I used to keep in touch through occasional email exchanges long after I left Yale. In one of them he spoke about his personal life in revealing ways. I think it can be quoted here because it further shows his strength of character. George came from a family of modest background and means, and his education was interrupted by the service in the US Navy, where he worked aboard submarines in the Pacific Ocean during World War II, but he excelled in the academic career he chose in an elite institution. In his own words: "My mother's father was killed by a thief when he tried to save his chickens from being stolen. My mother was younger than 8 years old at the time and had no schooling. She was sent to take care of a doctor's children, where she was employed for 16 years. She was very religious and learned the liturgy by heart and eventually got

IN MEMORIAM

hold of a copy of the liturgy and managed to connect the written word with the spoken word. During WWII she wrote to me (in Greek) when I was in the Navy and I responded, also in Greek, although both of us wrote in kitchen Greek, since we had no formal training in the language. My entire childhood was influenced by my mother, who had an endless quest for knowledge of nature. I could never repay her, of course, but when she was getting older, she could not walk much because of her heart and when I learned that, I walked the halls of the Yale hospital until I happened to walk into the office of William Glenn, a pioneer in artificial hearts and pacemakers. My mother was one of his first patients and she lived 9 years after the procedure. My father finished 9th grade. Both of them were proud of their children, although they didn't understand what any of us did." In his last e-mail, he mostly spoke about his wife's health, which was of great consequence to him. His death seems to have been peaceful with no struggle, and George greatly deserved that peace.

I will miss George; it was important for me just to know that he was there, solid and steady as a rock, when I needed his advice and thoughts.

K.R. SREENIVASAN, *New York University*

It's hard to express in words how profoundly George Veronis influenced my life. Little did I know in 1976, at 27 years old, that the man who just hired me to work in Yale's G&G department would become one of the most important men in my life. I was in awe of George's brilliant mind and couldn't comprehend how those yellow notebook papers filled with numbers and unfamiliar symbols written in pencil (all over his "messy" desk) could end up as over 100 monumental publications and countless awards and honors. When hearing the name George Veronis, most people will think of his contributions to oceanography and GFD but that's not what I think of when I hear his name. I think of his heart. I was privileged to spend almost every day for 36 years with George. He was the most patient, kind, generous, and selfless man I have ever met. Anyone who came to his office in KGL – colleague, student, editorial assistant, janitor – was greeted with a smile, his full attention and his desire to help in any way he could. George's passion was teaching – and not just GFD; he thrived on sharing his knowledge and felt so much satisfaction seeing people absorb his enthusiasm about different subjects. He met weekly with foreign students to teach them English. He would have them read out loud to him from US history books. He loved Yale football. One day he said to me, "Doreen – I keep sending emails to Carm Cozza – the coach of the Yale football team – telling him what he should be doing and he doesn't even respond to me – do you believe it?"

George loved life – the simplest things would bring him joy. He would lean way back in his JMR chair, a big smile on his face and clasp his hands and say "Doreen – you won't believe this……" and I would think – "oh this is going to be something really important" and he would tell me how he baked 36 delicious hard rolls; how his morning walk was wonderful; how his Volvo hit the 200,000-mile mark and was still running like a brand new car; how his son Ben was starting a new venture; how his daughter Melissa was so good at math; how he saw a bobolink – one of his favorite birds; how he was amazed at Emily Dickinson's poems; how swimming in Crooked Pond was spectacular. He was humble, grateful and lived life in the moment.

George faced so many challenges in his life and he did so with courage and patience and failing was never an option. He seemed indestructible. I think that is why it is so hard to believe he is gone. A few months before he died I said, "George – I still miss JMR so much." He replied "Ahh yes, Doreen, those were the halcyon years." He was certainly right about that. I am truly blessed to have had George in my life and I think about him all the time – I see his smile and remember all the things I learned from him – so in a way - he's still guiding me and will for the rest of my life.

DOREEN ORCIARI
JMR Ed. Asst. – the halcyon years (1980-2012)

ALUMNI IN MEMORIAM

In Memoriam

George DeVries Klein

George DeVries Klein G '60 passed away on April 30, 2018. George earned a BA in Geology from Wesleyan University in 1954, an MA from the University of Kansas in 1957 and a PhD from Yale in 1960. He was a faculty member of the University of Pittsburgh from 1961 to 1963, the University of Pennsylvania from 1963 to 1969. He then accepted a faculty appointment at the University of Illinois at Urbana-Champaign and was promoted to full Professor in 1973.

In 1971, he proposed the term "Tidalite" for tidal process facies formed by tidal currents. This term was proposed to focus attention on the role of tidal sediments in the rock record, which at the time were considered of minimal importance. That facies recognition became a mainstream depositional system recognized globally by sedimentologist and was refined subsequently by Klein and others. It led others to organize an international "Tidalite" research conference. Klein's lasting contribution was to define a new process facies and define the research agenda for developing it. In the process, sedimentologists became aware of the role of astronomic forcing factors on sediment deposition.

Lucian Brewster Platt

Lucian Brewster Platt '60 passed away peacefully on January 1, 2019, at the age of 87, Lucian graduated from the Taft School in 1949 and earned BS ('53), MS ('57), and PhD ('60) degrees from Yale. He served in Army Counter Intelligence before completing his doctorate, and subsequently took up teaching positions at George Washington and Villanova universities, and then Bryn Mawr College, where he retired as Professor of Geology in 1993. A member of the Merion Cricket Club, he was an avid bridge and tennis player, skier, USGS field researcher and cartographer, and lecturer on climate change.

G&G received this alumni update from Lucian in the fall of 2018: *I walked on a glacier the first time in 1949. Since then I have visited glaciers from Mexico City to 80 degrees north latitude and on three other continents. Glaciers are interesting, and how they interact with global climate has been a big part of my reading for some decades. Here is a summary of what I have learned. The public has heard little or nothing of this."*

Written human history demonstrates cyclic shifts from warm to cold and back in 1,000-year repeats. Here they are. Europe had comfortable climate in classical Rome 2,000 years ago. This was followed by the cold Dark Ages with a temperature trough about 600AD. Then two or three degrees of warming over centuries culminated in the Medieval Warmth which peaked in 1,000AD a little bit warmer than now. Cooling climate, beginning about 1200AD froze the settlements in fjords on SW Greenland and on the north tip of Newfound-

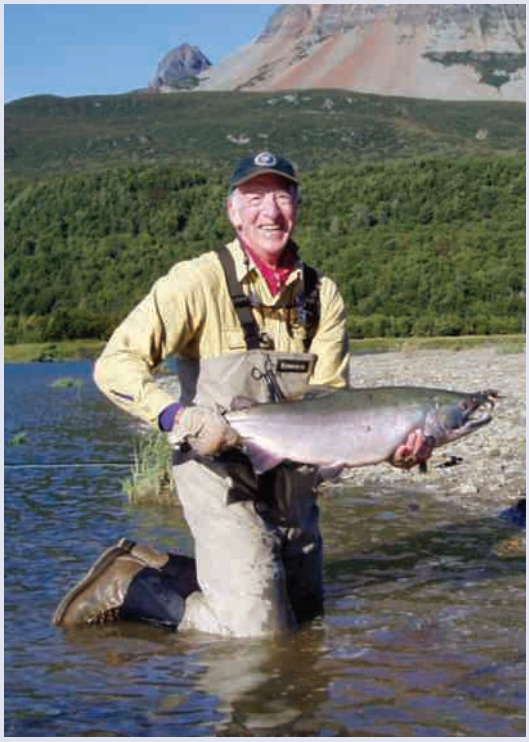
IN MEMORIAM

land, resulted in the Little Ice Age. This time was colder than the Dark Ages, so cold that the River Thames froze over at London during winters in the 1600s. A new warming trend began about 1700 that brings us to today, much like 1,000 years ago and 2,000 years ago. Although this written history is best recorded in Europe and the far east, we now know that the Medieval Warmth was preceded and followed by colder climate on five continents and in two oceans, all with lower CO2 in the atmosphere than now. As no fossil fuels were burned then, some natural cause(s) must have existed and continue periodically.

This recorded periodic history, confirmed and reconfirmed with geologic measurements and observations, indicates that we are at or very near the peak of the current warm cycle. The remarkable conclusion is that we will soon enter a cooling path, not the terrifying heating guessed at into the fog of the future by climate modelers.

Robert (Bob) Tracy

Robert (Bob) Tracy, Associate Professor 1978-1986, died at his home in Blacksburg, VA on January 6, 2019. Bob is survived by his wife of 50 years, Patricia. Bob was a metamorphic petrologist who's thinking always stemmed from the deepest understanding of mineral structure and chemistry, and from a delight in the beauty of phase equilibria. He made important contributions to our understanding of the measurement and significance of chemical zoning in metamorphic minerals, of metamorphic phase equilibria, of the processes of crustal melting and the mineralogy of residual rocks, of the behavior of sulfur during metamorphism, of microprobe dating of monazite, and of the tectono-metamorphic evolution of New England. Bob held a faculty position at Yale from 1978 – 1986, he moved to Virginia Tech in 1986.



