

THE UNIVERSITY OF OXFORD
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OXFORD

NEWS

ANATOMY OF A "ZOMBIE" VOLCANO: INVESTIGATING
THE CAUSE OF UNREST INSIDE UTURUNCU

FEATURE

FIELD TRIPS IN SUPPORT OF CARBON STORAGE

REPORT

FOURTH YEAR FIELD TRIP TO CANADA

Cover Photo by Jakob Kneale, British Columbia, Canada

WELCOME

TO THE OXFORD EARTH SCIENCES ALUMNI MAGAZINE

CONNAL MAC NIOCAILL – HEAD OF DEPARTMENT

Dear Alumni,

Welcome to the 2026 edition of our Alumni magazine; the first of my term as Head of Department. I'd like to thank my predecessor, Mike Kendall, for his leadership of the department over the past three and a half years in what have not always been smooth waters.

I begin by welcoming two new faculty members who started in Michaelmas term: Thomas Aubry as Associate Professor of Environmental Geophysics; and Noam Vogt-Vincent as Associate Professor of Climate Science. By coincidence both are Tutorial Fellows at St. Hugh's College. We also bid farewell (but not goodbye!) to Bob Hilton, who has been appointed to the Chair of Physical Geography, and moves next door to the School of Geography and the Environment but will continue as a visitor on our faculty.

I hope the articles in this magazine will demonstrate that the department is in rude health scientifically and intellectually. We are recognised world-wide for the quality of our research and teaching across the full spectrum of the Earth Sciences, and increasingly for our contributions to industry and government policy. This was borne out in the New Year's Honours list where Gideon Henderson was awarded a CBE for services to Science, following a 6 year secondment as Chief Scientific Advisor to the Department of the Environment, Food & Rural Affairs (DEFRA); while Tamsin Mather was awarded an OBE for services to Volcanology and to the Promotion of Science. Tamsin also served a short term as interim Chief Scientific Advisor to the Ministry of Defence in 2025.

Speaking of awards, David Pyle was elected Fellow of the Royal Society in 2025; Hugh Jenkyns was awarded the 2025 Lyell Medal

from the Geological Society for his lifetime contributions to 'soft' rock studies; and Julie Cosmidis was awarded the 2025 European Mineralogical Union Research Excellence Medal in recognition of her outstanding contributions to research in mineralogy, and in strengthening scientific links in Europe. Mike Searle will receive the 2026 Arthur Holmes Medal from the European Geosciences Union in early May for his exceptional standing and achievements in Solid Earth Geosciences; and Paula Koelemeijer is the 2026 recipient of the Royal Astronomical Society's Fowler Award for early career achievement. Claire Nichols received a 2025 MPLS Outstanding Research Supervision Award and Rebecca Colquhoun and Hannah Sanderson were winners of the Best Team Effort category in the 2025 MPLS EDI awards. At this rate we will need a trophy cabinet in the atrium!

Michaelmas term has seen the arrival of a fresh cohort of Undergraduates and Graduates. They are the lifeblood of the department and supporting them remains a big challenge in a constrained funding landscape. I'd like to thank all of you who help support us in providing them with opportunities. I look forward to catching up with as many of you as possible over the coming years and hope for your continued support (moral, practical and financial!) in providing a world-class education to the next generation.



STUDENT THANK YOUS

OUR STUDENTS WOULD LIKE TO EXPRESS THEIR GRATITUDE TO OUR ALUMNI FOR SUPPORTING THEIR FIELDWORK.

"Our Earth Sciences field trips have undoubtedly been one of the highlights of my time at Oxford. Thank you so much to our generous alumni and friends of the Department who continue to make the trips possible!"
Jakob Kneale (fourth year undergraduate)

"Thank you so much for supporting our field trips and equipment. These experiences have been crucial to my studies, and I really appreciate the generosity that makes them possible."
Scott Sellars (first year undergraduate)

"Thank you so much for contributing to the funding for our field trips. It has been such a great experience to be able to go all over Europe and explore the unique geology there, and has been a major highlight of my time at Oxford as an undergraduate."
Matthew McKinnon-Bell (fourth year undergraduate)

"I would like to express my sincere gratitude for your continued support in funding fieldwork equipment for first year undergraduates. Your generosity has helped ensure that fieldwork (a vital part of Earth Sciences, as I am sure you will agree) remains safe and accessible. Your support also helps to uphold the strong sense of community that defines Earth Sciences. Once again, thank you very much for your generosity."
Anonymous (first year undergraduate)

CHARITY WORK

A small selection of the ways in which members of Oxford Earth Sciences have contributed to society this year...

Over the past year **Matthew McKinnon-Bell** (fourth year student) raised £302 for muscular dystrophy in the Town and Gown 10K (May 2025) and £760 for Alzheimer's when running the Oxford Half Marathon (Oct 2025).

Emily Donald (Geofacilities Lab Manager) completed a week's voluntary service with Derby Kids Camp, a charity that gives disadvantaged children from the Derbyshire area a holiday in the countryside. The charity runs five weeks of camps over the school summer holidays, each a week in length. On average 70 children per week get out into the Peak District national park where they might otherwise have never left the city.

Professor Tamsin Mather and members of University College swapped the business suits and academic gowns for Lycra shorts and took part in a six-hour cyclathon to raise funds for the Oxford University Sport and Community Partnership.

Professor **Mike Searle** continues to raise money for his Nepal earthquake charity, Yarsa-Kashigaon village. He currently pays two teachers' salaries for the school that was built following the last earthquake.

Image credit:
Professor Mike Searle



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	NEW KIDS ON THE ROCK		OBITUARY – SARAH TREVARTHEN, 1971 – 2025

GILLMAN AND SOAME

Throughout the years, Gillman & Soame have photographed students at Department of Earth Sciences. They have created an online gallery of departmental photographs which are now available for you to view and purchase.

Please use the following link, and your email address when prompted, to view and order on the Gillman & Soame website: <https://www.gsimagebank.co.uk/earth/t/alumnibsg9gh>.

If you have any queries, or if the photograph you are looking to purchase does not have a preview image available, please contact enquiries@gillmanandsoame.co.uk as they will be able to assist you further.



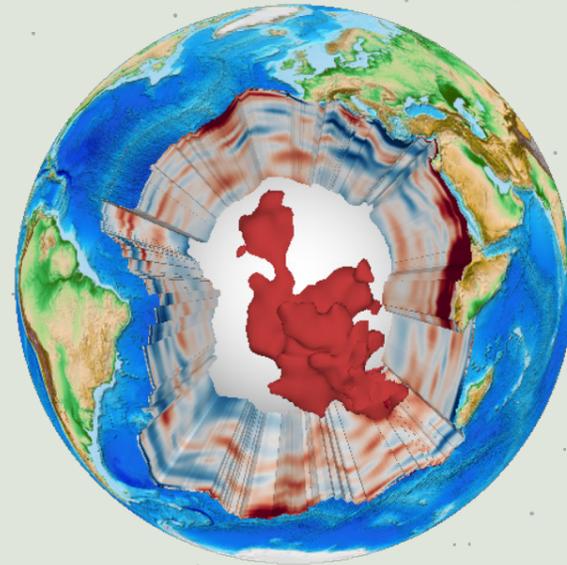
STUDYING THE EVOLUTIONARY HISTORY OF LARGE LOW VELOCITY PROVINCES IN THE DEEP MANTLE

Research by Associate Professor Paula Koelemeijer

A new study has revealed that two continent-size regions in Earth's deep mantle have distinct histories and chemical compositions, challenging the assumption that they are the same. Deep inside the mantle are vast areas beneath the Pacific Ocean and the African continent where seismic waves travel much slower than average. These "Large-Low-Velocity Provinces" (LLVPs) are larger than continents, up to 900 km high and thousands of kilometres wide.

Researchers have long assumed the LLVPs are similar in nature e.g. composition and age, because seismic waves behave similarly in both. But the new study, which modelled their formation through time, shows that the African LLVP contains older, better-mixed material, while the Pacific LLVP holds 50% more and younger subducted oceanic crust. These density differences may explain why the African LLVP is more diffuse and taller than its Pacific counterpart.

Such differences were overlooked because temperature mainly controls seismic-wave speed. The models show both LLVPs share the same temperature, explaining their seismic similarity. This underscores the importance of integrating scientific disciplines to investigate Earth's interior.



Visualisation of seismic model S40RTS (Ritsema et al., 2011), showing the LLVP (large red area) under Africa, made using the GPlates software.

RESEARCHERS UNCOVER CRUCIAL EVIDENCE FOR THE ORIGIN OF WATER ON EARTH

Research by Associate Professor James Bryson and Thomas Barrett

New research has uncovered crucial evidence for the origin of water on Earth. Using a rare meteorite type, an enstatite chondrite, whose composition reflects that of the early Earth (4.55 billion years ago), they identified a source of hydrogen critical for forming water molecules.

Crucially, researchers have shown that the hydrogen in this material was intrinsic, not from terrestrial contamination, suggesting that the building material of our planet was far richer in hydrogen than previously thought. Without this fundamental building block of water, Earth could not have developed conditions to support life.

The origin of hydrogen, and therefore water, on Earth has been heavily debated, with many arguing it was delivered by asteroids during the first 100 million years of Earth's history. But these new findings contradict that view, suggesting instead that Earth possessed the hydrogen needed to create water from its formation.



