GeoCam

EARTH SCIENCES ALUMNI MAGAZINE

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NEWS

Warm Mars missing link found

RESEARCH

Rare Earth Elements – seeking the critical minerals needed for future technologies

STUDENT FOCUS

Geochemistry at Acqua Verde

UNIVERSITY OF CAMBRIDGE

Welcome

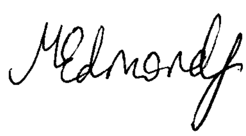
Very warm wishes for a happy and healthy 2026. I hope you will enjoy exploring this edition of *GeoCam*, which contains news about our current research and projects, what our staff are getting up to and the exploits of our students during their mapping and research projects.

2025 saw the department continue to rise to the challenge of tackling urgent research in the areas of climate change, biodiversity, the energy transition and natural hazards. New projects were funded by a range of bodies including the UK Research Councils, the Leverhulme Trust and industrial sources. Staff and students have published important new papers and I encourage you to read more about these here and on the news pages of our website. The Sedgwick Museum has hosted a number of successful exhibitions and events based on our research and is very active in school outreach, laying the foundation for future Earth Scientists.

In 2026, we will focus on strengthening existing and building new links with a range of stakeholders across industry, charities and government, to pursue our aims of producing globally competitive research to tackle society's most pressing challenges in our field. We are launching our new Affiliates Program in 2026 with the aims of enriching our postgraduate programmes and providing research-based solutions across the geophysical, climate and environmental sectors.

We are continually updating and renewing our courses. 2025 saw the introduction of a more diverse set of choices for part II projects that go beyond mapping and into the environmental and climate sector. We plan to further diversify our offering to ensure that the summer projects meet the expectations of both future employers and enrich our students' experiences with us, allowing them to develop critical skills to launch their careers across a wide range of sectors. Work continues to ensure that all of our teaching activities in the field are fully accessible to everyone.

You, the Alumni, are very important to us. We want to make it easy for you to maintain the relationship with the department that started during your time here. As well as *GeoCam*, we have a termly e-newsletter, an alumni LinkedIn group and department Instagram and Bluesky accounts for you to follow. If you find yourself able to join us, the Alumni Day on May 9, is a chance to reconnect – with staff and student volunteers as well as your peers. I wish you a happy and healthy 2026. We hope to see you soon,



Marie Edmonds, Head of Department

IN THIS ISSUE

EDITING TEAM
Cara Hanman
Dr Nigel Woodcock
Dr Erin Martin-Jones

Cover Image: A view within the Grand Canyon.

SIMON LAMB

Life After Earth Sciences

My time as a geologist at Cambridge was longer than the usual undergraduate stint, because I also completed a PhD degree. Field work involved spending part of each year in the small southern African Kingdom of Eswatini, mapping some of the oldest relics of Earth's surface. I was also hooked on something else – film making – ending up as president of the Cambridge Film Unit (does this still exist?).

My post-doc took me to the other end of the geological timescale in New Zealand, investigating an active subduction zone. It convinced me that the key to our geological past is how Earth actually works today. And fortunately, John Dewey at Oxford University invited me to work with him on studying the origin of the Andes, a project made possible by a Royal Society University Research Fellowship, and then lectureship, at Oxford. Over a period of 10 years, I spent my summers at high altitude in Bolivia, nursing an ancient Toyota Landcruiser over thousands of kilometers of desert landscape. I climbed virtually every active volcano in Bolivia and northern Chile too.

By now, a friend from my student days – David Sington – was working for the BBC Horizon strand, and on the lookout for ideas. This was the birth of a collaboration that eventually resulted in ten BBC 2 TV programs, including the Earth Story series. I also wanted to see if I could enthuse a wide audience with my Andean research, so I wrote it up in a popular science book called 'Devil in the Mountain', referencing the belief amongst Bolivian miners that the local devil controls a mine's fate.

In 2010, new avenues of research beckoned, now on active tectonics in New Zealand, and I relocated to Victoria University of Wellington as Associate Professor in Geophysics. This also gave me the opportunity to team up again with David Sington to make a feature length documentary film in Antarctica and the Arctic on the science of climate change – Thin Ice – which was screened all over the world on Earth Day 2013. Coming full circle, I have now returned to those strange ancient relics of the early Earth in southern Africa, with which I began my research career. It has also inspired my latest foray into popular science: The Oldest Rocks on Earth, which can be found at: **https://bit.ly/4pB9Ff6**.

Kitted out for arctic filming in 2007, while making the Thin Ice feature documentary on the science of climate change.