Floyd F. Sabins

Floyd F. Sabins Jr '55 was an American petroleum geologist, educator and author who was a pioneer in the development, application and advocacy for the field of geological remote sensing.
Floyd was born on January 5, 1931 in Houston Texas and graduated from the University of Texas at Austin in 1952 with a B.S. in Geology and went on to earn a PhD in Geology from Yale University in 1955. He met his wife Janice in New Haven, Connecticut while studying at Yale and they married on October 2, 1954.

Floyd and Jan had 2 children, Barbara and Edward. Floyd loved his family and was a proud grandfather to 4 grandsons, Robert and Eric Belfield and Connor and Spencer Sabins.
Floyd worked for Chevron in La Habra, California for 37 years and was fortunate to travel the world and work on many projects. He was proud to be

IN MEMORIAM

on the discovery teams for Chevron's prospects in the North Slope of Alaska, and the Hawtah Trend complex, Raghib Oil Field and Dilham Oil Fields in Saudi Arabia. He was also a key player in the exploration success at the Hedinia and Agogo Oil Fields in Papua New Guinea.

Floyd's parallel career within Chevron's mineral division was no less impressive. He worked on the discovery teams for copper deposits at Ujina and Collahuasi in northern Chile as well as the El Penon gold deposit also in Chile. Significant discoveries were also made by Floyd and the Chevron team for boron and lithium deposits at Salar de Uyuni in Bolivia along with multicommodity exploration targeting using remote sensing in Peru and Mexico.

Following retirement from Chevron, Floyd remained active as a consultant for private and government agencies. Notably, from 2010 to 2013, supported by the US Dept. of Defense and the USGS, Floyd guided processing and interpreted multispectral and hyperspectral imagery of over 25 sites across Afghanistan, finding new mineral exploration targets to promote economic development.

Floyd became involved in the higher educational system starting as an Adjunct Professor in 1966 in the Geological Sciences Department, University of Southern California and later as a Regent's Professor with the Earth and Space Sciences Department at UCLA in a teaching role concurrent with his Chevron position.

He was a giant among other remote sensing experts and an entertaining field guide for trips to remote sensing sites in the western United States. He led many field trips under the auspices of the Geological Society of America, ERIM, NASA and JPL to classic test sites including Cuprite, Virginia City, Yerington and Death Valley often giving insightful presentations on the outcrop with imagery on display.

One of Floyd's other lasting professional contributions includes the landmark book entitled "Remote Sensing Principles and Interpretation" first published in 1978 at the dawn of earth looking satellite technology. It was the first textbook on the subject of geological remote sensing at university level.
Subsequent editions of the text won critical acclaim as one of the top five geoscientific books in print and is still considered the gold standard of geological remote sensing textbooks along with a detailed laboratory manual that has been used by multiple generations of teachers and students world-wide. Floyd was nearly finished completing the 4th edition of his landmark text with co-author Jim Ellis and it will be published later this year.
Floyd received a number of honors and professional awards notably the William T. Pecora Award by NASA and U S Department of Interior in 1983 for "His outstanding contributions in education, science, and policy formulation to the field of remote sensing." This award is the highest recognition in the field of remote sensing in the United States. A decade later in 1993 Floyd received the Chevron Chairman's Award for "His contribution to the discovery of a major copper deposit in Chile." This is Chevron's highest achievement award.
With all of his professional and academic accomplishments, Floyd always considered himself first and foremost a field geologist, due to his early training at the University of Texas and during his dissertation while at Yale mapping the Cochise Head Quadrangle in southeast Arizona.
In his spare time Floyd loved to fish and travelled the world to many exotic and storied fishing spots with each photo of his catches becoming larger and more colorful than the last. He volunteered for many organizations including Trout in the Classroom, St Jude Hospital, the Southern California Bluebird Club and MADD to name a few.
He was especially proud of growing and maintaining his impressive collection of fern plants in his back yard.

Floyd will be greatly missed by family, friends and colleagues. He is an inspiration to all those who follow the career path of geological remote sensing and those who aspire to a life well-lived.

RECENT AWARDS AND HONORS: FACULTY


Dave Bercovici

Dave Bercovici, the Frederick W. Beinecke Professor and Chair of Earth & Planetary Sciences, was elected to the National Academy of Sciences in 2018 and inducted in 2019. Members are elected to the National Academy of Sciences in recognition of their distinguished and continuing achievements in original research. Membership is a widely accepted mark of excellence in science and is considered one of the highest honors that a scientist can receive.

Dave was also elected to the Connecticut Academy of Science and Engineering. He was inducted at their annual dinner on May 28, 2019.


Bhart-Anjan Bhullar

Bhart-Anjan Bhullar, Assistant Professor, was the recipient of an American Association of Anatomists Young Investigator Award in April 2018. The award recognizes investigators in the early stages of their careers who have made important contributions to biomedical science through research in the morphological sciences.


Derek Briggs

Derek Briggs, the G. Evelyn Hutchinson Professor of Earth & Planetary Sciences and **Shun Karato,** the Knopf Professor of Earth & Planetary Sciences, were elected to the American Academy of Arts & Sciences, Derek in 2019 and Shun in 2020. The Academy was founded in 1780, during the American


Shun Karato

Revolution, by John Adams, John Hancock, and 60 other scholar-patriots. Membership recognizes the outstanding achievements of individuals in academia, the arts, business, government and public affairs. Derek and Shun join a distinguished group that includes Benjamin Franklin, Albert Einstein, Martin Luther King, Vera Rubin, Barack and Michelle Obama and Yale President Peter Salovey.

Derek was also awarded the Lapworth Medal in February 2020, the most prestigious honour bestowed by the Palaeontological Association, awarded to a paleontologist who has made a significant contribution to science via a substantial body of research.


Alexey Fedorov

Alexey Fedorov, Professor, was named a 2018 Guggenheim Fellow. Guggenheim Fellows are appointed on the basis of impressive achievement in the past and exceptional promise for future accomplishment.


Maureen Long

Maureen Long, Professor, was selected as one of the 2020 finalists for the prestigious Blavatnick National Award for Young Scientists. The Awards were originally founded in 2013 and administered by the New York Academy of Sciences, to elevate the work and research of early-career scientists. The Awards recog-

RECENT AWARDS AND HONORS: FACULTY

nize the past accomplishments and future promise of the most talented faculty-rank scientists and engineers aged 42 years and younger at America's top academic and research institutions.

Maureen was also awarded Yale's Graduate School Graduate Mentor Award for the Natural Sciences. The Graduate Mentor Award recognizes faculty members who have been exceptional in their support of the professional, scholarly, and personal development of their students. It is the University's principal award for superb teaching, advising and mentoring of graduate students.


Juan Lora

Juan Lora, Assistant Professor, was the recipient of the Ronald Greeley Early Career Award in Planetary Sciences from the AGU in 2020. The Ronald Greeley Early Career Award in Planetary Sciences is presented annually and recognizes significant early-career contributions to planetary science.


Noah Planavsky

Noah Planavsky, Associate Professor, received the 2018 F.W. Clarke Award from the Geochemical Society. The Clarke Award is the Geochemical Society's premier award for an early-career geochemist.

In 2019, Noah was also presented with the S. George Pemberton Award from the International Geobiology Society. This award is presented to an early career scientist for significant achievements in geobiology.


Ellen Thomas

Ellen Thomas, Senior Research Scientist, has been elected to the GSA Fellowship. She was honored at the Presidential Address and Awards Ceremony at the GSA Annual Meeting in Phoenix, Arizona on September 22, 2019.


Mary-Louise Timmermans

Mary-Louise Timmermans, Professor, received the President's Early Career Award for Scientists and Engineers in July 2019. The PECASE is the highest honor bestowed by the United States Government to outstanding scientists and engineers who are beginning their independent research careers and who show exceptional promise for leadership in science and technology. In addition, she was named the Harald Sverdrup Lecturer, one of the major section lectures at the American Geophysical Union in August 2019. Finally, Mary-Louise was named the Damon Wells Professor of Earth and Planetary Sciences in the Yale Faculty of Arts and Sciences, in August 2020.


John Wettlaufer

John Wettlaufer, the A.M. Bateman Professor of Geophysics, Mathematics & Physics, was elected as a Fellow of the American Geophysical Union in 2019. The AGU elects members as fellows whose visionary leadership and scientific excellence have fundamentally advanced research in their respective fields.

RECENT AWARDS AND HONORS: STUDENTS


Sarah Arveson

Sarah Arveson, in May 2018, was the recipient of the CT Space Grant Graduate Research Fellowship. This award, the second for Sarah, supported her work on the behavior of sulfur at extreme conditions, as it applies to Jupiter's moon Io and other S-rich planetary bodies.

Sarah was also awarded an Outstanding Student Presentation Award (OSPA) in the Mineral and Rock Physics (MRP) section at the 2018 AGU Fall Meeting. Sarah's presentation was titled "Evidence for Liquid Immiscibility in the Fe-Si-O System at Deep Earth Pressures."
In addition, Sarah was also the recipient of AGU's SEDI (Study of Earth's Deep Interior) Section Award for Graduate Research in 2020. The award is presented annually to one or two graduate honorees for their notable contributions.