The meteorite used in this study - LAR12252 - when it was discovered in Antarctica. Image credit: The ANSMET (ANTarctic Search for METeorites) Program, Case Western Reserve University and the University of Utah

HIDDEN CHEMISTRY OF EARTH'S CORE REVEALED BY HOW IT FROZE

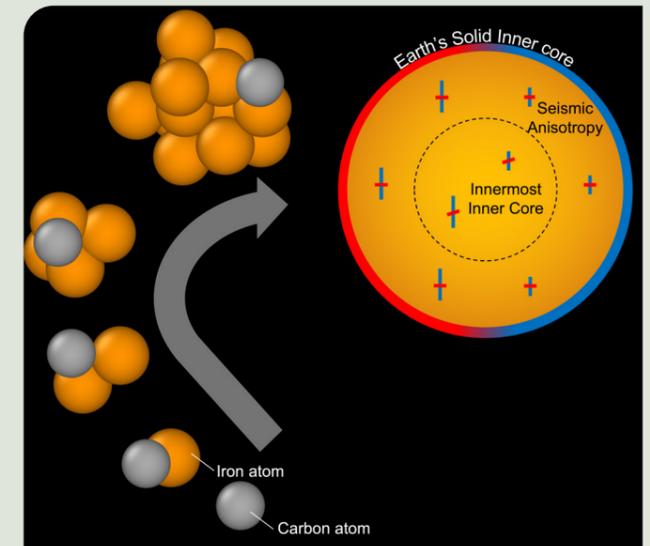
Research by Associate Professor Andrew Walker

Earth's inner core, the iron-rich mass at the planet's centre, is slowly growing as the surrounding molten outer core cools and freezes. But when did this freezing begin?

Molten iron must be supercooled—cooled below its melting point—before it can freeze. Previous calculations suggested that 800–1000°C of supercooling would be required if the core were pure iron. Yet if the core had supercooled this much, simulations show the inner core would have grown excessively and Earth's magnetic field would have failed. Seismic observations and ancient magnetised rocks indicate neither occurred. Instead, scientists think the core cooled by no more than about 250°C below its melting point.

How, then, could the inner core freeze with such limited supercooling? New research has examined how elements, including silicon, sulphur, oxygen and carbon affect freezing. They found silicon and sulphur slow the process, while carbon accelerates it.

By testing different compositions, researchers showed that if 3.8% of the core's mass is carbon, required supercooling drops to 266°C. This suggests carbon may be more abundant in the core than previously thought, and that without it, a solid inner core might never have formed.



The authors used atomic scale simulations to identify solids nucleating in supercooled liquids. They found that carbon atoms can accelerate this process, perhaps enough to trigger the freezing of Earth's solid inner core. Image credit: Dr Alfred Wilson

YEARS AFTER AN EARTHQUAKE, RIVERS STILL CARRY THE MOUNTAINS DOWNSTREAM

Research by Professor Bob Hilton

On 12 May 2008, the magnitude 7.9 Wenchuan Earthquake shook central China. Over 69,000 people died, nearly a third from geohazards such as the 60,000 landslides. After 15 years of research, scientists now have an account of the fate of the landslide debris. Surveys of a reservoir downstream of the epicentre revealed how the region's major river moved this sediment and how it affected the river channel. The results suggest that hazards caused by megaquakes may last long after the ground has settled.

It has long been known that bedload carried by rivers after earthquakes can fill river channels with sediment. Flooding often follows earthquakes, and scientists believe this pulse of sediment freed by seismic activity is to blame. But direct measurements of bedload flux have been very difficult.

The Zipingpu Dam, which began construction in 2001 and started impounding the Min River in 2006, became the perfect sediment trap for investigating these questions. The reservoir, 20 km downstream of the Wenchuan epicentre, collects sediment from the Longmen Mountains.

Researchers began surveying the sediment flowing into the reservoir. They monitored suspended sediment daily, but needed data on the river's bedload. This seemingly straightforward task required over a decade of field campaigns. The team spent days on a boat mapping the reservoir bottom with sonar. Changes from one expedition to the next created an account of total sediment accumulation. Subtracting suspended-load flux from total sediment flux allowed calculation of bedload flux.

The team found that total sediment flux in the Min River grew sixfold after the earthquake, but more striking was that bedload increased 20-fold. Bedload thus accounted for about 65% of sediment flowing through the river after the earthquake, compared with typical values of around 20% for mountain rivers of this size.



Landslides on the hillsides and sediment on the river valley sides at Longmen Shan, Sichuan China. Image credit: Professor Bob Hilton

SCIENTISTS DEFINE THE INGREDIENTS FOR FINDING NATURAL CLEAN HYDROGEN

Research by Professor Chris Ballentine and Professor Mike Daly

Researchers at the University of Oxford, Durham University and the University of Toronto have detailed the geological ingredients needed to find clean sources of natural hydrogen beneath our feet. The work describes the requirements for natural hydrogen to accumulate in the crust, produced by Earth over geological time, and shows that environments with these ingredients are globally widespread.

These findings, published in Nature Reviews Earth & Environment, offer a solution to the hydrogen-supply challenge and will help industry locate and extract natural hydrogen to meet global demand, eliminating the use of hydrocarbons for this purpose.

In the modern world, a reliable hydrogen supply is vital: fertiliser made from hydrogen feeds half the global population, and hydrogen is a key energy component in many carbon-neutral roadmaps, essential for avoiding the worst climate-change scenarios.

In the past billion years, Earth's continental crust has produced enough hydrogen to supply humanity's energy needs for at least 170,000 years. Although some has been lost, consumed or is now inaccessible, the remainder could offer a natural, emission-free resource.

Until now, limited hydrogen sampling and measurement have restricted understanding of where, and how much, hydrogen exists in the crust. This research outlines the key ingredients needed to guide exploration for different 'hydrogen systems' including how much hydrogen is produced and the rock types and conditions involved; how hydrogen migrates underground; the conditions that allow a gas field to form; and the conditions that destroy hydrogen.



Abandoned water well, Montana, USA. Measurement of gases dissolved in groundwater may help discover natural hydrogen. Image credit: Professor Chris Ballentine

NEW METHOD PROVIDES THE KEY TO ACCESSING PROTEINS IN ANCIENT HUMAN REMAINS

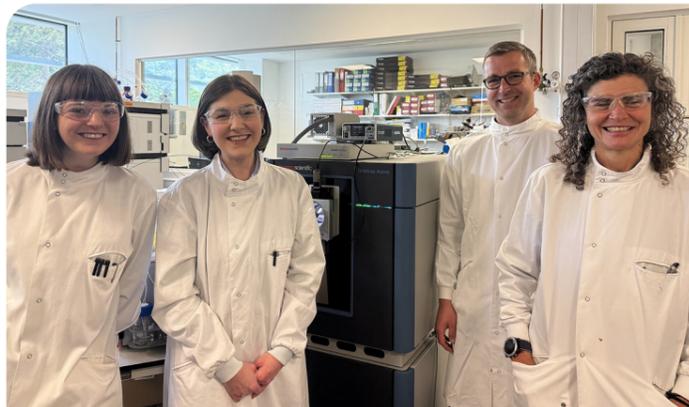
Research By Alexandra Morton-Hayward

A new method developed by researchers could soon unlock the vast biological information preserved in proteins from ancient soft tissues. From brains and muscles to stomach and skin, such tissues offer unique insights into the past and individual lives. In this study the team developed the first robust method for extracting and

identifying proteins from ancient soft tissues, then demonstrated it on archaeological human brain samples.

A key hurdle was finding an effective way to disrupt cell membranes to release proteins. After testing ten strategies on samples from 200-year-old human brains excavated from a Victorian workhouse cemetery, the team found that urea (a major component of urine) successfully broke open the cells. After extraction, proteins are separated by liquid chromatography and identified using mass spectrometry, which separates them by mass and electrical charge. The team increased the number of identified proteins by up to 40%. Using the combined method, they identified over 1,200 ancient proteins from just 2.5 mg of sample, the largest and most diverse palaeoproteome reported from any archaeological material.

They identified a wide range of proteins involved in healthy brain function and potential biomarkers of neurological diseases such as Alzheimer's and multiple sclerosis. Since fewer than 10% of human proteins are expressed in bone, compared with about 75% in internal organs, this technique could vastly expand understanding of ancient diet, disease, environment and evolutionary relationships



Authors of the study (left to right: Dr. Sarah Flannery, DPhil student Alexandra Morton-Hayward, Prof. Roman Fischer, and Dr. Iolanda Vendrell) in the Mass Spectrometry Lab at the Centre for Medicines Discovery, Nuffield Department of Medicine, University of Oxford. Image credit: Roman Fischer

ANATOMY OF A "ZOMBIE" VOLCANO: INVESTIGATING THE CAUSE OF UNREST INSIDE UTURUNCU

Research by Professor Job Blundy and Professor Mike Kendall



Cerro Uturuncu, one of many volcanoes on the Bolivian Altiplano that lie above the Altiplano-Puna Magma Body. Image credit: Professor Jon Blundy

Scientists from China, the UK and the USA have collaborated to analyse the inner workings of the Uturuncu volcano. By combining seismology, physics models and rock-composition analysis, researchers identify the causes of Uturuncu's unrest, alleviating fears of an imminent eruption.

Deep in the Central Andes lies Uturuncu, Bolivia's "zombie" volcano, so called because although technically dead (its last eruption was 250,000 years ago), it still shows signs of unrest, including earthquakes and gas plumes. This unrest appears as a "sombbrero" pattern of deformation, with land in the centre of the volcanic system rising and surrounding areas sinking.

For the local population, assessing the likelihood and severity of a potential eruption is vital, but until now there was no explanation for the continued unrest. Scientists believed the key was to visualise how magma and gases move beneath the volcano.

The new study, used signals from more than 1,700 earthquake events to produce high-resolution images of the shallow-crust plumbing system beneath Uturuncu. The findings show that the volcano's "zombie"-like unrest is caused by the movement of liquid and gas beneath the crater, with a low likelihood of an imminent eruption.