CARA HANMAN, ALUMNI RELATIONS

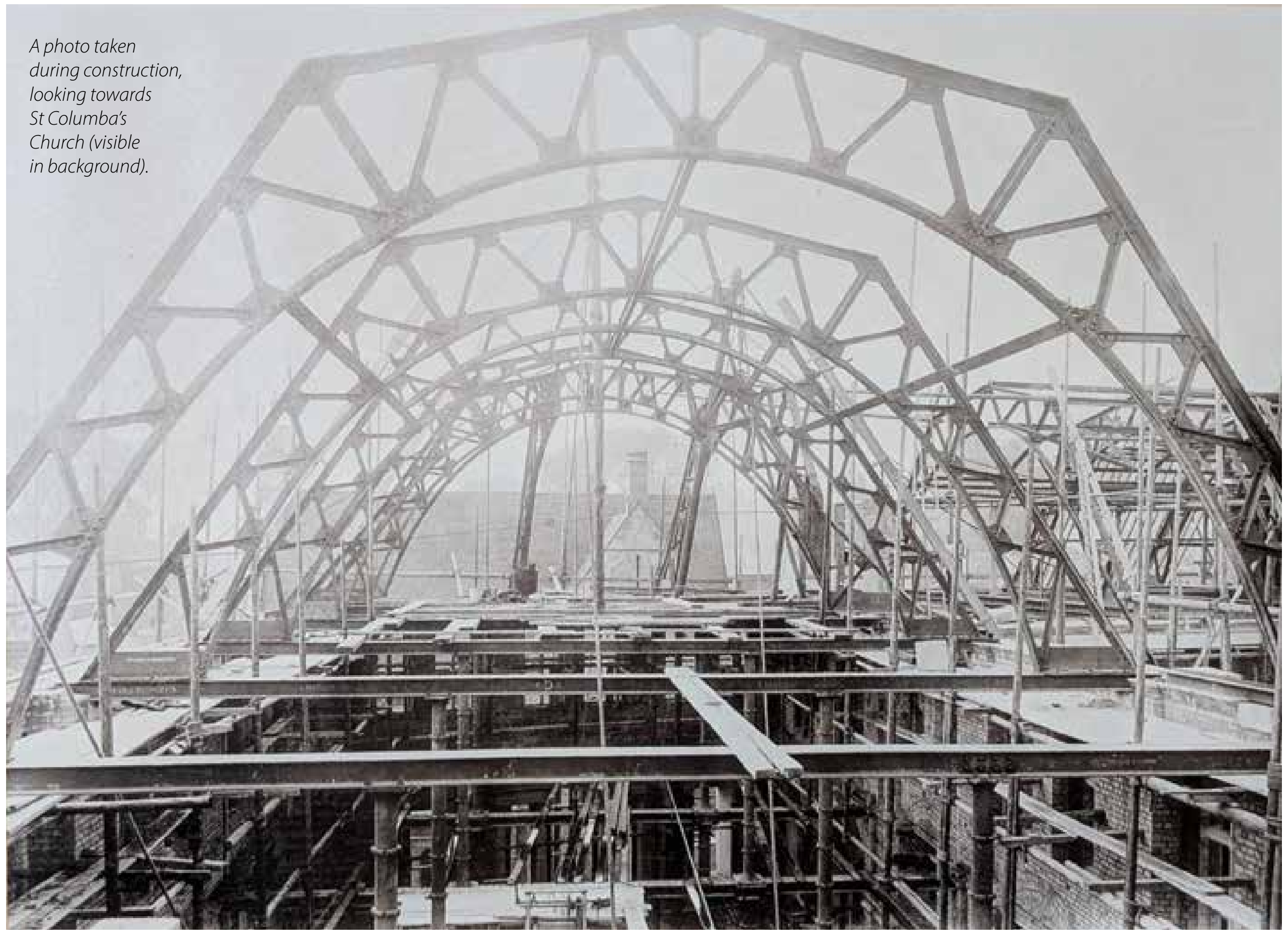
The skeleton exposed

Work to remove asbestos materials on the top floor of the Sedgwick Building has given the Department's leadership team a fantastic opportunity to update and redesign the available working space. This work will allow for a larger number of people to remain working and studying at the downtown site and will also allow for better collaborations between researchers. The materials removed have also exposed the skeleton of the roof of the building that was last visible on this scale more than 120 years ago when it was being built.

The history of the building is well known – from Professor McKenny-Hughes' work to raise the necessary funds to the opening of the building being attended by King Edward VII in 1904 – and most alumni will be aware that it was a major feat to create the department's downtown home. What you might not know is that the construction included a metal framework which had an impressive 'rib cage' that supported the roof structure.

The Museum has a photograph of the roof under construction (taken some time between 1899 and 1904). The image is taken from within the specimen store looking east, and shows row after row of metal roof trusses like a rib cage exposed to the sky. The spire and chimney of the United Reformed Church (St Columba's) is visible in the distance. Once the roof was on and lined and wall partitions installed, only portions of some individual roof trusses remained visible, with the array of successive trusses largely hidden from sight.

The asbestos decontamination work exposed the full majesty of the metalwork once again, giving us a chance to admire the architectural beauty otherwise kept unseen. Fortunately, the Department plans to keep the majority of what has been exposed visible, insulating and lining the ceiling where it attaches to the trusses rather than hiding the metal supports behind panelling.



A photo taken during construction, looking towards St Columba's Church (visible in background).

With the walls stripped out, it was possible to admire what is a vast space. It is a rare opportunity and no doubt has been quite a challenge to maximise the use of such an area. The top floor was originally designed as the specimen storage space and so was built to hold a hefty weight of rocks and fossils. There was an old warning sign at the entrance to the area that declared, "this floor is capable of sustaining 175lbs per square foot. This loading must not be exceeded." The tone was stern enough to make some visitors to the floor pause before realising the load amount was substantial.

A visit to take photos of the top floor midway through the work was a brilliant chance to admire the structure and revel in the unobstructed space that had been exposed, if only for a brief time before work to make the floor habitable once again was begun. Along with the trusses having been made visible, we could admire the iron radiators, which were stacked up waiting to be returned to their wall spaces. A walk around to the back of the stack brought the sludgy, dark green of their original paintwork into view – it is fair to say that they were not painted for prettiness! There have been assurances that the paintwork on both the radiators and the trusses will be more muted going forward.

This visit also gave us the chance to investigate the boarded up Victorian fireplace that sits about one third to halfway down the Downing Street facing wall. The chimney connects it all the way down to the fireplace in the old Department Administrator's office on the ground floor. The fireplace won't be left exposed, thanks to the unfortunate need to place a panel wall up to the centre of it but is an interesting reminder of the history of the building. We are still baffled as to why someone left a lightbulb behind the boarding around the fireplace though…

The original warning sign at the entrance to the top floor store.

The Victorian fireplace that will remain behind panelling – complete with mysterious light bulb.

Below: The view towards St Columba's Church in 2025 with the room stripped back to its bones once again.

RESEARCH NEWS

FOR ALL THE LATEST EARTH SCIENCES RESEARCH NEWS, VISIT WWW.ESC.CAM.AC.UK/NEWS

GRAND CANYON WAS A 'GOLDILOCKS ZONE' FOR THE EVOLUTION OF EARLY ANIMALS

A treasure trove of exceptionally preserved early animals from more than half a billion years ago has been discovered in the Grand Canyon, one of the natural world's most iconic sites.

The rich fossil discovery – the first such find in the Grand Canyon – includes tiny rock-scraping molluscs, filter-feeding crustaceans, spiky-toothed worms, and even fragments of the food they likely ate.

The fossilised animals date from between 507 and 502 million years ago, during a period of rapid evolutionary development known as the Cambrian explosion, when most major animal groups first appear in the fossil record.

In some areas during this period, nutrient-rich waters powered an evolutionary arms race, with animals evolving a wide variety of exotic adaptations for food, movement or reproduction.

Most animal fossils from the Cambrian are of hard-shelled creatures. Now, the Grand Canyon has revealed the first soft-bodied, or non-mineralised, Cambrian fossils from an evolutionary 'Goldilocks zone' that would have provided rich resources for the evolution of early animals to accelerate. The results are reported in the journal Science Advances.

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Read more: https://bit.ly/4qlrlGC

MAP OF SLOW EARTHQUAKES PAVES WAY FOR FORECAST TESTING

© NASA EARTH OBSERVATORY

Unlike regular quakes, slow earthquakes unfold over days to weeks – rather than seconds – and generate tremors so subtle they're barely perceptible. Since they recur more frequently than typical earthquakes, this type of tectonic activity is particularly useful for learning about patterns of fault rupture through time. "Slow earthquakes are complex, but they do exhibit some level of predictability," said Adriano Gualandi, Assistant Professor of Geophysics at the Department of Earth Sciences. He has developed a map charting decades of slow earthquakes across the Cascadia region of the Pacific Northwest. It's the first map to use geodetic data – which tracks how the Earth's surface deforms or shifts over time, not just the shaking – to provide daily updates of slow earthquakes.