Neala Creasy

Neala Creasy was a recipient of the 2019 Graduate Research Award from the Study of the Earth's Deep Interior Section of the American Geophysical Union, based on her work on the structure and dynamics of the deep mantle.
Neala was also recently named as a National Science Foundation Postdoctoral Fellow, based on her proposal "Shear Wave Splitting based on 3D Seismic Wave Simulations: Forward to Inverse Modeling of Upper Mantle and D" Anisotropy."
She is carrying out her postdoc work at the Colorado School of Mines.

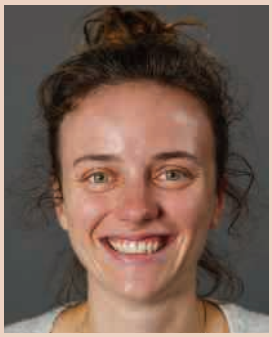
Liz Clark won the Division of Invertebrate Zoology (DIZ) Best Student Oral Presentation Award. Each year the DIZ at The Society for Integrative and Comparative Biology receives numerous entries for its Best Student Oral Presentation Award. Liz's presentation "Insights into the Control Setup underlying the Resilient Decentralized Locomotion of Brittle Stars" was selected as the winner of the 2018 competition.

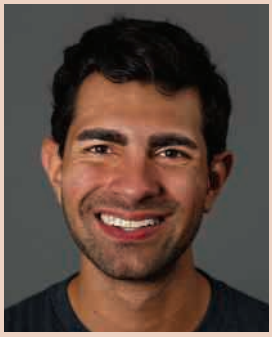

Liz Clark


Jie Deng

Jie Deng was a 2018 recipient of AGU's Study of the Earth's Deep Interior Graduate Research Award, based on his work on melting of Earth materials at deep Earth conditions.

Erica Evans received a 2019 YIBS Small Grants Program, Doctoral Pilot Award for her project "Investigating the influence of ice sheet substrate on accelerated melting: Faster flows on bedrock or regolith?"


Erica Evans


Caleb Gordon

Caleb Gordon was awarded a Graduate Research Fellowship from the National Science Foundation in April 2020. He is one of eight paleontology students in the United States to receive the award this year. This fellowship will support his research in Anjan Bhullar's lab on the developmental evolution of the limb in aquatic reptiles.

Meng Guo was awarded an Outstanding Student Presentation Award (OSPA) in the Volcanology, Geochemistry, and Petrology (VGP) section at the 2019 AGU Fall Meeting in San Francisco. Meng's presentation was titled "Argon Constraints on the Growth of Continental Crust and Its Composition."


Meng Guo

RECENT AWARDS AND HONORS: STUDENTS

Ulla Heede has been awarded the NASA Future Investigators in NASA Earth and Space Science and Technology (FINESST) fellowship for her project titled: "Mechanisms of Changes in the Tropical Pacific Mean State and Walker Circulation in Response to Global Warming: Satellite-Based Observations Versus Climate Models."

Ulla Heede

Alexie Millikin

Alexie Millikin received a 2019 grant from the Lewis and Clark Fund for Exploration and Field Research for her project "Timing, Tempo & Drivers of Tonian (1000-720 Ma) Eukaryotic Diversification: Insights from the Radiogenic Isotope Record of Nordaustlandet, Svalbard."

Nicole Shibley

Nicole Shibley was awarded a 2018 Harriet Evelyn Wallace Scholarship from the American Geosciences Institute. Nicole is studying the dynamics of the Arctic Ocean. Her research combines theory and observations to investigate ocean mixing processes that are responsible for vertical heat fluxes towards the overlying sea ice cover. Her research is further supported by the Department of Defense through the National Defense Science and Engineering Graduate Fellowship Program.

Daniel Smith, along with his advisor **Bhart-Anjan Bhullar,** won a 2018 Vizzies People's Choice award for photography from the National Science Foundation. The Vizzies, sponsored by NSF and Popular Science magazine, honor scientific visualizations that help people around the world to better understand scientific ideas and phenomena.

Daniel Smith

Emily Stewart

Emily Stewart is the recipient of an Outstanding Student Presentation Award in the Volcanology, Geochemistry, and Petrology (VGP) section at the 2019 AGU Fall Meeting in San Francisco. Her presentation was titled "Decarbonation of the subducting slab: observational constraints from the Cycladic Blueschist Unit, Greece."

Chris Whalen

Chris Whalen was given the NAPC Best Talk Award at the 11th Meeting of the North American Paleontological Convention in Riverside, CA in June 2019. The award was for the best student presentation at the meeting.

Bowen Zhao was the 2019 recipient of a NASA Earth and Space Science Fellowship. The title of her research proposal was "The role of cross-equatorial winds in ENSO dynamics revealed by satellite-based observations and numerical experiments."

Bowen Zhao

STUDENT NEWS: UNDERGRADUATE & PhD

G&G Graduating Seniors, Class of 2018

Ariege Besson
Advised by: Ron Smith
Weighing Earth, Tracking Water: Hydrological Applications of Data from GRACE Satellites

Theo Kuhn
Advised by: Jay Ague
Al-in-Hornblende Barometry of Southern New England Intrusions and Comparison with Metamorphic Bathograds

Holden Leslie-Bole
Advised by: Alexey Fedorov
Global Climate Impacts of the AMOC Slowdown Caused by Arctic Sea Ice Decline

Martha Longley
Advised by: Noah Planavsky
Lithium as a Proxy for Silicate Weathering during the Southeast Asian Monsoon

Peter Mahony
Advised by: Mark Brandon
Detrital Zircon Geochronology and Vitrinite Reflectance Analysis of the Cascadia Subduction Complex, Washington

Sophie Ruehr
Advised by: Xuhui Lee
The Oasis Effect: Evaluating Intrinsic Biophysical Mechanism Theory and its Implications for Sustainable Water Management in Zhangye, Gansu, China

Madison Shankle
Advised by: Ron Smith
Global Influences on the Indian Monsoon: Testing Existing Hypotheses with Climate Indices

G&G Graduating Seniors, Class of 2019

Emily Chu
Advised by: Maureen Long
The Relationship of Seismic Hazard and Building Codes in Supercities

Christoph Funke
Advised by: Mary-Louise Timmermans *Computing Pressure Fields Over Laboratory Water Waves using Particle Image Velocimetry Data*

Cerys Holstege
Advised by: Noah Planavsky
Toward an Understanding of Phosphorus Cycling on Waterworlds

Seamus Houlihan
Advised by: David Evans
Paleomagnetism of ca. 750 Ma Syenite Dykes of the Southern Congo Craton, Northern Namibia

Danya Levy
Advised by: Alexey Fedorov
Predicting Past and Future Variations in Global Mean Surface Temperature with a Simple Model

Chenyu Ma
Advised by: Michael Oristaglio
A GIS-based Analysis on the Capacity and Feasibility of Pumped Hydropower Storage Facilities in Tibet

Clara Ma
Advised by: Alexey Fedorov
Arctic Climate Change in Numerical Experiments with Abrupt CO2 Increase

G&G Graduating Seniors, Class of 2020

Nadia Grisaru
Advised by: Alan Rooney
Applying the Re-Os Isotope System to a Survey of Cratonic Bedrock in Northeastern Canada

Lindsay Hogan
Advised by: Ronald Smith
Air-Sea Fluxes in the Western Tropical Atlantic

Arianna Lord
Advised by: Bhart-Anjan Bhullar
Snout Scale Development in Alligator Mississippiensis and the Ancestral Condition of Keratinized Structures in the Reptilian Face

Sofia Menemenlis
Advised by: Juan Lora
Extreme Precipitation and Atmospheric Rivers in a Model of Pliocene Climate

STUDENT NEWS: UNDERGRADUATE & PhD

Daniel Monteagudo
Advised by: Ronald Smith
Satellite-based Permafrost Mapping and Climate Trend Analysis in Northern North America

Trina White
Advised by: Alan Rooney
Macroalgae and sediments as records of seawater 187Os/ 188Os composition in the Long Island Sound

PhD Students, 2018-2020
May 2018

Eric Bellefroid
Advisor: Noah Planavsky
Deciphering the Oxygenation of Earth's Surface: A Combined Carbonate Sedimentological and Geochemical Study of the Mid-Proterozoic
Eric is an Associate at McKinsey and Company.

David Colwyn
Advisor: Mark Brandon
Terrestrial Paleoenvironmental Reconstruction from Mountaintops to Sea
David is a Postdoc at the University of Colorado – Boulder.

Christopher Kruse
Advisor: Ron Smith
Mountain Wave Propagation and Attenuation and Their Influences on Earth's Atmosphere
Chris is a Postdoc at the National Center for Atmospheric Research.

Mengnan Zhao
Advisor: Mary-Louise Timmermans
The Dynamics of Arctic Ocean Mesoscale Eddies and their Role in the Beaufort Gyre Circulation System
Mengnan is a Senior Research Associate, Atmospheric and Environmental Research, Inc (AER).