Volcanic plumbing systems are a complex mixture of fluids and gases in magmatic reservoirs and hydrothermal systems. Previous studies have shown that Uturuncu sits above the world's largest known magma body in the Earth's crust, the Altiplano-Puna Volcanic Complex, and that an active hydrothermal

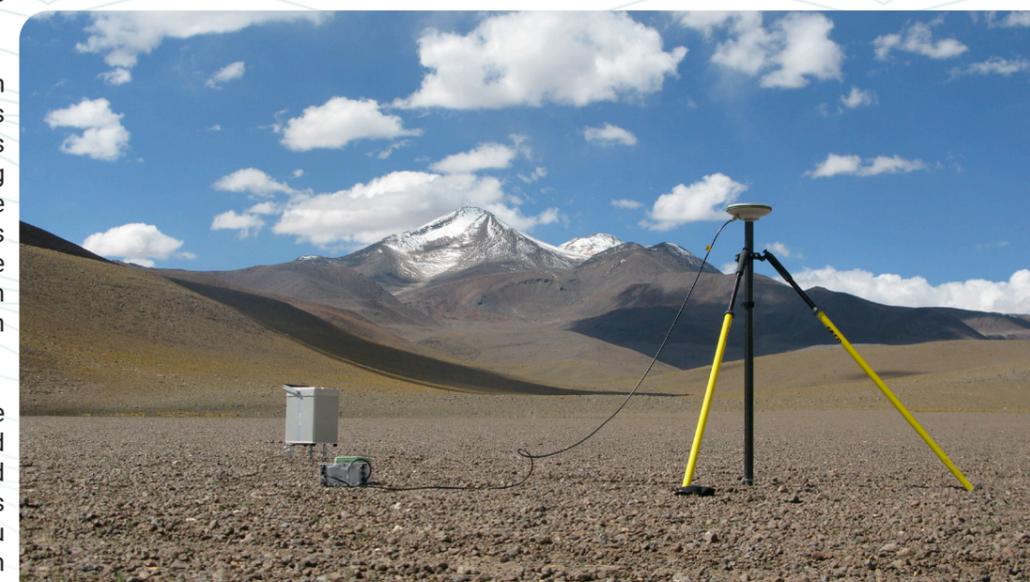
system connects this body and the surface. But it was unknown how fluids may be moving through this underground system.

The research team made use of seismic tomography, a way of imaging the interior of the volcano, similar to methods used in medical imaging of the human body. Seismic waves travel at different speeds through different materials, thereby providing high-resolution insights into the inner workings of Uturuncu in three dimensions. They combined this with analysis of the physical properties of the system, including rock composition, to better understand the subterranean volcanic system. This detailed analysis picked out possible upward migration pathways of geothermally heated fluids and showed how liquids and gases accumulate in reservoirs directly below the volcano's crater. The research team believe that this is the most likely cause for the deformation in the centre of the volcanic system, and that the risk of a

real eruption is low.

Professor Haijiang Zhang (School of Earth and Space Sciences, University of Science and Technology of China), one of the study's co-authors, said: "Understanding the anatomy of the Uturuncu volcanic system was only possible thanks to the expertise within the research team. This enabled us to combine various advanced geophysical imaging tools with modelling of the rock properties and their interactions with fluids."

The research team hope that similar studies using the joint analysis of seismological and petrological properties can be used to view the anatomy of other volcanic systems in the future.



Gravimeter and GPS station with Cerro Uturuncu in the background. Image credit: Duncan Muir, Cardiff University

FOR THE RECORD - RECENT AWARDS



Gideon Henderson **CBE**

Professor Gideon Henderson was awarded a CBE for services to Science in the New Years Honours. Professor Gideon Henderson joined the University of Oxford in 1999 and has been a Professor of Earth Sciences since 2006, also serving as Head of Department between 2013 and 2017. Throughout his career, Gideon has pioneered the use of geochemistry to understand a breadth of processes relating to climate, the ocean, and the carbon cycle. His world-leading research has transformed our understanding of surface Earth processes and their role in climate change, shedding light on sea-level changes, monsoon behaviours, and ocean circulation. He co-founded the GEOTRACES programme, which revolutionised understanding of trace metal cycles in the oceans, and has led global efforts to explore carbon removal strategies such as enhanced rock weathering and ocean alkalinity enhancement. His contributions have earned him numerous honours, including election as a Fellow of the Royal Society in 2013.

Alongside a celebrated research career, Gideon has also played a pivotal role in shaping environmental policy through numerous advisory roles, including chairing the Met Office Science Advisory Committee, as a member of the Advisory Board for the UN Decade of Ocean Science, and acting as Chief Scientific Adviser for the UK Government Department of Environment, Food, and Rural Affairs (DEFRA) between 2019 and 2025. His CBE recognises a career in which Gideon blends scientific innovation, leadership, and commitment to tackling global environmental challenges.



Tamsin Mather **OBE**

Professor Tamsin Mather was awarded a OBE for services to Volcanology and to the Promotion of Science in the New Years Honours. Professor Tamsin Mather joined the University of Oxford in 2006. She completed her undergraduate MSci in Chemistry and graduate degrees in History and Philosophy of Science (MPhil), and Earth Sciences (PhD) at the University of Cambridge. She was appointed Professor of Earth Sciences in 2014 and is currently a fellow of University College. Tamsin's internationally recognised research investigates volcanoes and volcanic behaviour, combining fieldwork, satellite observations, and modelling to unravel the complex links between volcanism, atmospheric chemistry, the environment and climate. Her expertise spans a diverse skillset which allows her to tackle questions surrounding the role of volcanism as a local to planetary-scale driver of environmental change (and stasis) throughout Earth's history in novel ways. Her scientific achievements have earned her numerous accolades, including the Rosalind Franklin Award in 2018 and election as a Fellow of the Royal Society in 2024.

Alongside her research, Tamsin is a passionate advocate for science communication and diversity in STEM. She has shared the excitement of Earth Sciences with the public through lectures, podcasts, media appearances, and her book *Adventures in Volcanoland*. She also sits on various advisory boards for UK government and more recently a venture capital fund focussed on promoting diversity and environmental solutions within its portfolio. She was the chair of the Volcanic and Magmatic Studies Group of Great Britain & Ireland from 2022 to 2025 and is currently the Associate Head of the MPLS division of the university for research and innovation. Her OBE recognises not only her groundbreaking contributions to volcanology but also her tireless efforts to inspire future generations and promote the value of science in society.



David Pyle **Fellow of the Royal Society**

We are thrilled to announce that David Pyle, Professor of Earth Sciences, has been elected a Fellow of the Royal Society. David is an internationally recognised volcanologist, and his election is in acknowledgment of his contributions to the understanding of processes, timings and impacts of volcanic eruptions, for creative use of archival materials to understand past volcanic crises, and engagement with wider publics. He has worked on volcanoes around the globe during his career, and has been dedicated to researching the causes and consequences of volcanic activity.



Hugh Jenkyns **Geological Society Lyell Medal**

Professor Hugh Jenkyns was the recipient of the 2025 Lyell Medal, awarded by the Geological Society of London for his pioneering research in 'soft'-rock studies. The Lyell Medal is awarded annually for contributions to 'soft'-rock studies and is among the Society's most prestigious awards. Hugh, who is an Emeritus Professor in the Department and Fellow of St Edmund Hall, is an internationally recognised sedimentary geologist, stratigrapher and palaeoceanographer. His pioneering research centres around understanding major global events in Earth history by examining their sedimentary and geochemical records, with a focus on Jurassic and Cretaceous marine and lacustrine sediments.



Mike Searle **EGU Arthur Holmes medal**

The Department of Earth Sciences is delighted to announce that Professor Mike Searle has been awarded the Arthur Holmes Medal of the European Geosciences Union for 2026, in recognition of his fundamental contributions to Himalayan tectonics. The Arthur Holmes Medal is one of the three equally ranked most prestigious awards made annually by the European Geosciences Union. The award is made to scientists who have "achieved exceptional international standing in solid Earth geosciences, defined in their widest senses, for their merit and their scientific achievements". Mike has worked on central Asian mountain belts for over 45 years and is celebrated as a pioneer of tectonic research. The focus of his scientific work is the structural, metamorphic, magmatic and geomorphological evolution of the continental crust in active mountain belts, and throughout his career he has examined the high Himalaya, mineralisation in Myanmar, ophiolite obduction in Oman, and Caledonian tectonics.



Julie Cosmidis **European Mineralogical Union Research Excellence Medal**

Associate Professor Julie Cosmidis has been awarded the distinguished 2025 European Mineralogical Union Research Excellence Medal in recognition of her outstanding scientific achievements. The European Mineralogical Union is a prominent scientific organisation whose objective is to further European cooperation in the Mineralogical Sciences. The Research Excellence Medal is presented annually to a young mid-career scientist who has made significant contributions to research in mineralogy, and whose professional and societal activities contribute to strengthening scientific links in Europe. Since joining Oxford Earth Sciences as an Associate Professor of Geobiology in 2020, Julie has led pioneering research at the intersection of geomicrobiology, mineralogy and environmental geochemistry. Her work explores microbial biomineralization (the process through which microbes produce minerals) and its implications for biosignature detection and sustainable materials.



Rebecca Colquhoun and Hannah Sanderson **MPLS ED&I Awards 2025**

Many congratulations to Earth Sciences DPhil students Rebecca Colquhoun and Hannah Sanderson, who were recognised in the MPLS Equality, Diversity and Inclusion Awards 2025. The MPLS ED&I Awards honour staff and students within the Division who have made outstanding contributions to advancing ED&I. Rebecca and Hannah were winners of the Best Team Effort category, having received multiple nominations from staff and students as the "indispensable, two-person team responsible for the impressively active LGBTQIA+ Affinity Group in the Earth Sciences Department". Among the founding members of the group in 2021, they have led the group this year alongside their final year DPhil studies. They organise monthly meetings for the Affinity Group, along with lots of events throughout the year as well as providing support and advice both for members of the group and for the wider Department.



Claire Nichols **MPLS Outstanding Research Supervision Award**

The MPLS Division Outstanding Research Supervision Awards acknowledge those who excel in their everyday supervision of DPhil students and early career researchers, and thank them for their vital role in supporting and preparing the next generation of research leaders. We are delighted to announce that Professor Claire Nichols was a recipient in 2025. Claire has been an Associate Professor of the Geology of Planetary Processes at the Department of Earth Sciences since 2020. She uses magnetism as a tool to understand how Earth and other celestial bodies generate magnetic fields, and the implications of this for processes in Earth's deep interior, the environment of the early Earth, and planetary habitability. Claire's ability to inspire confidence, foster collaboration, and support her students both academically and personally has earned her an MPLS Award for Outstanding Research Supervision.