This new method can detect ground movement that seismic stations miss, and the daily updates allow scientists to spot new slow earthquakes in real time as they happen. Data collected just as the quake is unfolding could be used to provide an indication of possible changes in the stress field. This approach marks a departure from previous studies, which typically examine slow earthquakes retrospectively. "We're now in a position where we can study slow earthquakes prospectively and see if we are able to forecast them in real time, as is routinely done for other complex systems like the weather," says Gualandi.

Read more: https://bit.ly/49nxAbT

© MARK BRENNER, 2023

Tourists explore the 'Dome of the Cathedral', the largest chamber in Grutas Tzabnah (Yucatán, Mexico), and the origin of Tzab06-1. The artificial well 'La Noria' now illuminates the cave.

MEXICAN CAVE STALAGMITES REVEAL CONDITIONS DURING MAYA COLLAPSE

Periods of drought, one lasting 13 years, may have contributed to the collapse of the Classic Maya civilisation, chemical fingerprints from a stalagmite in a Mexican cave have revealed.

A team of researchers, led by the University of Cambridge, have determined rainfall levels for individual wet and dry seasons between 871 and 1021 CE, which overlaps with the Terminal Classic period of Maya civilisation. This is the first time it has been possible to isolate rainfall conditions for individual wet and dry seasons during the Terminal Classic, the time of societal decline historically referred to as the Maya collapse.

During the Terminal Classic, limestone Maya cities in the south were abandoned and dynasties were ended, as one of the ancient world's great civilisations shifted north and lost much of its political and economic power.

The data contained within the stalagmite, from a cave in the Yucatán, showed that there were eight wet season droughts that lasted for at least three years during this period, with the longest drought lasting for 13 consecutive years.

This climate data aligns with existing historical and archaeological evidence: construction of monuments and political activity at several major northern Maya sites, including the famous city of Chichén Itzá, stopped at different times during this period of climate stress.

The accurately and precisely dated droughts provide a new framework for fine-grained analysis of the timing and dynamics of human-climate interactions in the region.

Read more: https://bit.ly/49ax2HE

WARM MARS MISSING LINK FOUND

Newly identified Martian rocks are a missing link in understanding how the red planet may once have been warm enough to host liquid water, enhancing its potential habitability.

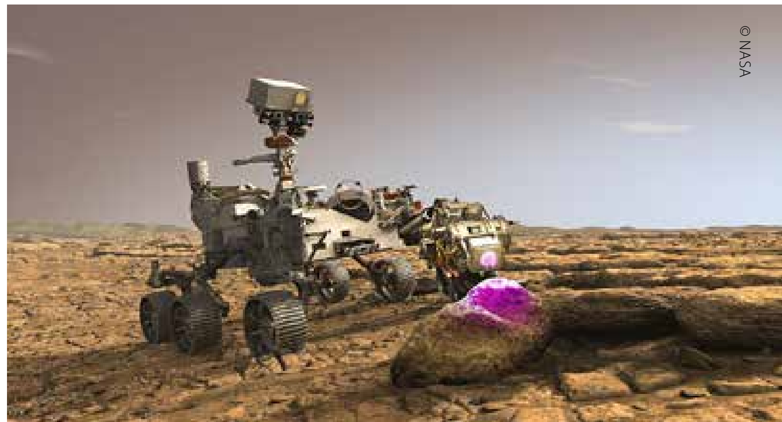
An international team have found the first direct evidence for serpentinization on Mars, a process whereby iron-rich rocks react with hot water, releasing hydrogen as a byproduct.

During the planet's infancy, the Sun was about 75% as bright as it is today, meaning it needed extra help to stay warm enough for liquid water to exist. The hydrogen produced by serpentinization could have trapped heat in the atmosphere, making Mars more hospitable.

The team made the first in-situ observation of serpentinite rocks formed by this process on Mars using NASA's Perseverance rover.

"For decades, it's been thought that serpentinization could be an engine for hydrogen production and warming on early Mars," said Nick Tosca, lead author of the study from Cambridge's Department of Earth Sciences. "It turns out scientists were looking for the wrong rock type."

Read more: https://bit.ly/4jrBR2A



© NASA

Student MAPPING PROJECTS

Mapping near Graz, Austria

Matthew Rayner

When choosing a mapping area, most Earth Sciences students favour well-documented regions – places with enough literature to help interpretation after fieldwork has ended. Alternatively, students choose a place where geologists have mapped before, suggesting good geology. The area my group chose matched neither of these criteria. For reasons only fully known to our past selves, we packed our bags and spent two days driving to an obscure region in the Austrian Alps where we would spend the next five and half weeks.

We stayed in the city of Graz and mapped north of a small village called Kainach. We typically left Graz at 7am, spent our day mapping the bedrock geology of the area, returned home puzzled at 6 to 7pm, then enjoyed a meal of delicious rice and dal made by our own talented chef, Juthika. Our area had a small sedimentary basin deposited during the Alpine orogeny (Late Cretaceous) and overlying some decidedly peculiar carbonates. North of this basin is a nappe of spectacular metamorphic rocks featuring pure white marble and schists with micas as big as the palm of my hand!

Something we had gleaned from the sparse and sometimes unreliable literature on the area was that the rocks were old enough to have experienced the Variscan as well as the Alpine Orogeny. Needless to say, this long history led to complicated structural geometries. Isoclinal folds (with parallel limbs) were commonly seen with wavelengths of a few tens of centimetres. These folds created fantastic deformational structures and patterns. Thin sections later revealed tremendous amounts of shearing in the region. This shearing turns out to explain the strange behaviour of the carbonate units in the adjacent nappe.

Overall exposure was far worse than anticipated, but still enough to make a reasonable map – the forests were so dense in places that we didn't notice there was a ruined castle in the middle of our mapping area for over two weeks! I am so grateful to have had this once-in-a-lifetime opportunity to experience another country's culture and geology; I believe the trip can be mostly summed up in two words: foliage and foliation.

Above: Wonderful views – but more trees than rock!
Above right: Juthika investigates a fold in marbles.
Right: The mapping group – Juthika, Matthew, Quinn and Toby.

© MADDY TOLLEY

Always exciting to see the local wildlife.

© NAOMI ROBEY

On the ferry with Rum in background.

Mapping on the Isle of Rum

Maddy Tolley, Naomi Robey, Sadia Jussab and Philip Couldery

Rum is a remote island off the west coast of Scotland. The Isle of Rum has only 40 inhabitants, including a self-proclaimed witch. It has only one shop that also serves as the post office, café, and pub. Although it is the largest of the Small Isles, it is still worthy of the name with a diameter of less than 10km. Despite that, it still manages to reach elevations of 812m at the top of its highest peak. Our legs definitely felt this by the end of the project!

The drive to Rum began at 7am and 13 hours later we arrived in Arisaig. The next morning we set sail. With access only possible by ferries that run once a day, we remained castaway for the next five weeks. We stayed at the best (and only) accommodation on the island, the Rum Bunkhouse, which is run and maintained by the amazing Elle and Coinneach. The Bunkhouse is a magnet for interesting people; we met three Cambridge alumni (including an Earth Scientist boat-race winner), a bread-baking civil servant, a kind Winchester music teacher, and an American writer, who wrote a blog article about our projects.