PhD Students, 2018-2020
December 2018

Yana Bebieva
Advisor: Mary-Louise Timmermans
The Origins and Evolution of Double-Diffusive Layers and Associated Heat Transport in the Arctic Ocean
Yana is a Postdoc at the Geophysical Fluid Dynamics Institute, Florida State University.

Elizabeth Clark
Advisor: Derek Briggs
How to Build a Brittle Star: An Investigation of the Evolutionary History, Morphological Features, and Integrated Systems underlying Ophiuroid Locomotion
Liz is a Postdoc in Forestry & Environmental Studies at Yale.

Devon Cole
Advisor: Noah Planavsky
A Toolkit for Tracking Earth's Oxygenation
Devon is a Postdoc at Georgia Tech.

Kierstin Daviau
Advisor: Kanani Lee
High-Pressure and High-Temperature Experimental Investigation of SiC and Related Systems: Implications for Carbon-Rich Planets
Kierstin is a Postdoc at Harvard.

Katelyn Gray
Advisor: Ruth Blake
Reconstructing Terrestrial Climates using Clumped Isotope Thermometry and Phosphate Oxygen Isotopes from Gar Scales
Katelyn is an Adjunct Professor at Austin Community College.

Shineng Hu
Advisor: Alexey Fedorov
El Nino Diversity, Intraseasonal Wind Bursts, and Decadal Climate Change
Shineng is a Postdoc at Scripps Institution of Oceanography.

Azusa Takeishi
Advisor: Trude Storelvmo/Ronald Smith
Simulations of Aerosol Effects on Deep Convective Clouds: Sensitivity to Model Representations of Aerosoland Cloud-Microphysical Processes
Azusa is a Postdoc at the Laboratoire d'Aérologie in Toulouse, France.

Yiqi Zheng
Advisor: Nadine Unger/Ronald Smith
Linking the Land Biosphere with Atmospheric Chemistry and Climate: Plant Volatile Emissions and Organic Aerosol
Yiqi is a Postdoc at the University of Alaska Fairbanks.

STUDENT NEWS: UNDERGRADUATE & PhD

PhD Students, 2018-2020 May 2019

Robin Dawson
Advisor: Celli Hull
The Cretaceous Greenhouse: Applications of Clumped Isotopes
Robin is a Postdoc at the University of Massachusetts, Amherst.

Jie Deng
Advisor: Kanani Lee
Melting of Earth Materials: Constraints from both Experiment and Density Functional Theory
Jie is a Postdoc at UCLA.

Anwar Mohiuddin
Advisor: Shun Karato
An Experimental Study of Grain-Size Evolution and its Rheological Consequences during the Phase Transitions in Olivine to its High-Pressure Polymorphs
Anwar is working in the Technology Department at Intel.

Holger Petermann
Advisor: Jacques Gauthier
Life-History Studies on Squamates from the Mojave and Colorado Deserts of California as a Test for Paleoecological Application of Skeletochronology
Holger is a Research Associate with the Denver Museum of Nature and Science.

James Super
Advisor: Celli Hull
Organic Proxy Reconstructions of Warm Past Climates
James is Associate Editor at Nature Geoscience.

PhD Students, 2018-2020 December 2019

Neala Creasy
Advisor: Maureen Long
Investigation of Lower Mantle Seismic Anisotropy and Heterogeneity Via Seismic Observations and Mineral Physics Experiments
Neala is a postdoc at the Colorodo School of Mines

Chhavi Jain
Advisor: Jun Korenaga
Improving Constraints on Olivine Rheology Through the Reanalysis of Experimental Deformation Data and Geodynamic Modeling
Chhavi is a postdoc at the Washington University in St. Louis.

Varun Murthy
Advisor: Bill Boos/Ronald Smith
The Role and Control of Moist Convection in Tropical and Monsoon Depressions

Terry Tang (Isson)
Advisor: Noah Planavsky
On the Co-Evolution of Life and Planetary Climate Stability
Terry is a faculty member at the University of Waikato.

PhD Students, 2018-2020 May 2020

Janet Burke
Advisor: Pincelli Hull
Physiological and Ecological Implications of Planktonic Foraminiferal Test Morphology
Janet is a postdoc at Michigan State.

PhD Students, 2018-2020 December 2020

Sarah Arveson
Advisor: Kanani Lee
Experimentally Determined Material Properties at Extreme Pressures and Temperatures: Applications to Earth's Core
Sarah is a postdoc at Berkeley.

Christopher Whalen
Advisor: Derek Briggs
Macroevolutionary, Phylogenetic, and Paleoecological Patterns in the Paleozoic Water Column, with an Emphasis on Early Deuterostomes and Cephalopods
Chris is a postdoc at the American Museum of Natural History and Yale.

POSTDOC NEWS

Annie Bauer

Annie Bauer was a Postdoctoral Associate working with Alan Rooney from 2017-2019, she received the Simons Collaboration on the Origins of Life Postdoctoral Fellowship in 2018. The fellowship supports independent research topics related to the origins of life. The title of her proposal was: *The Dynamics of the Lomagundi-Jatuli Excursion and Implications for Early Life.* Annie is currently an Assistant Professor in the Department of Geoscience at the University of Wisconsin-Madison.

Luke Parry was a YIBS Donnelley postdoctoral fellow working with Derek Briggs on early animal evolution from 2018-2020. Luke's fellowship work focused on fossils from Paleozoic of China and North America, including the oldest annelid worms. Luke is currently an early career teaching and research fellow at St. Edmund Hall, University of Oxford.

Luke Parry

Drew Syverson

Drew Syverson *was a Flint Postdoctoral Fellow working with Noah Planavsky and Alan Rooney from 2017-2019. In 2018, Drew attended training at the East Pacific Rise. He had the opportunity to use HOV Alvin, the submersible, which was "an enlightening experience". For more information: http://csw2018.unols.org/*

Bin Wen was a Postdoctoral Associate working with David Evans from 2016-2019. The title of his research was: Paleomagnetism and tectonic history of Tarim and Alxa terranes, central Asia. Bin also worked on the topic of "Ediacaran kinematics of the West Avalonia (Newfoundland, Canada) and its implications for the final formation of West Gondwanaland". Currently, Bin is an Appointed Professor (Young Talent Program of CUG) in the School of Earth Sciences at China University of Geoscience Wuhan (CUG-W).

Bin Wen

RETIREMENT: RON SMITH

Ronald B. Smith

Ronald B. Smith retires, July 2020

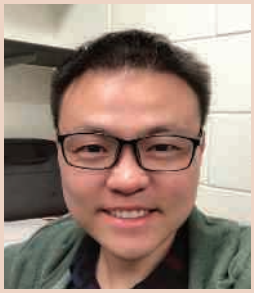
The following text, prepared by Jeff Park, was read by Graduate School Dean Lynn Cooley at the final faculty meeting of 2020.

Ronald Smith. Bachelor of Aeronautical Engineering, Rensselaer Polytechnic Institute, M.S., Princeton University, Ph.D. The John Hopkins University, a titan in the field of dynamic meteorology. Also one of the grand figures in science at Yale where, at his retirement this June, he will have been a professor for forty-four years. Ron served as Lead or Mission Scientist on numerous meteorological field projects. He is a long-standing Fellow of the American Meteorological Society, and has been honored with the Society's Mountain Meteorology Award and their Jules Charney Award. Here at Yale, in 2012 you were awarded the Harwood F. Byrnes/Richard B. Sewall Teaching Prize for the teacher who "has given the most time, energy and effective effort" to educating undergraduates. You have mentored dozens of developing researchers in meteorology, not only graduate students and postdoctoral fellows, but undergraduates as well, many of them now distinguished in their fields.

Your scientific career centered on the problem of how mountains influence the winds that attempt to flow above and around them. How does a high topography influence the pattern of rainfall in the surrounding lands? What are the dynamics of uplift, condensation and precipitation? Many of your field projects addressed these questions in far-flung locations: Mount Blanc in the French Alps, St. Vincent and Dominica in the Lesser Antilles, the Sierra Nevada, and New Zealand. Your own certification as a pilot aided these studies, and they form the sustaining vortex of your contributions to atmospheric science. A number of other research topics have spun out from your central interests. As a junior professor, you made major contributions to the nonlinear theory of rock deformation. In mid-career you pioneered the use of stable-isotope geochemistry in meteorological research, and have made important contributions in the applications of satellite remote-sensing data. Your imagination spanned the gap between mathematical theory, field measurements, and interdisciplinary collaboration. You founded the Center for Earth Observation at Yale, collaborating with other Yale College departments, Yale's Institute for Biospheric Studies and the School of Forestry and Environmental Studies. Along the way you mentored numerous PhD graduate students, such as Benjamin Zaitchik, Vanda Grubisic, Eric Salathe Jr., and Alison Nugent.