Oxford Earth Sciences **Green Impact and LEAF Sustainability Awards**

We are proud to announce that the Department has received a number of Sustainability Awards this year, recognising the commitment of our technical staff to driving improvements across our building. The Department was awarded their fifth Gold Award in the Green Impact Programme, and seven facilities received a LEAF Award for Sustainable Laboratories, of which five were certified as gold standard. Green Impact is an award-winning programme that breaks down the often-complex world of sustainability into practical steps that University members can take to improve sustainable practice within their building, department or college. This year's Gold Award recognises the dedication of our Buildings and Facilities Team, Ashleigh Hewson, Jeanette Stimpson and Jason Dowsing, to improving sustainability in the Department.

NEW GEOLOGICAL MAP OF THE HIMALAYAN RANGES

MIKE SEARLE, PROFESSOR OF EARTH SCIENCES



Professor Mike Searle making some additions to the eastern sheet

The Himalayan ranges runs for about 2500 km along the northern boundary of the Indian plate and contain most of the highest peaks on Earth. The Indian plate collided with Asia approximately 50 million years ago, and since then it has indented northward causing the rise of the Himalaya, as well as the great Plateau of Tibet at an average elevation of just over 5 km above sea-level. Remnants of the Tethyan ocean that once separated the Indian plate from the collage of plates that make up Asia

Indian plate that form the south-vergent fold-and-thrust belt. The southern margin of the Himalaya is the Main Boundary Thrust, the active thrust fault along which the Indian plate is currently underthrusting the Himalaya and along which many of the large Himalayan earthquakes occur, such as the 2015 Gorkha earthquake in Nepal.

I have been researching the geology of these collisional mountain belts almost every year since 1981, together with some 20 Oxford DPhil students and key collaborators, mostly in Kashmir – Ladakh – Zaskar (NW India), the Nepal Himalaya, and the Karakoram – Hindu Kush Ranges of north Pakistan, and southern Tibet. Several forays into Tibet and the remote parts of the Pamir and eastern Himalaya in Bhutan and Sikkim also increased my understanding of how the Himalaya were made. Some of the stories of these adventures in geology are recounted in my book “Colliding Continents” (Oxford University Press, 2017). Our research has relied on ground truthing (geological mapping) and structural geology, combined with stratigraphy, palaeontology, geochemistry, metamorphic modelling (thermobarometry), detrital zircon chronology (protolith stratigraphy), U-Th-Pb geochronology (age of peak metamorphism and crustal melting), and deep crustal – mantle geophysics (INDEPTH crustal profile and others). The resulting maps are lithotectonic maps, combining stratigraphy with structural – metamorphic information. Cross-sections are constructed using geological mapping and down-plunge projection from surface information.

are preserved along the Indus – Yarlung Tsangpo suture zone than defines the northern boundary of the Greater Himalaya from Waziristan (Afghanistan) east across Ladakh and southern Tibet to the northern Myanmar (Burma) region. The upper crust of the Himalaya (Tethyan Himalaya) consists of the Phanerozoic sedimentary and volcanic rocks of the Indian plate. The deeper crustal rocks exposed along the Greater Himalaya are metamorphic rocks, migmatites and crustal melt leucogranites that comprise most of the high peaks along the Himalaya. These rocks are bounded by a low-angle normal, the South Tibetan Detachment, along the top and the Main Central Thrust Zone with its characteristic inverted metamorphic isograd sequence along the base. In the south the Lesser Himalaya are the mostly unmetamorphosed older sedimentary rocks of the



Close up of the Western sheet of the hand drawn geological map

One of my retirement projects was to bring all my maps, together with those of my students and other researchers, into a grand new ‘Geological Map of the Greater Himalayan ranges’. The coverage includes all the mountain ranges between the Afghanistan – Pakistan border in the west to the northern border of Myanmar (Burma) to the east. It includes the Hindu Kush, Hindu Raj, Karakoram, and Pamir ranges to the north, as well as the Gangdese range of southern Tibet. The

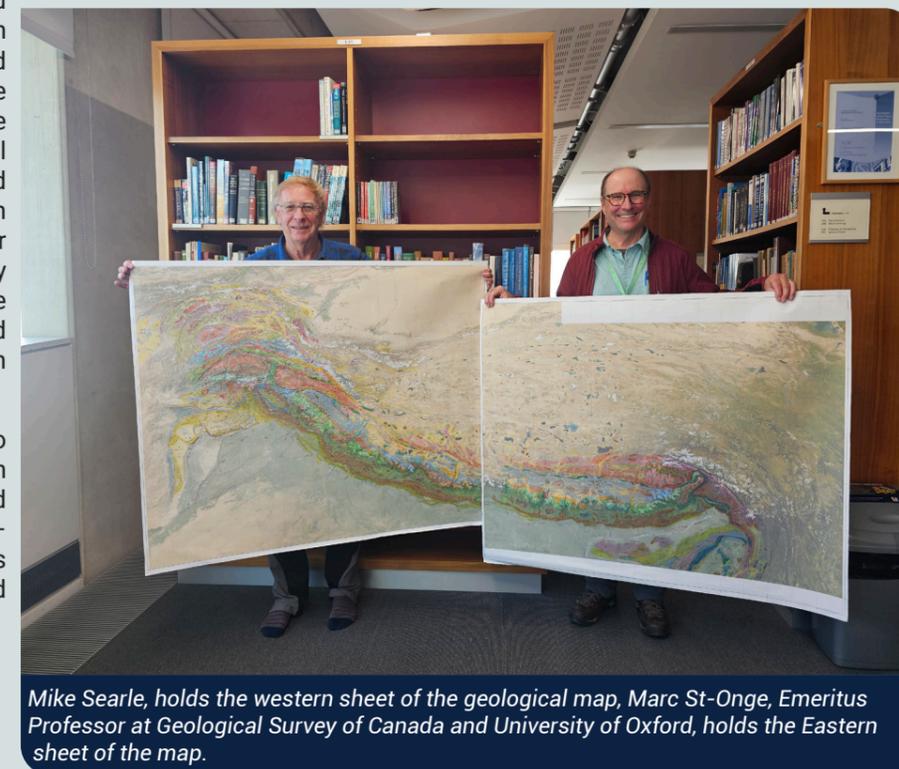


Close up of the Eastern sheet of the hand drawn map.

map was drafted using a base map extracted from the Environmental Systems Research Institute (ESRI) world imagery server produced by Earthstar Geophysics, and provided by the Geological Survey of Canada, Ottawa. The base map is at 1:1.5 M scale, and the final maps will be printed in two sheets, a Western Sheet and an Eastern Sheet. This project is a collaboration with the Geological Survey of Canada, Professor Marc St-Onge and colleagues, who are digitally recompiling my hand-coloured maps, and the Sorbonne University, Paris who will print and publish it under the auspices of the Commission for the Geological Map of the World.

The ultimate aim of our geological work is to determine the processes that make mountain belts, and to do this we rely on detailed and accurate field data, mapping and structural – strain data, in combination with all the methods outlined above. Tectonic models are only as good

as the data that goes into them, and it is more relevant than ever that accurate field mapping lies at the heart of this. Our understanding of the processes that form mountain belts are becoming more refined using all this data. Notable new ideas on tectonic processes that have arisen from recent Himalayan work include the subduction of continental crust to depths in excess of 100 km forming ultra-high pressure eclogites during initial collision, low-angle normal faults in compressional tectonic settings (South Tibetan Detachment), inverted metamorphic isograds along crustal-scale thrust faults (Main Central Thrust), and ‘channel flow’ – the southward extrusion of a partially molten layer of middle crust along the Greater Himalaya during the Miocene. Our 25 year-long Himalayan project at Oxford has involved a multi-faceted approach using expertise from many personnel and laboratories across the entire geological spectrum. It is hoped that this new geological map compilation will stand the test of time, relying on the fundamental building blocks of geological mapping.



Mike Searle, holds the western sheet of the geological map, Marc St-Onge, Emeritus Professor at Geological Survey of Canada and University of Oxford, holds the Eastern sheet of the map.

Professors Mike Searle (Earth Sciences) and David Gellner (Anthropology) will lead a Himalayan trip to Mustang region of Northern Nepal during October/November 2027 and invite you to join them. The trip will be 14 days and cover the history, culture, geology and natural history of Nepal. We will visit the classic ancient temples of Kathmandu and Patan, the beautiful lakeside town of Pokhara, and approximately 10 days travel, mainly by jeep but with short treks, to the fabled district of Mustang on the Tibet border. We will stay at excellent hotels in Kathmandu and Pokhara, and small guesthouses in Mustang. We will jeep along the Kali Gandaki gorge between the 8000 meter high peaks of Dhaulagiri and Annapurna looking at classic geological sites en route, and spend 3 days in the magical capital of Mustang, Lo Mantang. The all-inclusive trip will be organised by Distant Horizons in UK and Mike Treks and Expeditions in Pokhara. Please contact Charlie Rex for further information.

BERMUDA: FUSING THE PAST, PRESENT AND FUTURE OF CLIMATE CHANGE

NOAM VOGT-VINCENT, ASSOCIATE PROFESSOR OF EARTH SCIENCES

Since 2010, half of the fourth-year undergraduates begin the academic year at the Bermuda Institute of Ocean Sciences (BIOS), a marine research station in the middle of the Sargasso Sea, in the North Atlantic. This remarkable and intensive field course uniquely bridges the past, present and future of climate change, acting as a capstone for this running theme across our Earth Sciences course.