The geology of the area was incredibly interesting. The basement was 1.7Ga Lewisian Gneiss, overlain by Torridonian Proterozoic sediments. Intruding into this was the Rum Igneous Complex, 60Ma in age, which had a large variety of lithologies exposed, from intrusive granites, gabbros and peridotites, to extrusive tuffisites and lava flows. The central portion of this complex is a fantastic layered series, preserving the heart of a fossilised magma chamber. The first attempts to understand magma chamber behaviour were carried out here, in particular as a result of the geological mapping of Alfred Harker.

We enjoyed encountering the diverse wildlife such as seals, red deer, feral goats and many seabirds. However, there was one aspect of the wildlife that we were never excited to see: midges. Rum midges are the worst in Scotland, so we (almost) never left without midge hoods. Weather conditions were also challenging. We witnessed the 80mph winds of Storm Floris as it felled at least 50 trees and braved the 48mph winds the next day outside.

This experience is one we will look back on fondly, and we hope to return in the future!

© MADDY TOLLEY

A view to the water past Kinloch Castle.

CARA HANMAN, ALUMNI RELATIONS

Behind the Scenes
FIELDTRIPS

Fieldtrips are a hugely important part of the Earth Sciences offering at Cambridge. Taking students from the shelter of the lecture theatre to wide-open spaces to study geological exposures and environmental geochemistry solidifies all the teachings our academic staff work so hard to share.

Whether the trip is heading to Arran, Sedbergh, Greece, Spain, or elsewhere, a team of people work tirelessly in the background to ensure everything goes smoothly. Their work behind the scenes considers the many layers of organisation needed to run a successful fieldtrip today amid rising student numbers and associated logistical complexities.

I spoke to just a few of the people who share the complex work involved.

Therese Williams manages the logistics of the fieldtrips – a deceptively simple sounding task. Everything must be well thought out and done at least a year in advance, sometimes two. Therese elaborates by saying, "student numbers can vary enormously and accommodation in some locations is limited. It's important that students can move around safely and are not too remote from the rest of the group. We also maintain close links with property owners to hold bookings year on year." Transportation, food and access must be organised. The right vehicle for the group size but also for the roads must be booked. Special requirements must be catered for and the switch between managing a group to managing individuals must be done with speed and ease. No small feat.

Meanwhile the teaching office, with Charlotte Kenchington and her team at the helm, are managing other complexities. They are working with the challenging Venn diagram of which academics are suitably knowledgeable and have the right training. "With five trips running concurrently over Easter, the challenge is making sure each trip has enough staff who know the area – both geographically and academically," says Charlotte. "It is a balancing act of allocating faculty to the trips they are best suited for, and then filling in any gaps in subject expertise or first aid training with a handful of elite demonstrators. We must be mindful of workload, caring commitments and ensuring we are training up enough new people so that no trip is ever short-staffed." Conversations with students are a key aspect to ensuring that the logistics being put in place are adequate – making sure students know what to expect and any fears they have are assuaged.

© WILL MCMAHON

Charlotte flying a drone to generate footage to allow students with mobility issues to determine if they would be able to manage the terrane before they attempt it (as well as potential scientific value).

(L-R) Therese and Michelle in the Watson Gallery with some of the equipment used for fieldtrip safety.

Michelle Austin ensures that fieldwork health and safety needs are met. From staff training and driver certification management to storing and maintaining the first aid kits and the risk assessments, Michelle must ensure every field trip has what it needs. She sums it up by saying, "the process starts with the draft risk assessment, considering anything we have learnt from the previous year's trips and any additional needs of those taking part. Each trip has its own equipment and bank of information which includes safety briefing points, emergency contact numbers, risk assessments and equipment details. We also provide guidance to students for their Field Safety Project risk assessments and first aid training."

If any piece of the jigsaw puzzle that is field logistics disappears then it must be swiftly replaced. Whether that's finding a new supplier, site to visit, different access or a replacement member of staff, the team has historically handled it with a practical and agile mindset.

If you were to tweak the metaphorical curtain back further, you would spot Ben Froste and Simon Childs busily preparing the teaching materials for each trip. The packing list ranges from thin sections and slides to handouts including field guides, maps, workbooks and to equipment such as microscopes, visualisers, projectors and hard drives of information – all of it necessary to keep teaching quality high. For the Geochemistry fieldtrip, the chemicals and equipment must be prepared and there may be significant amounts of documentation that goes with it on its journey into the field.

Last, but by no means least, the Accounts Team are engaged in ensuring that the money side of things is as balanced as possible. Even academic institutions suffer with economic struggles, and costs for fieldtrips are not immune. Growing student numbers and the rising costs of accommodation, transport and other aspects of fieldwork delivery drive up running costs but not the available funds. Making sensible savings without an impact on provision is another element to carefully weave into the preparation. Perhaps this is the biggest challenge of all.

We will continue to work to make fieldtrips an enriching student experience here in the Department and, with your help, the financial pressure could be eased. If you are able to contribute to our Fieldwork Fund, please see the donation form sent with this copy of GeoCam or visit **https://www.esc.cam.ac.uk/alumni/support-the-department**

CARRIE SODERMAN, POSTDOCTORAL RESEARCHER

RARE EARTH ELEMENTS
Seeking the critical minerals needed for future technologies

Igneous rocks – formed when magma erupts or cools underground – can contain abundant valuable elements. Many technologies underpinning the green energy transition rely on these elements. As such, there is growing interest in understanding their global distribution, with potential resources in Greenland and Ukraine featuring in recent geopolitical debates.

Developing secure supply chains of these 'critical minerals' requires understanding their geological distribution. Why do some igneous rocks contain abundant, easily extractable minerals rich in valuable elements, whilst others almost none? Our research tackles this question with a focus on the 'rare-earth elements' (REEs) commonly found in alkali-rich igneous rocks. REEs are essential for producing high-strength magnets used in wind turbines and electric vehicles. Despite their importance, we know relatively little about the geological processes that concentrate REEs into economic deposits.

We combine two approaches to tackle this problem. First, we conduct fieldwork in ancient 'frozen' magma chambers. We examine and sample the rocks in detail to reconstruct their magmatic histories and identify differences between REE rich and poor systems. Second, we use new phase equilibria models developed in Cambridge [1] to simulate magma crystallisation. These models let us "reverse-engineer" igneous rocks to infer their formation conditions – such as pressure and water content. We can then use the same models predictively to explore which conditions are most favourable for REE enrichment. Currently, we are using case studies in Namibia, Scotland, Greenland, and Côte d'Ivoire.

Postdoctoral researchers Carrie and Charlie looking into the interior of the Ilimmaasaq complex, southern Greenland.