At Yale you have taught the introductory course G&G 140a on atmospheres, ocean and climate for as long as anyone can remember. This course was an erstwhile favorite of the Yale Sailing Team and now serves as a key core-course of Yale's interdisciplinary Environmental Studies Major. You originated G&G/EVST 362/562, Observing Earth From Space, exposing undergraduate, masters' and PhD students to hands-on use of remote-sensing data. You later taught courses in sustainable energy and wind power in support of Yale's Energy Studies certificate program. You have been a lynchpin of Yale's teaching in environmental and climate science. We will be scrambling to fill your shoes in the coming years.

VISITORS


Minmin Cai

Minmin Cai, Associate Researcher from the Huazhong Agricultural University visited in 2019-20, he was working with Ruth Blake on the degradation of organic pollutions and isotopic analysis.


Lidong Dai

Lidong Dai, Professor, Chinese Academy of Sciences visited in 2019-20, working with Shun Karato. His research is focused on the electrical conductivity of hydrous Ti-doped synthetic olivine aggregates under conditions of high temperature, high pressure and different oxygen fugacities using the Kawai-1000t multi-anvil apparatus in Karato's high-pressure laboratory.


Luca Martin Fennell

Lucas Martin Fennell, Postdoctoral Fullbright Fellow, specializes in tectonics and structural geology, he graduated from the University of Buenos Aires in Argentina, and is currently an Assistant Researcher working for CONICET at the Institute of Andean Studies "Don Pablo Groeber" (IDEAN) at the University of Buenos Aires. In 2019 he worked with Mark Brandon analyzing the topographic evolution of the Southern Central Andes at 35°S by using stable isotope paleoaltimetry of hydrated volcanic glass and organic molecular proxies contained in foreland terrestrial sediments. The main goal of his research at Yale was to understand how the Andes' topography changed during the Cenozoic and when they attained their current size, as well as analyzing the contribution of climate to the stable isotope composition of water contained in both proxies through time.


Tim Gibson

Tim Gibson, Postdoctoral Fellow visiting from Dartmouth College in 2019-20 and working with Alan Rooney. Tim is a field geologist broadly interested in reconstructing Earth's history using its sedimentary record. His research combines sedimentology, stratigraphy, geochemistry and geochronology to decipher how interactions between geological and biological processes have regulated our planet's environment through time. He is currently investigating various 1.2 to 0.8 billion-year-old sedimentary basins through the lens of geobiology, with an emphasis on the lower Tonian Veteranen Group in Svalbard. This work aims to shed light on the environmental landscape in which early animals and crown group eukaryotes emerged, and also to test various trigger mechanisms for Cryogenian Snowball glaciation.


Megan Holycross

Megan Holycross, Assistant Professor, Earth and Atmospheric Sciences, Cornell University visited in 2019-20 as part of her National Science Foundation Postdoctoral Fellowship. She worked with Jay Ague to quantify the oxidation state of subducting oceanic lithosphere, focusing particularly on eclogites from the Cyclades subduction complex in Greece

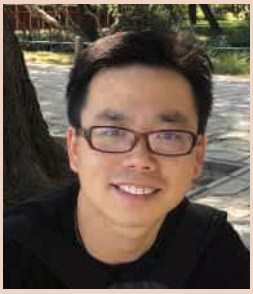

Haiying Hu

Haiying Hu, Associate Professor Institute of Geochemistry, Chinese Academy of Sciences visited in 2019-20 working in the Karato lab. Haiying worked with her collaborator Lidong Dai on experiments that focus on the synthesis and electrical conductivity measurements of olivine with different amounts of doped titanium.

VISITORS


Michael Hren

Michael Hren, Assistant Professor, Department of Chemistry, Center for Integrative Geosciences, University of Connecticut, visited in 2019-20 working with Mark Brandon.


Xianqing Jing

Xianqing Jing, Lecturer in College Resources, Environemnt and Tourism at the Capital Normal University in Beijing, China visited in 2018-19. Xianqing worked with David Evans on the Neoproterozoic True Polar Wander event and its use in the reconstruction of the Rodinia Supercontinent, by conducting paleomagnetic and geochronological studies on strata from South China.

Lei Kang, Lecturer, State Key Laborator of Continental Dynamics, Department of Geology, Northwest University, China is visiting in 2019-20. Lei is working with Shun Karato studying water partitioning among co-existing minerals in the upper mantle using high-pressure experiments.


Lei Kang


Jilei Li

Jilei Li, Associate Professor in the Institute of Geology and Geophysics at the Chinese Academy of Sciences visited in 2018-19. Jilei worked with Jay Ague on high-pressure metamorphism and fluid activity in subduction zones.


Brendan Murphy

Professor **Brendan Murphy** was a Fulbright Visiting Scholar for the winter term of the 2017-2018 academic year. He collaborated with David Evans on the origin of supercontinents, participated in a graduate seminar course organized by Noah Planavsky and Mark Brandon, and attended a memorable undergraduate field trip to southern Spain (photo above), organized by David Evans. He also initiated research projects with Noah Planavsky and Alan Rooney on the origin and potential geodynamic significance of Paleozoic ironstone deposits. Professor Murphy is at the Department of Earth Sciences at St. Francis Xavier University.


Paul Myrow

Paul Myrow, Professor of Geology at Colorado College, visited during February 2020. Professor Myrow is a world-renowned expert in process-based sedimentology, which he uses to tackle a wide range of interdisciplinary topics up and down the geologic time scale, including questions of paleoenvironmental change, geochronology, tectonics, marine biogeochemistry and invertebrate animal evolution. During his visit, he collaborated with Lidya Tarhan on projects involving the lower-middle Paleozoic paleoenvironmental history of the Dinosaur National Monument region. He also gave three short courses to the department on storm-mediated sedimentary processes and deposits, flow dynamics and bedforms, and sequence stratigraphy.

VISITORS


Damian Nance

Damian Nance, Kennedy Distinguished Professor, Department of Geological Sciences, Ohio University, visiting in 2018-2020. Damian writes: Between field work in southern Spain with the G&G 212: Global Tectonics students and frequent speaking trips to the UK, China, Australia (twice) Mexico and here in the US, I have held a Visiting Fellowship at Yale sponsored by David Evans. David and I have known each other a long time and have long been interested in supercontinents and the supercontinent cycle - the notion that Earth history has been punctuated by episodic supercontinent assembly and breakup with profound consequences to the geosphere, hydrosphere, atmosphere and biosphere. But we come to this interest from different directions - David from the field of paleomagnetism and myself from a background in field-based studies of orogenic belts. Ironically, however, the focus of my thinking this past six months has been on an issue over which we disagree - the existence (or not) of the late Precambrian supercontinent Pannotia. Paleomagnetic data for the Ediacaran Period (635-539 Ma), during which this supercontinent is proposed to have amalgamated, is limited. Hence, the paleomagnetic evidence for its existence is equivocal at best. So David is doubtful. But the proxy evidence for its assembly and breakup in the rock record is collectively quite strong. So I am a believer. Only time will tell which of us will gain the upper hand!

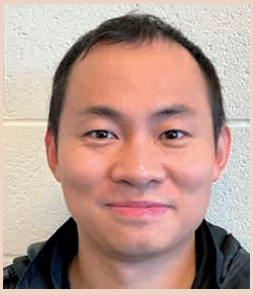

Miriam Reiss

Miriam Reiss, Research Associate, Goethe-University Frankfurt, visited Maureen Long for six months in 2018. Her project was aimed at understanding flow at the base of the mantle beneath Africa. She used differential SKS-SKKS splitting to map lowermost mantle flow with unprecedented resolution. Her work found evidence in support of the idea that large low shear velocity provinces (LLSVPs) are thermochemical piles that are being pushed by remnant slabs, which may induce the formation of mantle plumes at their borders.


Elizabeth Sibert

Elizabeth Sibert, Junior Fellow, Harvard Society of Fellows visited in 2019-20, working with Pincelli Hull. Elizabeth's research focuses on how fish and marine ecosystems respond to global climate changes. She uses the microfossil record of fish and sharks, their microscopic teeth and scales, preserved in deep-sea sediments, to reconstruct marine ecosystem dynamics across major global change events throughout Earth's history, including global warming and mass extinctions, spanning timescales ranging from 100 million years ago to the present. Elizabeth is most interested in how marine ecosystems function, and what types of processes and environmental conditions drive evolution in those ecosystems. At Yale, Elizabeth has been focusing on developing a multi-proxy record of a major and un-described open ocean extinction event, to better understand the structure of today's modern marine ecosystems.

Elizabeth has also been awarded a YIBS Hutchinson Postdoc Fellowship and she will be hosted in EPS for 2020-21.


Changle Wang

Changle Wang, Associate Professor, Precambrian Geology, Institute of Geology & Geophysics, Chinese Academy of Sciences is visiting from 2018-2020. Changle is working with Noah Planavsky on chromium isotopes of Precambrian and Recent carbonates. By comparing the Cr isotopic data of carbonate rocks precipitated during different geological periods, we will use them to discuss the complications when applying fractionated Cr isotopes to indicate oxidative Cr weathering and by inference, the presence of free oxygen in the atmosphere.