Students exploring the geological history of Bermuda

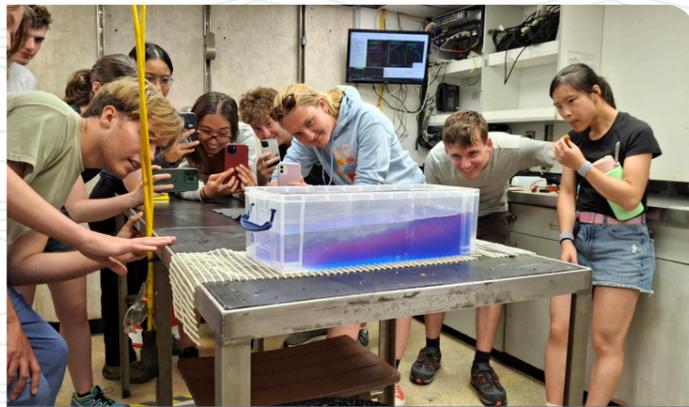
Through marine and terrestrial excursions, students observe a modern carbonate factory in action across the Bermudan marine environment, directly next to their lithified products on land. The dunes, palaeosols and beaches recorded in the Bermudan geology describe a dynamic history of environmental change in response to Pleistocene glacial cycles, while the adjacent marine life is itself responding to ongoing, anthropogenic changes in the Earth system. BIOS is also the home of the Bermuda Atlantic Time Series (BATS), one of only two long-term oceanographic time-series in the world. Every year, our students are given the unique privilege to participate in a 2-day research cruise to BATS aboard the R/V Atlantic Explorer, sampling the physical, chemical, and biological properties of the water column down to abyssal depths. This is real science in action,



The R/V Atlantic Explorer

with the data gathered forming part of a valuable multidecadal archive of change in our ocean. Combined with student-led presentations in the evenings based on their observations and the primary scientific literature, this field trip gives a holistic insight into oceanographic and (palaeo)climate research, creating an excellent foundation for the research-motivated fourth year.

The run-up to the 2025 field trip was spent anxiously monitoring the National Hurricane Center forecasts as Hurricane Gabrielle barrelled towards Bermuda. Fortunately, the hurricane just missed the island, and we arrived to perfect weather. One of our first tasks was to investigate "Devil's Hole", a silled depression on the Bermuda platform which develops a benthic anoxic layer during the summer, before being broken down through wind-driven mixing in autumn. This year, we managed to catch Devil's Hole with the anoxic layer still intact, with the students finding a stratified, low-pH and high chlorophyll layer in the bottom few metres using oceanographic instruments deployed from a boat. The third and fourth days were spent at sea on the R/V Atlantic Explorer. Despite Hurricane Gabrielle, the swell was surprisingly gentle. In between the excellent food served by the galley, we examined the physical, chemical, and biological data gathered by the ship's instruments and samples brought up from depths of over 3000 m. Operations on the ship continue 24/7, and many students expeditiously stayed awake for the nighttime zooplankton trawls, continuing past midnight.



Students examining the samples brought up from depths of over 3000 m

After returning from sea, we continued to analyse data gathered from the R/V Atlantic Explorer (including zooplankton identification and chlorophyll fluorometry). Over the following two days, we explored the geological history of Bermuda, with the rocks recording alternating palaeosols, fossilised dunes, and beach rock representing the effects of Pleistocene glacial-interglacial climate variability. Through a visit to a series of caves, we were able to clearly see the effects of past changes in sea-level on speleothem (cave formation) development.



Sunsets at sea

The geological record of environmental change on Bermuda provides valuable context for how this coral reef system is responding to climate change in the 21st century. On the final full day, we reached the northern rim of the Bermuda platform – North Rock – by boat, which is also the northernmost coral reef in the world. Bermuda was hit by a strong marine heatwave earlier in the

summer, with an intensity that would have devastated most tropical coral reef ecosystems. Amazingly, while we saw bleached corals as we surveyed North Rock through snorkelling, live coral cover remained high and there was little evidence of serious damage from the heatwave. With its position right at the latitudinal limit of reef formation, the corals in Bermuda experience much



Exploring the effects of past changes in sea-level on speleothem

greater temperature variability than their tropical counterparts. There is growing evidence that corals experiencing fluctuating temperatures may be more resilient in the face of rapid climate change, which is certainly consistent with what we saw at North Rock.

After a final goodbye to the Bermudan reefs at Tobacco Bay and a discussion synthesising everything we had learned over the week, we headed back to Oxford. Returning to the damp British autumn is often disappointing for some, but two further major hurricanes were heading towards Bermuda as we departed. One of these hurricanes, Humberto, hit Bermuda as a Category 5 hurricane days after we left, so we were very lucky indeed! We are extremely grateful to the BATS team, R/V Atlantic Explorer officers and crew, everyone at BIOS, and our enthusiastic fourth-year students, for making this year's trip such a success.

The Bermuda field trip has been transformational over its 15 years of operation. In addition to bringing the ocean and climate components of the course to life, it has directly shaped the careers of many of our alumni. Jennifer Weeks (taking part in 2017) is a sea-level expert at the Met Office, and Eloise Chambers (2019) now works on the R/V Atlantic Explorer at BIOS. I joined the Bermuda field trip as a student in 2018 and left inspired to do a PhD in coral reef oceanography. I was over the moon to be able to return to Bermuda this year as a member of faculty, showing the next generation of Earth Scientists the same things that changed my life almost a decade ago.

The educational outcomes afforded by the Bermuda trip are exceptional and would not be possible in a field location closer to the UK. However, running this course comes at a considerable cost. Part of this field trip is funded by the Earth Sciences Field Teaching Fund and we are extremely grateful to all our donors for their continued support. If you would like to contribute to the future of field trips in Earth Sciences you can find details of the fund on the 'Support Us' page of our website or on the back page of this magazine. Your financial support allows us to ensure that the Bermuda field course can continue into the future, inspiring student cohorts for many more years to come.

Photo credits: Noam Vogt-Vincent

FOURTH YEAR FIELD TRIP TO CANADA

JAKOB KNEALE, 4TH YEAR EARTH SCIENCES STUDENT

Over the summer, I enjoyed an unforgettable trip to beautiful British Columbia, Canada. The core of my trip was a fieldwork expedition to conduct geological mapping and collect rock samples for lab analysis in Oxford, to form the basis of my fourth year Masters of Earth Sciences project.

I joined a team of three geologists, Tarryn Cawood (UBCO), Lee Groat (UBC), and Danny Hnatyshin (GSC), and we flew by helicopter (a thrilling first) to camp at 2000m in the Canadian Cordillera mountains, on the Traditional Unceded Lands of the Sinixt people. Our field site, a large expanse of bare rock exposed by recent glacial retreat, is ideal for geological study.



Soon after we arrived, however, forty-eight hours of torrential rain transformed the landscape; little streams swelled into torrents, bare rock faces became sheets of running water, and flat areas became ponds. We were very grateful for our communal cooking tent (where we spent a number of evenings huddled around the propane stove) and for the BC Parks and Recreation tent platforms, which kept our tents raised above the flooded ground! For two days, I donned my field gear just as wet as I had peeled it off the night before!



We were all delighted and relieved when the weather changed and we were treated to long days of sunshine, stunning panoramic views, and glorious sunsets. Despite the rugged setting, I was surprised to find beautiful alpine meadows of colourful wildflowers growing in the scree above the tree-line and even, remarkably, from cracks in the bare expanse of rock. Camping in 'bear country' was a new experience for me. We took every precaution for safe coexistence in black and grizzly bear habitat, but didn't see any - to the relief of the team, and the slight disappointment of this Canada newcomer.



Our study focuses on a Li-mineralised pegmatite. With partial melting of the country rock and no granite in the area, this site appears to offer an excellent opportunity to test the anatexis model of pegmatite formation – something we will investigate with geochemical analysis. Understanding the formation of these rocks is a topical aim because Li mineralised pegmatites are an important source of lithium, a 'battery metal' crucial for many green energy technologies.



A massive thanks to Tarryn, Danny, and Lee for having me along for the ride, for being such a fantastic field crew, and for all their valuable teaching and expertise. It was an unforgettable experience! Thanks also to Exeter College for their financial support via the North American Travel Scholarship. I'm excited to continue the project from Oxford with my supervisors, Professor Richard Palin (Oxford), Assistant Professor Tarryn Cawood (UBCO) and Dr Lot Koopmans. The trip not only developed my geology fieldwork skills but also allowed me to explore a beautiful part of the world and broadened my horizons, opening my eyes to the wealth of exciting field geology opportunities in Canada.

INTRODUCING THE OXFORD EARTH PROGRAMME

DISRUPTING 'BUSINESS AS USUAL' - TIME FOR RESOURCE INNOVATION

We can no longer march along with a "business as usual" approach to natural resources. This is especially true for the so-called critical raw materials, a group of naturally occurring metals and minerals that are critical to a wide range of technologies, including those needed for the green energy transition. It is time to be bold, disruptive, and push the limits of what is possible.

This is the philosophy driving Oxford EARTH – a pioneering new strategic research programme at the University of Oxford dedicated to tackling the pressing global challenges of sustainable and equitable natural resource innovation. Traditional mining practices carry heavy environmental costs and have historically been associated with social inequality and exploitation in resource-rich regions, often countries in the Global South.

At the heart of Oxford EARTH'S work, we ask: *How can we access the resources we need for a sustainable future without repeating the environmental and social injustices of the past?* As the world races to achieve net zero energy production, demand for critical raw materials is increasing dramatically. Yet there remain significant social, technical, and geopolitical supply chain challenges to overcome. Metals such as lithium, cobalt and nickel are essential for electric vehicle batteries, while indium, gallium and tellurium play a key role in photovoltaic cells – and this is only the tip of the iceberg.

Led by Programme Director Professor Mike Kendall and Research Director Professor Jon Blundy, the Oxford EARTH programme brings together experts from nine departments and two academic divisions across the University. This diversity of expertise allows the programme to holistically integrate scientific, technological, social, and policy perspectives in a way that no single discipline could deliver alone. There is no other university programme addressing the resources challenge with a such a breadth of disciplines.

This interdisciplinary approach to natural resource research is exemplified through the Oxford Martin School-funded ReSET project in Montserrat. Researchers have been exploring the role that volcanic systems may play in enabling the transition to net zero in terms of clean energy production and resource recovery. While geothermal energy from volcanoes already supports electricity generation in many regions, the role of geothermal systems in transporting minerals and metals to the Earth's surface is less well understood. Determining what controls the metals endowment of geothermal fluids and exploring ways to co-recover these metals alongside geothermal heat provide opportunities for more sustainable forms of resource recovery and harnessing already existing geothermal operations.