© CHARLIE BEARD

Our most recent fieldwork was in Côte d'Ivoire in April 2025. Although most Ivorian intrusions are not mineralised for REEs, they contain relatively high overall concentrations, making them a natural laboratory for understanding why some magmas evolve into REE-rich systems. Our target during fieldwork was the ~1.6-billion-year-old, 2-km-wide Ninakri intrusion, located 450 km from the airport in Abidjan. After a full day's drive with local colleagues to get there, we stayed in an empty new hotel apparently built to accommodate geologists for expanding gold exploration. Central Côte d'Ivoire is lush even at the end of the dry season, with spectacular 'flame trees', and mango and cashew cultivation. Dense vegetation obscured exposure, so we used satellite images and local knowledge to locate outcrops. Each morning began with explaining our work to village chiefs before heading into the midday heat – quickly learning not to leave metal-handled hammers in the sun! Ninakri is intriguingly diverse in rock types which we documented and sampled. Initial sample processing has taken place in Burkina Faso, and later this year our collaborators will visit Cambridge to carry out geochemical analyses.

Our other recent field campaign was in southern Greenland in summer 2024, with a return visit planned for 2026. Here, a 1.2-billion-year-old failed continental rift produced several alkaline igneous complexes, now beautifully exposed by glacial erosion. These complexes include the world-famous REE-mineralised Ilimmaasaq intrusion, alongside un-mineralised complexes such as Illerfissalik. These contrasting systems sit side-by-side, making this region ideal for our research to pinpoint critical 'tipping points' in magmatic histories that lead to REE deposits. We spent three weeks in the area, collecting 150 kg of samples, eating a creatively limited canned-food diet, and debating whether distant white shapes were sheep or polar bears. With no road network, a boat collected us every few days to relocate our campsite along the coast.

Two moments stand out. The first was exploring Ilimmaasaq's roof zone. The former uranium mine and surrounding spoil heaps host over 30 minerals first described here, about half of which are yet to be discovered elsewhere. We found several of these exotic minerals, including tugtupite, a pink sodalite-group mineral that fluoresces and temporarily changes colour after UV exposure. The second highlight was our final week around Illerfissalik, the

© OWEN WELLER-GIBBS

Sunrise before our ascent to the top of Illerfissalik.

highest local peak at 1752 m. Our campsite overlooked a terminal moraine that trapped drifting icebergs, providing a dynamic panorama of creaking ice. Up in the intrusion itself, we explored diverse syenites, striking bright green alteration of surrounding quartzites, and numerous pegmatites, including shimmering 'moonstone'. We ended the trip with a 12 hour, 20-km hike to the summit, rewarded with spectacular views toward the Greenland ice sheet and a very satisfying final sampling site.

Since these trips, we have demonstrated how our approach can constrain the formation conditions of ancient alkaline magma chambers using geochemical data from the rocks, with published examples from Greenland and Canada [2,3]. This work helps identify the magmatic processes that drive critical metal enrichment, to support identification of potential new sources.

We are also passionate about sharing these remarkable rocks with the public. Over the past year, we have developed an exhibition at the Sedgwick Museum in Cambridge, showcasing our samples, Greenland fieldwork experiences, and the vital role these minerals play in modern technology and the green transition. The exhibition – 'From Magma to Magnets' – opened in February, so please come and visit!

References:
[1] Weller et al. 2024 J. Pet. 65(10) egae098
[2] Soderman et al. 2025 Nat. Geo. 18 555–562
[3] Soderman et al. 2025 EPSL 667 119516

(L to R) Project lead Prof. Owen Weller-Gibbs and postdoctoral researchers Dr Carrie Soderman and Dr Charlie Beard at the summit of Illerfissalik on the final day of fieldwork.

© CARRIE SODERMAN

Our Illerfissalik camp site.

IN CONVERSATION WITH Nicole Shibley

© DR ERIN MARTIN-JONES

Dr Nicole Shibley is a physicist and Assistant Professor jointly based between the Department of Earth Sciences and Department of Applied Mathematics and Theoretical Physics. Her research explores the physical processes governing ocean-ice interactions on Earth and on icy moons in our solar system. Here she is interviewed by Dr Erin Martin-Jones.

You're an interdisciplinary scientist – what originally sparked your interest in STEM subjects?

As a kid I was always curious about how things worked. I would build things: I remember wanting a pair of high heels, so I made some out of cardboard. I also loved math and would do math practice books for fun, and my family encouraged me to be creative.

I studied physics at Yale as an undergraduate. My route into Earth Science began during my sophomore year, when I reached out to Prof. Mary-Louise Timmermans, a renowned physical oceanographer in Yale's Earth & Planetary Sciences department. Having grown up in Florida, near the ocean and where hurricanes are a regular part of life, I was interested in exploring the physics of Earth's climate system, including the ocean or atmosphere. I began working with Prof. Timmermans as an undergraduate, going on to do my senior thesis with her, and later my PhD. She became a key academic mentor to me.

Tell us about your PhD

After pursuing Part III of the Mathematical Tripos at Cambridge, I returned to Yale for a PhD in Earth and Planetary Sciences. My research focused on the physics of Arctic Ocean mixing.

This explored how a small-scale ocean mixing process known as diffusive convection moves heat vertically toward the overlying sea ice. In certain regions of the Arctic, this mixing creates a staircase pattern in the water column, with alternating layers of well-mixed and sharply stratified water. I studied these staircases across the Arctic, using a combination of observational data and mathematical modelling. One key finding was that staircases are not always present where expected, and that intermittent turbulence may disrupt them – something that may help us understand the energetic landscape of a warming and changing Arctic Ocean.

I was also lucky to participate in an expedition to the Arctic on board an icebreaker, where we measured ocean properties and took measurements of ice thickness. We were on board for 3 or 4 weeks and it was an incredible experience, showing insight into both the Arctic system and the way we take measurements.

How did you make the leap to planetary science?

As a child, I wanted to be an astronaut. During the later stages of my PhD, I often had lunch with a grad-student friend and their supervisor – an astronomer – and we'd talk about astronomy and planetary science. Eventually, the supervisor and I started working together, thinking about icy moons in the solar system, some of which are thought to have oceans beneath their surfaces. We wrote a paper on one of Jupiter's moons, Europa, investigating what may drive geysers to erupt through Europa's ice. This explored whether trapped carbon dioxide could fuel these eruptions – similar to volcanic explosions on Earth.

In reading the planetary literature, I became curious about many aspects of such icy moons. Because their oceans lie under kilometres of ice, their properties can't be measured directly. This challenge motivated my postdoctoral research at Princeton, where, alongside inspiring collaborators, I built mathematical models to infer ocean properties from an understanding of the ice shell, drawing on what we know from Earth's ice-ocean systems.