VISITORS


Chao Wang

Chao Wang, Associate Professor, Department of Geology, Northwest University in China. visited in 2019-20 working with Dave Evans. Chao's research focuses on applying petrology, geochronology and geochemistry to understand the continental crustal and tectonic evolution of mountain belts, in particular processes associated with subduction zone metamorphism, ophiolite formation and magmatic petrogenesis in western China. He has also worked on continental reconstructions, specifically the Neoproterozoic-Paleozoic palaeogeography and plate tectonics, working mainly in the Central Asia Orogen and Tibetan Plateau regions.

Chao will collaborate with David Evans to work on the late Paleoproterozoic to Cambrian paleogeographic evolution of the Quanji massif located in the northeastern margin of the Tibet Plateau. Well-preserved successions Quanji Group and overlying strata of the Quanji Massif, NW China preserve a rich late Paleoproterozoic to Cambrian stratigraphic record which captures great unconformity, glaciation, early animal evolution, sea level changes, occurrence of black shales, rift-related volcanics and overall sedimentation systems. Through working at Yale, paleogeography and sediment sources of the basin system evolve over this time will be addressed. Also, Neoproterozoic-Paleozoic continental reconstruction of the Proto-Tethys Ocean will be discussed.


Zhaohui Wu

Zhaohui Wu, Engineer, Exploration and Production Research Institute, Shandong China. Zhaohui visited in 2019-20 working with Noah Planavsky. He is working on four "C"s, compiling the database of paleo-environment proxies from nearly 500 references, calculating the paleo-latitudes of outcrops and drilling cores, comparing their relationships with TOC and CIA, and constructing the paleo-environment based on 660+ world-wide sites throughout Paleozoic ages, etc.


Chan Yu

Chan Yu, Lecturer, Hubei University is a Laboratory Associate working with Ruth Blake. Her research focus is on the phosphorus cycle.


James Zachos

Professor **James Zachos,** from the University of California, Santa Cruz was our Richard Foster Flint Lecturer in April 2019. Professor Zachos gave three lectures: Preparing for Future Climate Change: Lessons from the Past; Intensification of the Hydrologic Cycle during the Ecocene Hyperthermals and Trends, Rhythms, and Aberrations in Global Climate during the Cenozoic: A New High-Fidelity Perspective.

YUKON FIELD TRIP 2019

In June 2019, a group of G&G graduate students (led by **Nicole Shibley, Zheng Gong, Alexie Millikin,** and **Erica Evans**) and two faculty leaders (Professors **Mary-Louise Timmermans** and **Alan Rooney**) travelled to Juneau, Alaska and the Yukon Territory of Canada to study the region's geological and environmental processes. The trip loosely followed a route taken by gold prospectors during the Klondike Gold Rush, beginning in Juneau, AK and taking us all the way to Dawson City, YT.

Alexie Millikin, Alan Rooney, Nicole Shibley, Mary-Louise Timmermans, Boriana Kalderon-Asael, Erica Evans, Daniel Gaskell, Zheng Gong, Juri Miyamae, Yu Liang

We started the trip in **Juneau** with a 7-mile hike to the base of the Mendenhall Glacier and were able to see many glacial features along the away. The next day we took a ferry north to **Skagway,** AK and saw whales, porpoises, and seals. Next we made our way from Skagway to Whitehorse, YT, stopping at various rock formations to discuss the local geology. In Whitehorse, we visited the Yukon Beringia Center, a wonderful museum with many fossils from animals from the Ice Age, as well as toured Miles Canyon, where the Yukon River cuts through immense basaltic rock. Then, we took a detour to Kluane Lake Research Station to take measurements of Kluane Lake and hike through the local terrain.

The group began their trip in Alaska's capital city, Juneau, however, no major roads connect Juneau the surrounding area. To reach their next destination the group took a ferry ride to the historic mining town of Skagway. This boat trip coupled as a whale watching and wildlife tour of Alaska's fjords.

YUKON FIELD TRIP 2019

Professor Mary-Louise Timmermans uses Kluane Lake to teach students about ocean currents and stratification at Kluane National Park.

A visit was also made to the Kluane Museum of History, which had exhibits about the **Kluane First Nation** and the region's natural resources.

We next drove to **Keno City** (a town at the end of the Yukon Silver Trail) and toured the nearby **Alexco** mining facility. Here two incredibly knowledgeable guides taught us about silver mining in the region and the company's current exploration efforts.

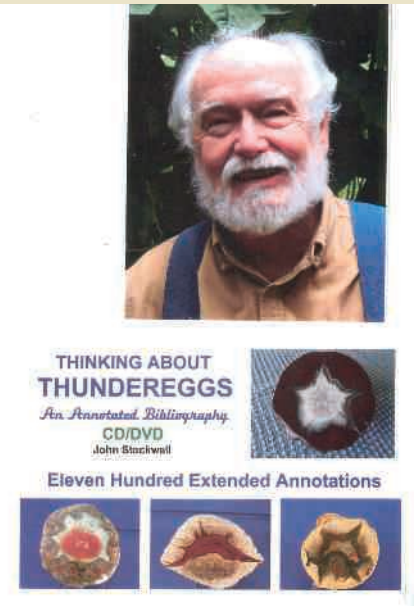
One of the guides from Alexco discussing the local geology near Keno City.

The base of the Mendenhall Glacier near Juneau, Alaska.

Finally, we traveled to **Dawson City** to finish our journey with a visit to **Dredge No. 4** (which was used to mine gold), and to try our hand at gold panning. The trip gave us a better appreciation of the geology and history of the region.

ALUMNI NEWS

John Stockwell, ’57 writes: *Following graduation magna cum laude in1957 I resigned a Stanford fellowship, spent three years in the army, and never got*

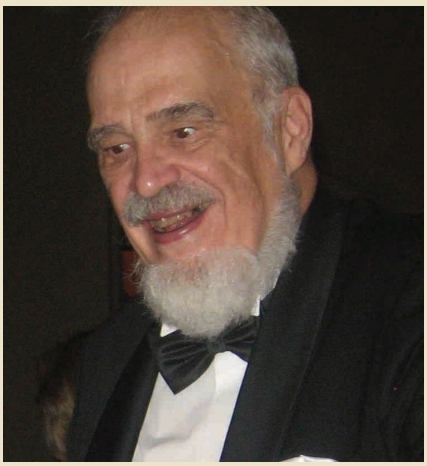


entirely back on track in geology despite some years in the 80’s of exploration with BP Alaska and SOHIO, spending parts of several winters on the Alaskan Arctic coast, including a winter as a wellsite geologist on the Lisburne Field discovery well. While at Yale I was Professor Bateman’s bursary student, assisted Professor Gregory in the field in Utah, and interned with Bear Creek Mining Company in southwest Virginia, and with Cllahan Lead and Zinc in Nevada under Professor Jensen. I made opaque sections while Dan Barker made thin sections nearby. As a senior in 1956-57, in a history of science course, I wrote a long paper attempting to synthesize Wegener’s continental drift theory with the work of Tasmanian geologist S.W. Carey on oroclines. It was suggested I publish, but I declined, thereby missing perhaps becoming a very minor footnote in the history of the theory of plate tectonics. (A few years ago I learned that a year later Carey had himself addressed the subject.)

But an interest in philosophy, along with counterculture enthusiasms, also occupied me during those years and for many after. When I became involved with geology again later, initially as a rockhound, I began to follow the careers of my classmates: Hopson at Chicago, Swinchatt and McClellan at Colgate, Wilde at UC Berkeley, McKee at the USGS, Guidotti at Maine, and also Holdaway, ’58. I became active in the Northern California Geological Society. In 2013, the oldest student earning degrees in any field that year, I received a Master’s in geology from California State University East Bay. I remain enthusiastic, and have become an internationally known student of thundereggs, over the past twenty years presenting papers at the American Gemmological institute, at the Colorado School of Mines before the Friends of Mineralogy group, and at several other symposia on agate and cryptocrystalline quartz. I am nearing completion of an eleven hundred entry annotated bibliography of the literature on thundereggs.

Some regrets, yes, but satisfactions as well.

Edward (Ted) W. Lollis, ’59 recalls George Devries Klein G ‘60: *I started Yale in 1955 and wanted to major in geography, but Yale didn’t have a geography major, so I turned to geology which required attending a summer camp, but Yale didn’t have summer camp, so I turned to MIT, whose geology camp was in Nova Scotia. After two courses, summer students were farmed out to do field work under a graduate student, and I was sent (with MIT student David Waldbaum) to Digby Neck on the Bay of Fundy to help George measure Triassic “red beds”*



Edward Lollis

(similar to those of New Haven and the Connecticut River valley). The three of us lived together in a boarding house for a month and got to know each other REAL well. Of course, I also later knew George at Yale.

When I graduated from Yale in 1959, I received admission to Princeton graduate school and a Fulbright scholarship for a year in Australia. As I traveled back to Princeton via India (and a zillion other countries) I decided to abandon geology, serve my

ALUMNI NEWS

army commitment (stemming from Yale ROTC), and apply to become a US Foreign Service Officer (which I did, ending my government career as Consul General in Bordeaux, France).