Another team within the programme is examining biomineralisation – capitalising on the ability of microbes to produce minerals – as an alternative to traditional metal extraction techniques. Dr Julie Cosmidis, geomicrobiologist in the Department of Earth Sciences is leading this work in partnership with bioengineers from the Department of Engineering Science.



Crucially, Oxford EARTH's work extends beyond the laboratory. Through engagement with communities, policymakers, and industry partners, the programme is helping to shape a new global conversation around resource use, one that values environmental protection, social justice, and economic resilience equally.

In the coming years, Oxford EARTH will grow its training activities to develop the next generation of scientists and innovators in the Earth resources sector

worldwide. By equipping future leaders with interdisciplinary skills and ethical awareness, the programme aims to ensure that sustainable and equitable resource innovation and management is a foundation of global progress.

As our work expands, opportunities for collaboration, advisory involvement, and partnership will also increase, and we invite alumni with industry experience or global networks to get involved. If you are interested in funding our innovative projects or postgraduate students from developing nations, please get in touch. We would be delighted to work with you to develop and grow this part of the Oxford EARTH programme.



Article by Amanda Lee Ying, Oxford Earth Communications Officer



Stay informed about Oxford EARTH's progress and upcoming events:
Visit our website: oxfordearth.web.ox.ac.uk
Follow us on LinkedIn.
For direct enquiries, please email oxfordearth@earth.ox.ac.uk.

UNDERSTANDING DYNAMICALLY CHANGING RAINFALL PATTERNS

CHRIS DAY, RESEARCH FELLOW IN STABLE ISOTOPES

In wetter regions like the UK, it is easy to forget how reliant we are on clean freshwater. We turn on the tap and fresh drinking water gushes out. Until it doesn't. When rainfall patterns change, and groundwater reserves deplete, even advanced societies such as the Maya and the Akkadians have been forced to migrate away from previously prosperous regions, abandoning infrastructure that took centuries to develop.

Understanding dynamically changing rainfall patterns over hundreds to hundreds-of-thousands of years is a central research-topic for the 'Environmental Proxy' and 'Climotope' research groups of Oxford Earth Sciences. We have developed new isotopic techniques, often applied to cave stalagmite samples, to reconstruct past rainfall amount. We use U-Th radiometric dating of the stalagmite growth layers (similar to tree-rings) to date hydrological events, with chronological uncertainty < 10 years in some cases. These long, continuous hydrological records play a significant role in researching climate mechanisms on regional and global scales. To provide a brief overview of this work we provide snapshots of two of our recent research articles: i) rainfall reconstruction in the Middle Yangtze Valley of central China, an area that currently accounts for >30% of Chinese rice production; and ii) a study into when, where and why parts of the Sahara desert have been wetter and more habitable in the past. Variable rainfall and forced migrations play a significant role in shaping the history of modern-humans, promoting technological and cultural knowledge-exchange.

PRECISE CHRONOLOGY OF HYDROLOGICAL CHANGES AROUND 4.2KYR IN CENTRAL CHINA, TO ASSESS THE IMPACT OF FLOODING ON THE SHIJIAHE AND SHANG NEOLITHIC SOCIETIES

This stalagmite work, with colleagues from Wuhan, China, is our most isotopically involved hydrology study, reconstructing past rainfall from the Middle Yangtze Valley (MYV) in central China. With Oxford Earth Sciences measurements of Ca-isotopes, Mg/Ca elemental ratios and U-Th chronology, we produced a 1100 year long record of past rainfall at ~7 year resolution. Our record shows three drier-intervals with rainfall <700 mm/yr (4.36-4.33kyr BP, 4.23-4.10 kyr BP, 3.57-3.55 kyr BP), and two wetter-intervals with rainfall >1000 mm/yr (3.95-3.84 kyr BP, 3.70-3.59 kyr BP). Combined with archaeological and paleo-flood evidence, this data suggests that the Shijiahe culture underwent adaptation and thrived during drier periods, but abandoned the MYV when rainfall was >1000 mm/yr. This work demonstrates that water-excess can be as problematic as water-shortage even for more advanced neolithic societies. A latitudinal transect of hydrological records from Northern to Southern China demonstrated the existence of so-called 'dipole/

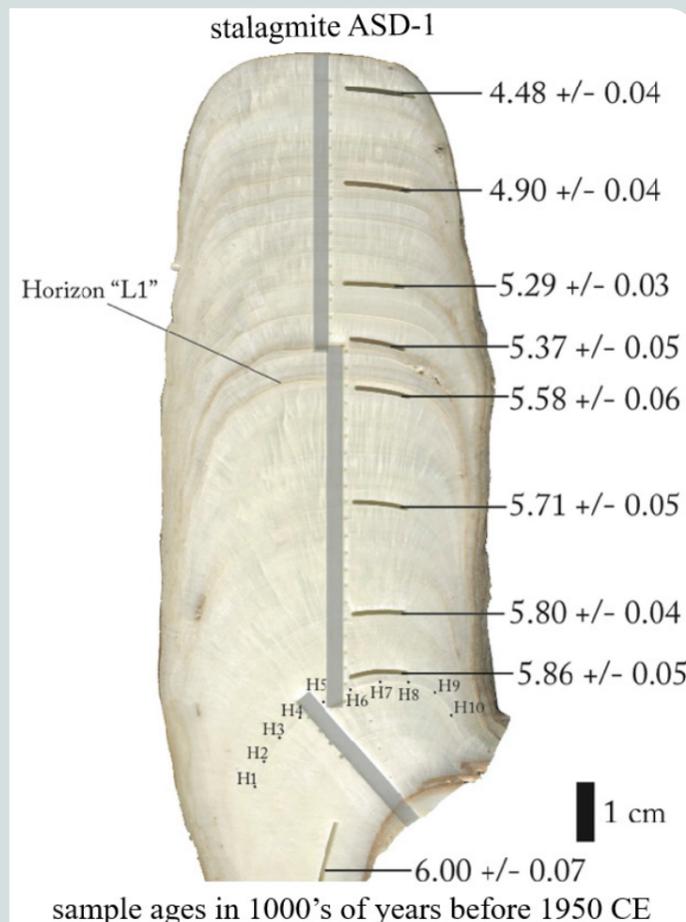


Asdif cave in southern Morocco, with Julia Barrott and Chris Day for scale. (Image Credit: Ben Lovett)



Returning from a day's work in the caves. This landscape has been much greener in the past, something that Sam Hollowood is seeking to better quantify. (Image Credit: Ben Lovett)

tripole' patterns of rainfall during this time period. Tripole/dipole rainfall patterns are also observed in the modern-day, and are known to respond to major climate systems such as the El Niño Southern Oscillation (ENSO). Full details are available in our online article, freely available at <https://tinyurl.com/5xna29bt>.



ASD-1 is an example stalagmite used in our North-African study, from a cave found by Julia Barrott during her 2010 fieldwork. We are careful to work with samples that are already broken from natural processes, e.g. by earthquakes or by rock fall within the cave. Stalagmites grow from bottom to top with banding similar to tree rings. Accurate chronology shows that the sample started to grow shortly before 6000 years ago. (Image Credit: Julia Barrott)

Major changes to the Sahara Desert 8,000 years ago uncovered by Moroccan stalagmites

Together with collaborators from Morocco and Algeria we work on a transect of research sites south of the Atlas mountains, on the north-western boundary of the Sahara desert, from ~125 km to ~1500 km inland from the Atlantic ocean. In these dry regions there is significant value in improving our understanding of groundwater recharge. During field expeditions with Oxford Earth Science DPhil students we were able to seek and find stalagmite samples in semi-arid to hyper-arid regions of North-West Africa. The existence alone of stalagmites is an indicator that these regions received increased rainfall in the past because they form when rainwater soaks through the soil and drips from the cave roof onto the ground. So, when we discovered stalagmites on the fringe of the largest hot desert in the world, we were excited to discover what information they could provide about Saharan rainfall in the past. Despite very low levels in stalagmites, analysis of uranium and thorium from stalagmite growth layers enabled us to determine when they started (and stopped) growing – and therefore when these areas of the Sahara were rainy in the past. The evidence suggests that our desert sites received more rainfall between 8,700 and 4,300 years ago, during the African Humid Period. We analysed the amounts of different oxygen isotopes contained within the calcium carbonate stalagmite to investigate the mechanism which supplied the rainfall. These measurements provide strong evidence that additional rainfall came from tropical plumes, huge bands of clouds in the upper atmosphere which can transport moisture from the tropics into the subtropics. This is the first study to show the influence of tropical plumes on this region in the past. At the same time, there is evidence from previous studies that the West African Monsoon encroached into the Sahara from the south, and that combined with tropical plume rainfall to the north, this suggests that the desert narrowed significantly during this period. This improved-habitability north and south of the central Sahara, increased recharge to rivers, and a narrower desert, may have encouraged movement by people across the Sahara during a key period in the development of land use and animal production. This time period coincides with a rise in the number of Neolithic archaeological sites in the region south of the Atlas Mountains, which then plummeted when arid conditions resumed. The full article is freely available at: <https://tinyurl.com/4jhfuz2>

The outcomes from these studies are testament to the decades of development work that take place daily in Oxford Earth Sciences, and to the excellent students that we are fortunate to work with. The list of all researchers and support staff that have contributed to this work is too long to mention, but students Julia Barrott, Rob Owen, Jin Liao, Hamish Couper, Chris Theaker, Samuel Hollowood, Nuchthita Khongbua have all played a central role. Our well-established instruments (multi-collector plasma mass spectrometers, gas source and quadrupole mass spectrometers) are also central to producing this cutting-edge data. We are always grateful for any support, no matter how small, for maintaining research and teaching momentum.