HAVING GROWN UP IN FLORIDA, NEAR THE OCEAN AND WHERE HURRICANES ARE A REGULAR PART OF LIFE, I WAS INTERESTED IN EXPLORING THE PHYSICS OF EARTH'S CLIMATE SYSTEM, INCLUDING THE OCEAN OR ATMOSPHERE.

How are you finding your return to Cambridge?

It's now eleven years since I first came to Cambridge. The main difference (aside from seeming as though it somehow rains more now) is that I now have an affiliation with both DAMTP and Earth Sciences. Being between two departments has opened up some exciting opportunities for collaboration, especially in areas like geochemistry and other elements of the Earth system – research areas I haven't worked on before. I am growing my research group, with a new PhD student, and have some exciting budding collaborations, one of which is on rock-water interactions on icy moons with colleagues in both DAMTP and Earth Sciences.

Through my involvement with the Leverhulme Centre for Life in the Universe, I've started imagining research that connects with bigger questions – related to the origins of life. Cambridge is an exciting place to be involved in these questions, and I am inspired by the many interdisciplinary dialogues and stimulating conversations that occur here daily.

ISSY GRAVES

Geochemistry at Acqua Verde

Completing an in-field titration at Acqua Verde.

Acqua Verde is an astonishing site at 1370m altitude in the Aosta Valley, Italy where the effects of acid mine drainage are vividly on display. The nearby Servette-Chuc mining complex, exploited for copper, iron, and manganese since at least the Middle Ages and possibly Roman times, has left behind a measurable geochemical signal.

Left: Mixing zone of yellow and blue streams at Acqua Verde. Below: View into the Aosta Valley looking down Saint Marcel river.

We spent 15 days in the field investigating the chemistry of the valley's streams. Using a pH probe, we first identified areas of interest for sampling before analysing sulphate, calcium, magnesium, copper, and silica using spectrophotometry. We also carried out in-field titrations, plotting results each evening back at our makeshift lab to calculate alkalinity.

We travelled upstream along the Saint Marcel River, L'eau Verte, and many side streams collecting probe measurements. But our main site of interest was the immediate area around Acqua Verde ("Green Water"), where two wildly contrasting waters meet. A bright yellow stream with a pH of ~2.5 converges with a blue, alkaline stream (pH ~8). These streams mix over a length of 5 metres giving rise to a unified stream which continues to flow into the valley precipitating green minerals.

Practical challenges shaped our fieldwork as much as the geology. By day three we discovered that GPS coverage was so poor our phones were disagreeing by huge distances, making digital mapping impossible. Resorting to more dependable methods, we laid out a labelled string transect along the channel. This improvised set up seemed to deeply amuse the Parisian tourists hiking in the area.

Our analyses revealed sharp geochemical gradients. Copper concentrations, for example, dropped by two orders of magnitude along the mixing zone between the yellow and blue streams. We also noticed temporal variability in flux. On one morning the yellow stream nearly ran dry by noon, altering downstream patterns.

Overall, we learned how to collect high-quality data under unpredictable conditions, refine hypotheses in the field, and appreciate the complex interplay of acid mine drainage, mixing, and mineral precipitation. We also learned never to underestimate the logistics of a 20km round-trip walk to and from your study site when carrying many sample bottles.

LIZ HIDE, DIRECTOR OF THE SEDGWICK MUSEUM

What's it like working in a Museum?

In the Sedgwick Museum we're often contacted by people interested in careers in museums, and we're always happy to help by offering volunteering or work experience opportunities where we can. Being passionate about the rocks and fossils is of course an essential requirement, but our team bring a wide range of skills and experience to support our research, student and public audiences. Read on to find out about three of our team who are in the early stages of their museum careers.

"I'm Evie, a Collections Documentation and Access Assistant in the Sedgwick Museum. My role involves a bit of everything. I enable researchers, other museums, and fellow staff members to access collections by locating, packing and transporting specimens (and sorting the paperwork). I also help with museum events and conservation. I previously worked part-time in customer service but always wanted a career in museums, so I volunteered with various collections alongside work and my Museum Studies master's at St Andrews. This job has helped me kick-start my career. I love that it enables me to think proactively about the past, how we relate to it, and how we care for it. Plus, having the keys to the cabinets is a novelty that doesn't wear off!"

"I'm Harriet, a Visitor Services Assistant in the Museum. I work front of house welcoming visitors, operating the museum shop and answering enquiries about the Museum. I'm also involved in public programming, including tour delivery, facilitating events and contributing to social media. I studied Museum Studies at UCL, which included a placement at The Postal Museum.

I have always wanted to work in the museum sector- this is my first official role. I love learning about the people behind the objects in our collection and sharing their fascinating stories with our visitors. It is wonderful to work somewhere where history is such a big part of every day!"

"My name is Amy, the Learning and Engagement Assistant in the Museum. I deliver workshops for school groups, create learning activities for families, and support our community programme. After graduating with a BSc in Biology in 2020, I worked as a teaching assistant. I enjoyed working in an education setting and decided to pursue a career that would combine teaching and science. I was particularly drawn to museums and their public engagement work and spent a year getting some volunteer experience in museums.

I love how varied and creative my role is. One moment I might be teaching a group of preschoolers about dinosaurs, and the next be working with volcanologists to design lava-themed activities for families!"

If you know someone who's interested in working in museums, come and have a chat with our team, we're happy to help.

SERGEI LEBEDEV, PROFESSOR OF GEOPHYSICS,
WITH **NICK RAWLINSON,** MCKENZIE PROFESSOR OF EARTH SCIENCES

Seismic imaging of Iceland's volcanoes, the North Atlantic Igneous Province, and the Iceland Plume

Iceland is known for its frequent volcanic eruptions. Around 60 million years ago, basaltic volcanoes with similar rock compositions erupted across the entire North Atlantic region, forming the vast North Atlantic Igneous Province.

Cambridge PhD student Rob Green deploying a seismometer during the Holuhraun eruption in Iceland, 2014.

The volcanoes both in Iceland and across the North Atlantic are thought to have been caused by the Iceland Plume – a giant, hot convective upwelling rising from Earth's core-mantle boundary towards the surface. The volcanoes are scattered over an area thousands of kilometres across; this could be explained by lateral flow of plume material, but evidence for such flow has been scarce.

Seismologists at the Bullard Laboratories are using seismic imaging to study all pieces of the puzzle: the active volcanoes in Iceland, the mechanisms for the dispersal of the magmatism over the broad area, and the enigmatic deep mantle plume that may be responsible for the magmatism.

In Iceland, new seismic data are collected on frequent expeditions to the remote corners of the island. The data are used for seismic imaging and for tracking earthquakes and volcanic tremors associated with the deep movements of magma. Seismic tomography, in particular, is a technique that yields 3D models of the Earth's crust and underlying mantle. Detailed views of the magmatic plumbing systems beneath the active Askja, Fagradalsfjall and other volcanoes in Iceland have been obtained and reveal the locations of magma reservoirs. The improved understanding of the processes promises advances in assessing volcanic hazards, in Iceland and elsewhere around the world.