Map Misadventure
By Edward Lollis '59
In the spring of 1958, I saw a circular announcing an annual competition for the best use of maps in a paper by a Yale undergraduate. Having just completed an inch-thick paper entitled "Geology of Digby Neck and Long and Brier Islands, Nova Scotia," I entered the competition, submitting a copy of my paper, as instructed, to the curator of maps at Sterling Library. Some weeks later, I was informed that I had won the competition and was asked to come to the library to meet the curator, Alexander O. Vietor, which of course I was thrilled to do immediately.

Mr. Vietor congratulated me, and we settled in for a friendly chat, which I assumed would be about my paper, my major (geology), and my love of maps. Yale required geology majors to attend a summer geology camp but had no camp of its own. So I had attended MIT's camp in Nova Scotia and must have done OK because I was awarded a small grant by the Nova Scotia Research Foundation to return the following summer to study Digby Neck, etc. and write a technical paper. I was justly proud of this international honor.

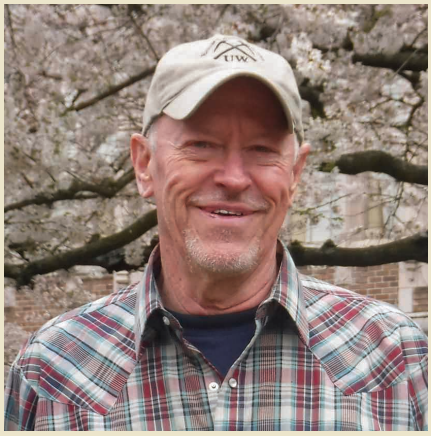
But no. Something I said to Mr. Vietor – perhaps mentioning that I was working on another long paper with even more maps – "Geology of Stony Creek and Thimble Islands, Connecticut (Long Island Sound)" – caused Mr. Vietor to interrupt our conversation with a start. "When will you complete that paper?" he asked. "In 1959," I replied. "You mean you'll still be an undergraduate next year...you're just a junior now?" "Yes," I said, not suspecting what was about to happen. "Then you can't receive this year's map prize. It's only for seniors!"

I should have asked to see the circular which I swore contained no assertion that "undergraduate" meant "seniors only." But I was so startled in the presence of the great man that I simply bit my lip and slunk away. I was not able to submit my second paper to the 1959 competition, as I was still working on it right up to graduation week.

Mr. Vietor's long career at Yale (1943-1978) had its challenges. In 1965, Yale accepted the "Vinland Map" of North America, declaring it to be "the greatest treasure in the Yale map collection." In 1974 the University was forced to admit the map a forgery. It is still part of the Yale collection, an object of forensic analysis and interpretation as to its provenance.

I did not become a professional geologist, instead, upon an epiphany in India in 1961 that I preferred people to rocks, I joined the federal government as a career Foreign Service Officer, beginning in Kigali, Rwanda – responsible for consular, economic, USAID and USIA projects, road and water systems. I witnessed the beginnings of genocide in 1964 and gave my first oration in French about Martin Luther King's "I have a dream" speech. My career continued to assignments in seven other countries, concluding as Consul General in Bordeaux, France.

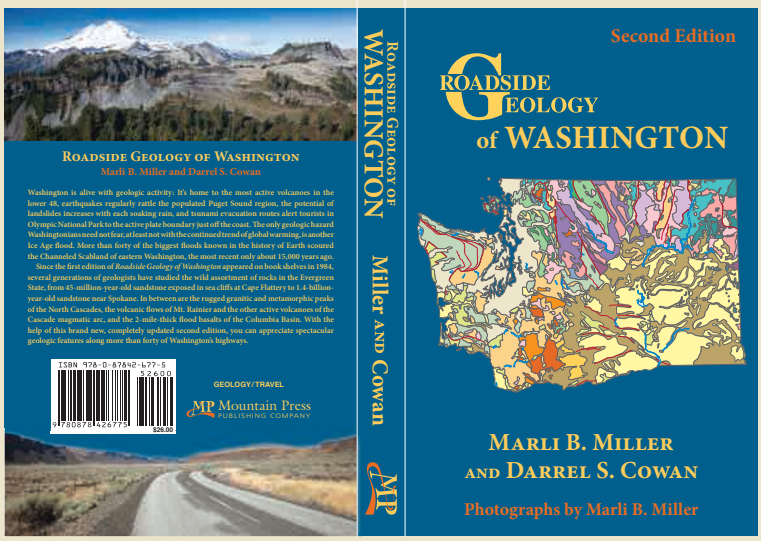
In retirement, I reverted to my love of maps, opening a retail map store in Washington's restored Union Station learning how to use a desktop Geographic Information System (GIS), and becoming a geographic consultant to corporations. Today I combine my knowledge of geography and desire for world peace to help bring about public awareness of peace monuments in all parts of the world.



Darrel Cowan

Darrel Cowan, a G&G graduate student from 1966-67 writes:
In September 2017, I retired from the Department of Earth & Space Sciences in the University of Washington, where I have been a faculty member since 1974. I co-chaired the local committee for the October 2017 annual meeting of GSA in Seattle. With lead author Prof. Marli Miller, my former Ph.D. student who teaches in the University of Oregon, I published the second edition of "Roadside Geology of Washington."

ALUMNI NEWS



Darrel Cowan's book "Roadside Geology of Washington."

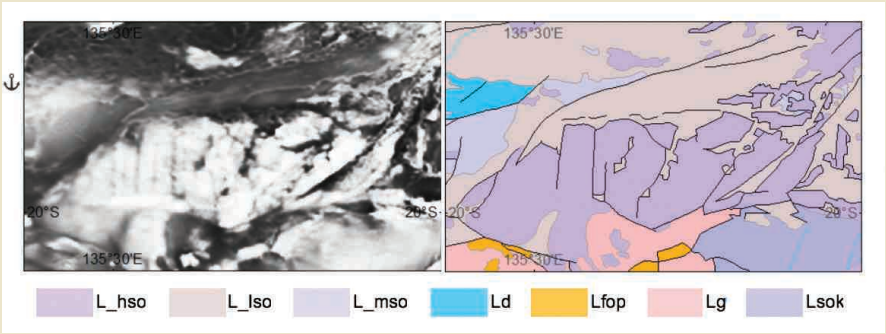
Alister Stewart

Alastair Stewart G '70 writes:
Over the past three years, I've been making solid-geology maps of northern Australia as part of a project to encourage mineral exploration companies to drill through the desert sands, alluvial plains, etc., that cover about 80 percent of the continent. The maps comprise four separate layers, which successively show Mesozoic, Paleozoic, Neoproterozoic, and Pre-Neoproterozoic rocks – major unconformities formed across much of Australia at the beginning of these times. Australia now has a complete and seamless total magnetic intensity (TMI) image of its land mass, some 7.7 million km2, almost all of it derived from closely spaced flight lines flown at low altitude. The layers are prepared by extending the geological formations shown on published 1:250 000-scale quadrangle mapping by interpretation of the half-vertical derivative of the TMI image, together with all other available data. So far, I have made solid geology maps of 1.2 million km2 of the continent.

The left half (65 km wide) of the accompanying figure shows the half-vertical derivative of the TMI image of part of central Australia, and the right half shows the solid-geology interpretation of the same area. North-block-east displacement along wrench faults in the north broke and rotated rectangular blocks of Paleoproterozoic rock (L_hso); the deformation increased eastwards and gradually destroyed the blocky shapes, forming a mega-breccia. The labels use L for Paleoproterozoic, a second letter for rock type (d – mafic intrusive rocks, f – felsic volcanic rocks, g – granite, s – siliciclastic rocks, _h – strongly magnetic rocks, _m – moderately magnetic rocks, _l – weakly magnetic rocks) and subsequent letters for the province/group/formation name (where applicable).

It took nearly 45 years, but **Gary Feulner M. Phil. 1974** *has finally made profitable use of his geological education, serving as local consultant to a small museum in Sharjah, United Arab Emirates, devoted to the geology of the Hajar Mountains of Eastern Arabia, dominated by the obduction of the Semail nappe, a 500 km slab of ophiolite.*

Gary practiced law in the UAE for more than 30 years but also kept up an active program of wide-ranging exploration and natural history studies in the UAE and neighboring Oman.
In semi-retirement in Dubai since 2010, he has devoted much of his time to expanding and publishing the results of those studies, including definitive surveys of the freshwater fish, freshwater snails, land snails and dragonflies of the UAE and northernmost Oman, as



Alister Stewart's solid-geology map of Northern Australia

ALUMNI NEWS

well as the flora of the mountains of the Musandam peninsula (the Ru'us al-Jibal) and the flora of the extensive ultrabasic environment of Wadi Wurayah National Park, in the northern Hajar Mountains of Fujairah, UAE. He has also published popular accounts of the geology of the UAE. Most recently Gary co-authored an introductory catalogue of the UAE spiders. He is currently completing, as lead author, an account of the butterflies of the UAE.