NEW KIDS ON THE ROCK

INTRODUCING THE NEW APPOINTMENTS IN OXFORD EARTH SCIENCES



Thomas Aubry

Associate Professor of Environmental Geophysics

Thomas joined the department in July 2025 as Associate Professor and Tutorial Fellow at St Hugh's. He trained in climate physics in Paris, followed by a PhD in volcanology in Vancouver, postdoctoral fellowships in Cambridge and a lectureship at Exeter. Thomas is interested in all things climate and volcanoes. His group use a range of modelling, experimental and observational methods to investigate how volcanic eruptions affect climate (and vice-versa!) as well as the hazards posed by volcanic ash. He moved from Exeter with 3rd-year PhD students Becca Tanner and Magali Verkerk.



Rachel Dobson

Postdoctoral Researcher in Macroecology and Palaeobiology

Rachel recently joined Oxford Earth Sciences after completing her PhD at the University of Leeds and a postdoctoral position at Durham University, where she modelled the impacts of climate change on birds and mammals in Ecuador. Her research explores the evolution of long-distance migration in whales, using ecological niche modelling and palaeoclimate reconstructions to investigate how migratory behaviour arose and changed over geological time.



Victoria Dutch

Postdoctoral Research Associate

Victoria joins the department as a postdoc modelling cryosphere change and hydrochemistry, specifically looking at the impact of Arctic change on oxidative weathering and the amount of CO₂ released by this process. Prior to this, Victoria was a postdoc at UEA and a PhD Student at Northumbria University, in both cases looking at greenhouse gas fluxes in different types of Arctic environments.

This year the department was also joined by...

Jack Holfield - IT Officer

Mark Honey - Workshop Technician

Cooper Malanoski - Postdoctoral Research Assistant in Palaeobiology, with a focus on Extinction Selectivity

Kamini Manick - Oxford EARTH Programme Manager

Nigel Perrin - Administrative Officer (Academic)



Noam Vogt-Vincent

Associate Professor of Climate Science

Noam returned to the department in August 2025 as Associate Professor of Climate Science and Tutorial Fellow at St Hugh's, after previously being based at the Hawai'i Institute of Marine Biology. His research uses oceanography, climate science, ecology, and numerical modelling to investigate how coral reef systems respond to climate change over various spatial and temporal scales, and how ocean-climate processes drive the transport and dispersal of objects in the ocean.



Isabel Smith

Postdoctoral Research Associate

Isabel recently completed her PhD at the University of Reading, focusing on aviation-related atmospheric turbulence within high-resolution global climate models, with particular emphasis on clear-air and mountain wave turbulence. Prior to her PhD, she obtained an integrated master's degree from the University of Reading and the University of Oklahoma. While at Oklahoma, her studies officially concentrated on severe weather and, unofficially, on tornado chasing across the Great Plains. In July 2025, Isabel joined the newly established Volcanoes, Society, and Climate research group at the University of Oxford, led by the also newly appointed Professor Thomas Aubry. Her postdoctoral research began at the University of Exeter's Cornwall campus before transitioning to the University of Oxford under the continued mentorship of Professor Aubry. Her current work investigates the challenges and uncertainties involved in representing volcanic climate forcings within the UK Earth system model.



(Kilivitige) Maleesha Fernando

Oxford Climate Research Network Coordinator

Maleesha joined the department in November 2025 as Coordinator for the Oxford Climate Research Network (OCRN). She recently completed an MSc in Environmental Change and Management at the School of Geography and the Environment, University of Oxford. She previously worked in the Climate and Environment Team of UNDP Sri Lanka, supporting a variety of climate projects. Her background is in project management and policy advocacy within the climate space.



Sacha Lapins

Royal Society Dorothy Hodgkin Fellow

Sacha joined the Department in October 2025 as a Royal Society Dorothy Hodgkin Fellow, having previously held a Leverhulme Early Career Fellowship at the University of Bristol. His research develops advanced seismic and machine learning methods to understand how fluids and magma move beneath volcanoes, with applications ranging from eruption forecasting to sustainably sourcing geothermal resources. At Oxford, Sacha is collaborating with Costa Rica's National Seismological Network (RSN), using next-generation sensor technologies (fibre-optic sensing and nodal arrays) and novel deep learning techniques to monitor and image subsurface magmatic and fault systems across the country's volcanic arc in unprecedented detail.



Mohammed Rehmanji

Postdoctoral Research Assistant in Genomics of Microbial Biomineralization

Mohammed has recently completed his Postdoc at University of Exeter, where he was a part of BBSRC funded project "Bioprocessing of Lithium Brines", focussing on Lithium recovery from geothermal brines using microbial processes (microbial induced carbonate precipitation -MICP and Diatom based Silica stripping). He holds a PhD in Biosciences from International Centre of Genetic Engineering and Biotechnology affiliated with Jamia Millia Islamia University, India. Mohammed has joined Oxford Earth Sciences as part of BioFacts, a 5-year ERC/UKRI-funded project aimed at understanding the biomolecular and genetic controls of microbial biomineralization. His current research investigates the molecular-level mechanisms of microbial biomineralization, with a particular focus on the organic-mineral interactions that give biominerals their special properties. More broadly, he will be working at the interface of geomicrobiology, mineralogy, and molecular biology, with an emphasis on linking genetic pathways to mineralization processes.



Aristeidis Varis

SNF Fellow

Aris is a geoarchaeologist using sedimentology to examine how past landscapes preserve traces of human activity. He is a Marie Skłodowska-Curie Fellow collaborating with Prof. Richard Walker and the Active Tectonics research group. His project, SPRINGSCAPES, investigates how tectonics and groundwater influenced human settlement during the last Ice Age in semi-arid Kazakhstan. He completed his PhD in the University of Tübingen, where he investigated how geogenic and anthropogenic processes contribute to the formation of a low-density archaeological record. He also holds an MSc in Earth Sciences from the University of Tübingen, an MA in Geoarchaeology from the University of Thessaloniki (with a placement at UCL), and a BSc in Archaeology from the University of Thessaloniki.



Amanda Lee Ying

Communications Officer, Oxford EARTH

Amanda joined The Oxford EARTH Programme in June 2025, bringing experience in event management, communications and stakeholder engagement. Before joining the programme, she worked within a public relations firm and later as a communications officer supporting activities at the Nature Positive Hub in New York and London. She holds a degree in Tropical Landscaping from the University of the West Indies and a master's degree in Environment, Development and Policy from the University of Sussex. At Oxford EARTH, she supports the programme's research and engagement activities, with a particular interest in communicating innovation in resource recovery.



Gabriela Rotari

Research Finance Manager

Gabi joined the department in May 2025 as Research Finance Manager, taking full responsibility for overseeing all Post-Award grant activity. She previously held a similar position in the Department of Biology, where she developed extensive experience in research finance and grant administration. Before joining the University in 2022, Gabi worked across various industry roles in finance and project administration, including several years in the banking sector. She holds a BSc in Finance and Banking.



Niki Brazzola

Postdoctoral Research Assistant in Carbon Accounting and Carbon Dioxide Removal Policy

Niki completed her PhD at ETH Zurich, focusing on strategies to adopt carbon dioxide removal, especially in the aviation sector. She holds a BSc and MSc in Environmental Sciences from the University of Tübingen and ETH Zurich. Niki has joined Oxford Earth Sciences and Oxford Net Zero as part of the Net Zero Aviation project, which aims at investigating the potential benefits of bundling fossil jet fuels with geological carbon offsets. In this project, Niki focuses on safeguards to enhance the credibility of this strategy, investigating certification requirements and carbon accounting rules to avoid greenwashing. Before joining Oxford, Niki worked at the Swiss Parliament, supporting the work of the Environment and Energy Committee.



Rashida Doctor

Postdoctoral Research Assistant in Quantum Diamond Microscopy and Chondrule Magnetism

Rashida recently completed her PhD at the University of Minnesota, focused on using the magnetic properties of cave deposits as records of the Earth's changing magnetic field and as markers of sea level fluctuations. She joins the Department to work on a project aimed at understanding early solar system formation by detecting records of planetary nebula magnetic fields held in meteorites using the quantum diamond microscope.

UPDATES FROM OUGS

OXFORD UNIVERSITY GEOLOGICAL SOCIETY (FORMELY GEOLSOC)

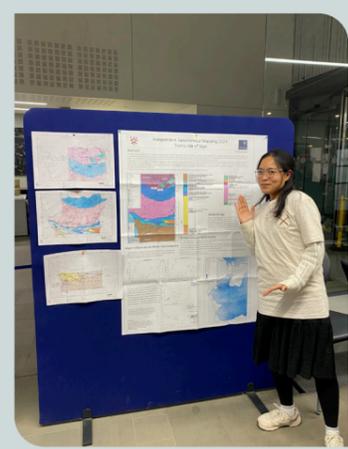
EMILY PARRY, 3RD YEAR EARTH SCIENCES STUDENT

Michaelmas term has been busy for the OUGS this year, with lots of fun events for our members.



We hosted our first freshers' fair stall and had a great time meeting many new students from across the university who are enthusiastic about geology and invited them to join the OUGS. While the society is still dominated by Earth Scientists, it has been refreshing to meet a handful of new people eager to learn more about geology and share their knowledge and experiences from their various degrees. We even managed to feature on @oliversoxford's SU

freshers fair Instagram video, where former committee member Ria can be seen being interviewed by Oliver himself!



ANNUAL MAPPING CONFERENCE

Our second annual mapping conference was a success, organised by our Field Trip reps, Daniel Crapper and Marina Yakimova. The conference allowed current fourth years to showcase their third year projects to the younger years and answer any questions or concerns about planning a project, handling the workload, and

organising their write-ups. This year's conference was also the first to feature a geochemical mapping project and a geophysics project, allowing younger students to see examples of all three project types on offer. The conference also included talks from last year's Gibbs Prize winner, Alex Vickers, and runner-up Matthew McKinnon-Bell, who each gave presentations containing their advice on planning a successful project.