Deployment of ocean bottom seismometers.

Deep beneath Iceland, seismic tomography shows anomalously low seismic velocities that indicate high temperatures and partial melting of the rock at depth, probably associated with the hot material of the Iceland Plume. The morphology of the plume turns out to be more complex than in a textbook image of thin, vertical column. At 400-600 km, the hottest material is detected beneath eastern Greenland, which suggest a strongly tilted plume, rising from underneath eastern Greenland toward Iceland.

A part of the North Atlantic Igneous Province is located in Britain and Ireland. It includes the famous Giant's Causeway, a part of the Antrim Lava Group in Northern Ireland, and numerous extinct volcanoes in Scotland. The Iceland Hotspot was around 1000 km away at the time of the eruptions, and this fuels debate on the origin of magmatism. At present, Britain and Ireland also show oddly uneven, poorly understood seismicity, with potential for destructive earthquakes.

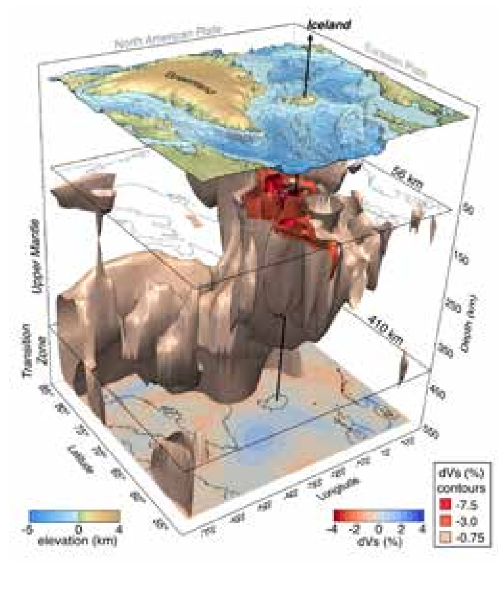
Seismic data collected in Britain, Ireland and on the North Atlantic seafloor is shedding new light on the mechanisms of these processes. Thermodynamic inversions of the data show that the locations of the Paleocene magmatism and uplift are all underlain by relatively thin tectonic plate (lithosphere). This indicates that the hot Iceland Plume material reached this region and eroded its lithosphere, with the thin lithosphere, hot underlying asthenosphere and its decompression melting causing the uplift and magmatism.

It is interesting that the unevenly distributed current seismicity in Britain and Ireland is also localised in the thin-lithosphere areas and along lithosphere-thickness contrasts.

The correlations of the lithospheric thinning, uplift, volcanism and seismicity provide answers to important, long-standing questions relating to the mechanism of the Paleocene uplift and volcanism in Britain and Ireland, to how plumes produce magmatism scattered over broad areas, and to what controls the uneven distribution of intraplate seismicity and seismic hazard.

Taken together, they provide a spectacular display of Earth-system dynamics, including previously unrecognised inter-connections between deep-Earth processes and natural hazards. Hot plumes rising from the core-mantle boundary shape the bottom of the lithosphere and carve out thin-lithosphere areas that capture the hot material and localise uplift and magmatism. Long after the uplift and magmatism subside, the lithospheric heterogeneity remains and localises deformation and seismicity. The distribution of earthquakes and seismic hazard today in such intraplate areas has thus been shaped by the action of mantle plumes many tens of million years ago.

The tilted Iceland Plume and its effect on the North Atlantic evolution and magmatism. Earth and Planetary Science Letters, *569, 117048. From Celli et al (2021).*



Further reading
Bonadio, R., Lebedev, S., et al, 2025. Volcanism and long-term seismicity controlled by plume-induced plate thinning. Nature Communications 16(1), 7837.

Glastonbury-Southern, E., Rawlinson, N., et al, 2025. Pre-existing structures control the orientation of strike-slip faulting during the 2021 dike intrusion at Fagradalsfjall, Iceland. Journal of Geophysical Research 130(6), e2024JB030162.

RECENT NEWS & AWARDS

Awards and achievements

Congratulations to **Marie Edmonds**, who was elected a fellow of the Royal Society in May 2025, a well-deserved honour in recognition of her excellent and sustained contributions to science.

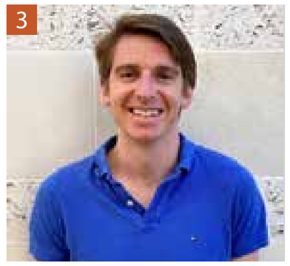
Neil Davies was promoted to Professor grade 12 in June 2025.

Alex Liu was promoted to Professor grade 11 in June 2025

In June 2025 **Owen Weller-Gibbs** was promoted to Professor grade 11.

Nick Tosca has been selected as a Mineralogical Society of America Distinguished Lecturer for the 2025–2026 academic year.






Top to bottom: 1. Marie Edmonds, 2. Alex Liu, 3. Owen Weller-Gibbs, 4. Nick Tosca.

The Geological Record

Obituaries

We are very sad to announce that **Dr Peter Friend** passed away on Thursday 9th October 2025. Peter spent his whole career in the Earth Sciences Department and was a very prominent sedimentology researcher, lecturer and field-trip leader. He ran the Friends of the Sedgwick Museum for many years. He was a known and well-liked member of staff for decades so many alumni will have happy memories of interactions with 'Pedro Amigo'. You can access the full obituary at **https://bit.ly/4toyGO2**

Student Prizes

Dave Thompson Award recipients, 2026: Calista Eitel-Porter (Corpus Christi), Flo Richardson (St Johns), Petra Brewer (King's), Emma Martin (Churchill), and Mia Tan (Churchill). Their project was mapping in the Cantabrian mountains in the North of Spain.

The Reekie Memorial Prize winner was Georgie Van Dyke (Christ's) for the project: Geology of Pichi Richi Pass, South Australia.

Class of 2005 Award: First prize was awarded to Juthika Sarma (Gonville & Caius), Quinn Chatten (Sidney Sussex), Matthew Rayner (Fitzwilliam) and Abi Crowdy (Trinity Hall) going to Austria.

Second prize was awarded to Flo Richardson (St Johns), Petra Brewer (King's), Emma Martin (Churchill), and Mia Tan (Churchill) mapping in northern Spain.

Retirements

Jane Hart, Secretary to the Department Administrator, retired at the end of February 2025 after many years of service to the department.

Carole Cornthwaite, a member of our accounts team, retired at the end of April after 9 years in the department.

New Staff





Left to right: Wei-Ning Fang, Quentin Kriaa, Dr Brennan O'Connell, Dr Ségolène Rabin and Julie Meunier.

In February 2025, **Johannes Stampa** joined as Research Assistant/Associate in Sergei Lebedev's group.

Lord Amissah started as our new Cleaner in February 2025.