Gary Feulner

Meghan Miller '79 writes:
I am wrapping up my decade+ of service as President of UNAVCO in Boulder, an NSF Large Facility that supports university investigators who use GPS, GNSS, lidar, and other modern geodesy tools in their research. In fact, I have been the only female lead of the NSF Large Facility for

Meghan Miller

most of this time! This is progress, although somewhat paltry I'm afraid. This work followed a few decades in research and academia. I was deeply gratified to be recognized by the American Geophysical Union last December with the 2018 Waldo E. Smith Award for extraordinary service to geophysics. I plan to retire at the end of September, although I will continue some longer-term professional service commitments for the next few years. As to what I will do with my time, my daughters are now far flung (Chile and the northeast) and I am also ready for some adventure travel and other pastimes!

Susan Kidwell G '82 in recognition of her extraordinary achievements is honored by the Yale Graduate School of Arts and Sciences with it's highest award, the Wilbur Lucius Cross Medal The medal recognizes distinguished achievements in scholarship, teaching, academic administration and public service, areas in which the legendary Dean Cross excelled. On October 7, 2019 Susan spent the day with the department meeting with students, faculty and postdocs, and giving a talk titled: "Our New Understanding of Dead-Shell Assemblages: A Powerful Tool for Deciphering Human Impacts." Susan received the medal at a gala dinner at the British Art Center.

Susan Kidwell and Peter Salovey

Bhart-Anjan Bhullar, Jacques Gauthier, Noah Planavsky, Mary-Louise Timmermans, Susan Kidwell, Mark Brandon, Tamar Gendler, Maureen Long, David Bercovici, Peter Salovey at the British Art Center Gala

ALUMNI NEWS

Michael Mann

Michael Mann G '98, Distinguished Professor of Atmospheric Science and Director of Penn State's Earth System Science center has been elected to the National Academy of Sciences. Recognizing distinguished and continuing achievements in original research. Membership in NAS is one of the highest honors given to a scientist or engineer in the United States.
Michael was also awarded the 2019 Tyler Prize for Environmental Achievement. Founded in 1973, the Tyler Prize — often referred to as the "Nobel Prize for the Environment" — remains the premiere international award for environmental science.
Mann shares this honor with fellow climate scientist Warren Washington, distinguished scholar at the National Center for Atmospheric Research.
One of the things that makes this award special for me is sharing it with a personal hero of mine, Warren Washington, an illustrious graduate of our program here at Penn State who has contributed fundamentally to the field of climate modeling, said Mann. Mann is honored with this award not only for his research in reconstructing the Earth's past climate and placing modern climate change in a long-term context, but also for his communication and outreach efforts. This award means a lot to me because it recognizes the two things that are most near and dear when it comes to my work and that's contributing both to the advancement of our science and the effort to communicate that science to the public and policymakers, Mann said. Mann is a recognized expert and is often called upon by the U.S. media to answer questions about complicated climate science topics.

Claire Bucholz '09 has been honored with the 2020 Hisashi Kuno Award from the American Geophysical Union. The award is presented to an early career scientist for outstanding contributions in the fields of volcanology, geochemistry, and petrology. She is an Assistant Professor at the California Institute of Technology.

Kimberly Lau '09 has been named the 2019 recipient of the Geological Society of America's (GSA) Doris M. Curtis Outstanding Woman in Science Award. The accolade was created to recognize women who have impacted geosciences in a major way based on their doctoral research, and it is given in memory of a pioneer in the field. Lau is an assistant professor at the University of Wyoming. She specializes in biogeochemistry, and her research focuses on investigating the causes of environmental changes in Earth's history.

Kimberly Lau, Abigail Freeman and Claire Bucholz

ALUMNI NEWS

Captain Aaron Judah

Captain Aaron Judah '11 returned from the middle-east in January 2018 where he was a member of Joint Task Force - Iraq, in support of the mission Operation Inherent Resolve - the multinational campaign against ISIS. In 2016 he was also awarded Officer of The Year for the 4th Canadian Division, for his outstanding leadership and military record. He has recently left full-time Army service, and is now working as a manager and scientist in the Nuclear Power Industry, in Ontario, Canada where he is enjoying a quieter life and is reconnecting with his science and academic roots.

Astrid Pacini '16 near Cape Farewell, Greenland during small boat ops. Astrid writes: I am a third year graduate student in the MIT-WHOI joint program in Physical Oceanography. My research focuses on Arctic and Subarctic circulation from an observational perspective. In particular, I work on the Overturning of the Subpolar North Atlantic Project (OSNAP). OSNAP is an international program that seeks to characterize the meridional overturning in the northern North Atlantic, at approximately 60°N, by using moorings, gliders, floats, hydrographic surveys, and modeling studies. More specifically, my research focuses on the structure, variability, and dynamics of the West Greenland boundary current system, as measured by the Labrador Sea OSNAP moorings. In order to fully understand the process of convection in the Labrador Sea, we must understand the Greenland boundary current system, as it influences the stratification in the interior of the basin and is responsible for the transport of ventilated waters around the subpolar gyre. In

Astrid Pacini

addition, I work on hydrographic data from the Chukchi and Beaufort Seas. A significant part of my time in graduate school has been spent at sea, and I have loved it. Last year, I had the opportunity to participate in a storm-chasing cruise in the Nordic Sea onboard the NATO NRV Alliance, to perform a hydrographic survey and service the OSNAP moorings off Greenland onboard the RV Neil Armstrong, and also to perform CTD and mooring work in the Chukchi and Beaufort seas onboard the USCGC Healy. Sometimes I think it's easier to be at sea than on land.
A reunion of four G&G alumni on the rooftop of the Department of Earth Sciences at Oxford, on a lovely British summer day. Left to right: Srikanth Toppaladoddi G '17 (junior research fellow), Meng Tian G '16 (postdoc), Ross Anderson G '17 (junior research fellow) and Associate Professor Erin Saupe, former G&G Postdoc.

Katelyn Gray G '18
After graduation, she moved back home to Austin, Texas, and was employed by Austin Community College to teach environmental science. She spent the spring 2019 semester teaching a group of economically disadvantaged, at-risk, and English as second language students at a charter high school through ACC. She will be starting a postdoc at the University of Delaware with Deb Jaisi in September 2019. Her research will focus on phosphorus cycling in both Chesapeake and Delaware Bay. Nutrient eutrophication is a pressing issue occurring in both estuaries, and by determining the molecular composition of terrestrially-derived organic phosphorus, she hopes to better elucidate the anthropogenic influence on biogeochemical cycling in the bay.

Katelyn Gray

BRIAN J. SKINNER POSTDOCTORAL FELLOWSHIP FUND

Brian J. Skinner Postdoctoral Fellowship Fund

Our beloved colleague **Brian Skinner,** passed away last year on August 21, at the age of 90. He was a member of the Yale faculty for more than fifty-three years, serving as a notable scholar in the Department of Geology & Geophysics, and as a mentor to students and faculty alike. Brian had a long, distinguished career, and for many of you, his introductory class was a key inspiration to major in the geological sciences. Moreover, his expertise in mineralogy and economic geology were invaluable to the many students and young scientists who worked with him.

Over the last year, students, colleagues, friends and family of Brian's have worked with the Department to establish a program honoring his many contributions. We have, therefore, created the **Brian J. Skinner Postdoctoral Fellowship Fund.** The purpose of the fund is to support one or more postdoctoral fellowships in the newly named Department of Earth & Planetary Sciences.

Postdoctoral scholars are vital to the scientific enterprise, and provide a bridge between students and faculty. They arrive with new ideas and approaches and foster intellectual cross fertilization between universities. Prize or Named postdoctoral fellows are prestigious and competitive fellowships, which attract outstanding candidates whose independence offers the freedom to catalyze new research and collaborations that might not otherwise occur. Establishing a robust postdoctoral fellowship program is a top priority for our department.

Our immediate goal is to raise $1.5M to create an endowment that will fund one postdoctoral fellow in perpetuity. We hope to grow this fund with your generous support to reach $3M and support two postdoctoral fellows through an annual search. We invite you, as someone who benefited from Brian's mentoring, to contribute to the fund in his memory. Several of our alumni have kickstarted the Fellowship and we currently have commitments exceeding $1M. We are close and hope you will help us reach our first milestone of $1.5M, on our way to our ultimate target of $3M.

We sincerely hope you will join us as a significant contributor to the *Brian J. Skinner Postdoctoral Fellowship Fund.* Please feel free to contact me directly with any questions at david.bercovici@yale.edu. Contributions may also be made by sending a check or online using the instructions below.

To make a donation by check: Please send a check made out to Yale University to the following address:
David Bercovici
Yale University.
PO Box 208109
New Haven CT 06520 8109
Please include in the memo line of the check: "Designation #38545" or "Brian Skinner Postdoctoral Fellowship Fund".

To make a donation online the instructions below can be followed:

1. Go to Giving.Yale.edu and click Make a Gift Now
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3. Select "Other"
4. Enter your gift amount and other pertinent information
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6. Complete the options and sharing of your personal information. Follow to payment information.

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