Wei-Ning Fang joined as a new Research Assistant/Associate in Oscar Branson's research group in February 2025.

Also in February 2025, we welcomed **Siddhartha Bishnu**, a new Research Associate in Ali Mashayek's research group.

Sanjoo Paddea, started in March 2025 as CDT Programme Manager for AI4ER.

Chris Parish succeeded Charlie Aldous as Building Services and Workshop Manager in March 2025.

Quentin Kriaa joined in April 2025 as an Assistant Professor, a joint post with DAMTP.

Carol Hickman joined in April 2025 as our Business Operations Manager.

In April 2025, **Isabel Papanagou** joined as a Research Associate working with Sanne Cottaar.

Thomas Ginnis started in April 2025 as a Research Associate working with Rich Harrison.

Satya Ilindra joined as a Research Associate working with Oscar Branson in April 2025.

Neil Marjoram was appointed Department IT Manager in September 2025.

In September 2025, **Dr Ayesha Fuentes**, joined the museum as Exhibitions and Displays coordinator (while **Rob Theodore** is on secondment with the central University Cambridge Museums team).

Adam Osmond was confirmed as the new Senior Workshop Technician in October 2025.

In October 2025, **Archie McCulloch** joined as Computer Technician in a Sandwich Placement.

Anna Piper-Thompson, Visitor Services Assistant, and **Amy Barker**, Learning & Engagement Assistant, joined the Sedgwick Museum in October 2025.

Dr Brennan O'Connell, became a Research Fellow (working with Neil Davies) in the 2025 academic year.

New Research Assistant, **Jessica Lok**, has begun working with Sergei Lebedev in October 2025.

Dr Ségolène Rabin, UKRI Research Fellow is now working with Helen Williams.

Dr Richard Fallon, Post-doctoral Researcher in Natural History Humanities is working with Liz Hide.

Ewan Davies and **Tsungrojungla Walling**, joined in November 2025 as Research Assistants, in Luke Skinner's research group.

Nanda Eguren Garcia joined as Teaching Coordinator in December 2025.

Julie Meunier started in December 2025 as a Research Assistant working with Ali Mashayek.

Simona Petretto joined as a Finance Assistant in December 2025.

January 2026, **Daniel Gaskell** joined as a Research Assistant working with Oscar Branson.

Caitlin Razzell joined as Archive Assistant in the Sedgwick Museum in January 2026.

Dianne (Annie) Carr started in the role of CREATES Training and Inclusive Support Coordinator in January 2026.

Andrea May joined in January 2026 as HR Assistant.

Leavers

Oksana Gerasimova, who was seconded as Assistant Department Administrator (maternity leave cover for Emma Chapman who returned in September 2025) left in July 2025, having successfully secured a new position as Assistant Department Administrator in the Department of Geography.

Alexandra Irish completed her temporary role in the Teaching Office, departing in October 2025.


A group of students on the 2025 Spanish field trip.

Make a world of difference in Earth Sciences

Donations from our alumni are increasingly important in adding value to our students' experience of Earth Sciences, whether through teaching or through research as a Part II or III undergraduate or post grad.

There are four ways that you can allocate your gift:

- The **Earth Sciences Fieldwork Fund** helps maintain the department's strong commitment to field teaching as a vital way of bringing lecture and practical material to life. Your support boosts fieldwork provision for all students so funds are not a barrier to full participation in our offering.
- The **Earth Sciences Student Support Fund** helps individual students struggling with the extra costs of doing an Earth Sciences degree. Our aim is for nobody to be disadvantaged because they can't afford a field course fee, or the cost of a laptop for remote learning for instance.
- The **Sedgwick Museum of Earth Sciences Fund** helps the Museum to care for and share its internationally important collections. The Museum continues to provide access to its collections for researchers and students including at the Collections Research Centre, while its targeted school and public programmes encourage the next generation of Earth Scientists.
- The **Earth Sciences General Fund** is unrestricted in its use. It can help to support all urgent or unexpected needs within Department, including topping up partially-funded postgraduate studentships, helping with travel to research labs, with new initiatives for lab equipment, and other urgent requirements.

You can donate online at **philanthropy.cam.ac.uk/give-to-cambridge/earth-sciences** or fill out the Donation Form inserted with this *GeoCam*.

For further information about donating to Earth Sciences or guidance on how to leave a gift, please do contact us:

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Associate Director, Physical Sciences
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Thank you to all our donors

To all whose contributions to the Department's funds makes possible providing a fuller and enriching experience for our students, we offer our most grateful thanks.

Your donations make a difference to the department on a daily basis.

Some year groups contribute regularly to a Class Award Fund which provides grants or awards to students. Details of the prize winners can be found on the Geological Record pages herein.

With costs rising for everyone, your donations – one-off and regular contributions alike – make a huge difference to Cambridge Earth Sciences, offering a fully rounded experience to our students and keeping the quality of learning provision as high as possible.

We are so grateful to everyone who offers us this support and welcome new donors. Please feel free to get in touch or utilise the donation form enclosed with this edition of *GeoCam* if you would like to contribute.

Ways to stay connected to Cambridge Earth Sciences

The Alumni Day and Dinner

Each year we open the doors to the department to welcome back alumni. Joining the day gives you an opportunity to catch up with your peers, meet current students, hear from current staff speakers, and explore the building once again.

Whether you've been to a past Alumni Day or not had the chance to return until now, coming along is well worth the journey and spending an afternoon on site will be surprisingly easy. See the flap on the back cover for more information and to book your tickets.

Email newsletters

Receiving our e-newsletters is a great way to keep up to date with current news, research updates and other happenings in the Department. Sent each term, they include bite sized articles we think you'll enjoy reading, that will keep you informed not only on the latest thinking in the discipline but also on the people and projects you may have encountered while studying here.

To receive the emails, please ensure that we have the right email address and permissions by accessing your cantab account or emailing **alumni@esc.cam.ac.uk**. Select the permissions that allow for Department emails and for alumni and event messages.

Affiliates Programme (CESAP)

In February, we launched our Cambridge Earth Sciences Affiliates Programme (CESAP). This new programme aims to build strong partnerships with industry – opening up career pathways for students and fostering collaborative thinking that will deliver science-driven solutions to today's pressing environmental challenges.

If your organisation would benefit from connecting with the programme, please do get in touch: **cesap@esc.cam.ac.uk**


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Moving home?

To keep in touch, make sure you update your contact details with us at: **alumni.cam.ac.uk/contact/update-your-details**

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Be part of the future with a gift in your Will

Leaving a gift to the Department in your Will helps the Department thrive long into the future. Your support will open up a world of opportunities for the next generation of students, researchers and academics. A legacy gift is a meaningful way for you to make a lasting difference.

For further information about the impact of a legacy and guidance on how to leave a gift to the Department of Earth Sciences please do contact us:

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Students on the 2025 Greece field trip.