CHRISTMAS PARTY

During the last week of term, we got into the festive spirit and enjoyed our end-of-term Christmas party. Many dinosaur-themed Christmas jumpers and Santa hats could be seen, and students from all four year groups sang the night away on a karaoke machine at the Oxford Retreat.



OVERALL, THIS TERM HAS BEEN VERY BUSY, VERY FUN, AND WE CAN'T WAIT FOR THE AMAZING EVENTS WE HAVE LINED UP FOR NEXT TERM!

SOCIALS

We held many successful relaxing socials this term, ranging from pottery painting and pumpkin carving to playing conkers in the department driveway. The artistic talent of our undergrad and postgrad members is amazing! You can see photos of our pottery and pumpkins in our OUGS Instagram stories.



ROCKTAILS

This term's social highlight was Rocktails. Our social secretaries, Alex Jones and Jemima Dinsley, transformed the OURFC clubhouse into the Milky Way for a night among the stars! Some incredible costumes were spotted, including astronauts, Roman gods of the planets, and the James Webb telescope!

WORCESTER GEOLOGICAL SOCIETY

PETER WEBSTER, 3RD YEAR EARTH SCIENCES STUDENT

Inspired by the Corallian Society at Univ and STAGS at St Anne's, the Worcester College Geological Society was established in Michaelmas 2024, bringing together geologically-minded students across college. We've had a strong first year, advocating for larger mapping project grants, creating an Instagram page, founding a shared drive as reference for mapping and Masters projects, doing lots of fossil hunting, and most importantly, taking trips to the bar!

When founding the society, we wanted to know if we were reviving a past college geological society. Unfortunately, the college archives hold poor records of student societies, particularly post-1939, with no mention of such a predecessor. We also don't know how long geology has been offered at Worcester, since there is no historical list of alumni and their subjects. The college archivist did find a photo album from Alexander Richard Nicholson, a geology student who in 1910, showing that geologists have roamed the college for over a century.

We would love to know more about the history of geology at Worcester and any potential college society, so if anyone has memories or information, please reach out!

To keep up with society happenings, follow us on Instagram: @worchester_college_geosoc



The Geology Group' from Alexander Richard Nicholson's album in the Worcester College Archives

OXFORD SOCIETY OF ECONOMIC GEOLOGISTS

RIA BHOJANI, 3RD YEAR EARTH SCIENCES STUDENT

The University of Oxford SEG (Society of Economic Geologists) student chapter is a growing presence in the Department. Having fallen dormant during the pandemic, a group of eager students revived the society, which has since ballooned both in its membership and the variety of events it organises.

Oxford SEG's term-time activities consist of frequent talks delivered by everyone from academics to exploration geologists, and even Rio Tinto's ex-CEO, Jakob Stausholm. The breadth of topics explored in these seminars, ranging from the nitty-gritty of ore-forming processes to the economics of running a mine, is a perfect complement to the content learnt in lectures and tutorials. After each talk, informal discussion and networking offers students the chance to ask the speaker more in-depth questions and hear advice from someone who has made their living in geology.

As any good geologist understands though, fieldwork is a crucial element of the subject, and this truth is not lost on the Oxford SEG, who have been successful in organising residential trips to both Portugal and Cornwall last academic year. Portugal saw students learn about the VMS deposits that form the Iberian pyrite belt and familiarise themselves with the workings of a successful polymetallic underground mine. In Cornwall we visited some of the companies responsible for presently reviving Cornwall's mining industry and were inspired to see the role the region will play in the energy transition.

This coming year has plenty in store! Having reached out to a number of mining companies, a field trip to either the Balkans or Finland is on the cards, as well as another trip to Cornwall. Arrangements are also being made for collaborations with the new Oxford EARTH initiative, and an alumni networking dinner, so watch this space for the opportunity to connect. Please get in touch through LinkedIn if you are a part of the mining industry, we'd love to add you to our ever-growing network!



EARTH SCIENCES OUTREACH UPDATE

DR CHARLIE REX, OUTREACH AND COMMUNICATIONS MANAGER

It has been another action-packed year of outreach for the Department, as we expanded the activities and events we offer and built on our successes from 2024. I'm always extremely proud of the way that our departmental community represents Earth Sciences to the general public, and am grateful for the 100+ volunteers who gave up their time to take part in our activities this year.



DPhil student Victoria Buckland and postdocs Dr Tom Kettlely and Dr Joe Asplet at Brookes Science Bazaar

The centrepiece of our engagement activities with the wider community in 2025 was the *Shake, Rattle and Roll* project, funded by the competitive MPLS Public Engagement Fellowship Scheme. A collaborative effort between David Pyle, Paula Koelemeijer, Laura Stevens, Matthew Kemp, Hannah Sanderson and myself, the project aimed to strengthen the Department's ability to support and foster high-quality public and community engagement. Alongside a pizza-fuelled training session about outreach activity design, we developed a suite of new activities to explain how we understand the physical Earth using standing waves. These materials were showcased at this year's Oxford Brookes Science Bazaar to great acclaim. We were particularly proud of how these activities brought



The Department gazebo featuring new bespoke artwork

together research across different disciplines, from geophysics to volcanology and seismology.

Also as part of *Shake, Rattle and Roll*, five students from the Department designed bespoke artwork which was printed on new weatherproof sides to our gazebo. Each artwork represents a different Earth Sciences theme, and can be displayed in any



Associate Professor Laura Stevens demonstrating the lego seismometer



DPhil student Hannah with our shaker table, which shows building resonance during an earthquake

configuration at our engagement events (and makes a wonderful welcome during our Open Days). This element of the project highlighted the immense artistic talents of our community, and we were thrilled to be able to capture their skills in this way.

We were excited to take our Climate Detectives activity to *Marie Curious* in both Warwick and Oxford this year. *Marie Curious* is a free one-day science event for girls and non-binary children aged 12-14, coordinated by the Department of Physics. The event aims to build confidence in under-represented genders with an interest in science and fuel a passion for continuing to pursue STEM subjects at a higher level. Thanks to our enthusiastic and knowledgeable volunteers, we were able to share the exciting world of climate science with this year's attendees.



Volunteers at Marie Curious, Warwick

After the success of last year's trip to Bodmin, we once again took part in the Oxplore Festivals this past summer, which took place in Bradford and Warrington. Despite our relatively small department size we certainly made an impact at the event, running our *Kilauea versus Fuego* volcanic hazards workshop and a new marine spatial



Professor Erdem Idiz and undergraduate student Haleema Khan at the MPLS Primary Science Days

planning workshop *Open Oceans* expertly designed by DPhil student Leah Tavasi (complete with 'Oceanopoly' game). Our exhibition stall this year at Oxplore was about ancient life, prompting students to think about how extinct animals and plants are preserved as fossils. Many thanks to recent graduate Erica Harrison-Scott for her coordination of this activity, which had multiple Year 7 students practically sprinting towards us whilst exclaiming "are you the

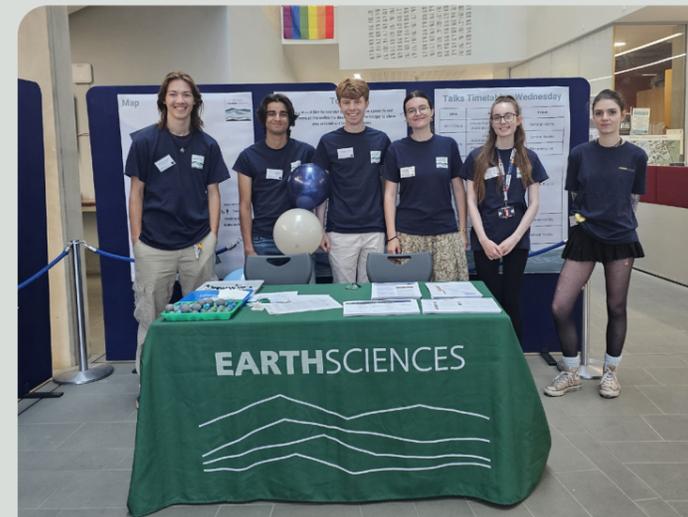


Volunteers at the Oxplore Festival, Bradford



Volcano workshops at the Oxplore Festival, Bradford

is always a joy to see. Those of you who have young people in your lives will be unsurprised to hear that the igneous rock they are most excited by is obsidian, courtesy of the popular game 'Minecraft'. If you have any suggestions of witty replies to "does this really open a nether portal?" please do let us know! Nevertheless, I am always thrilled when every 7-year-old knows how obsidian forms.



Students at our 2025 Undergraduate Open Days

I am excited to see where 2026 takes us in terms of our outreach initiatives, and am certain that with the immense talent and enthusiasm of our students and staff that we will continue to have an impact on the local Oxford community and beyond. If you are interested in learning more about outreach, including how you can support our initiatives, please contact outreach@earth.ox.ac.uk.

dinosaur people?!" (the answer was always a proud "yes").

Maintaining a local community focus remains a priority for the Outreach team, and we visited primary and secondary schools across Oxfordshire to run workshops throughout the year. Our volcano-themed workshops remained the most popular, and the excitement on the children's faces when they take part in our explosive experiments

ROCK-SOLID READS

HERE ARE SOME OF THE BOOKS PUBLISHED BY OUR TALENTED ALUMNI THIS YEAR...

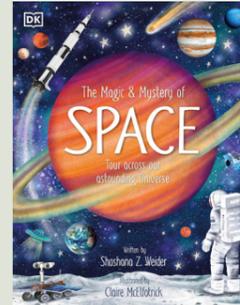
Shoshana Weider (matric. 2003)

Dr. Shoshana Z. Weider is the Executive Officer and a Program Scientist in the Planetary Science Division (PSD) at NASA Headquarters. Shoshana studied for her Masters in Earth Sciences at Oxford (matric 2003) and followed it up with a PhD in Lunar Science from Birkbeck College, University of London.

The Magic & Mystery of Space

Enter the world of amazing planets, swirling nebulae, and distant galaxies for an unforgettable journey through space. The Magic and Mystery of Space combines vivid illustrations with dazzling and up-to-date photography to help young scientists aged 7 to 9 learn all there is to know about space.

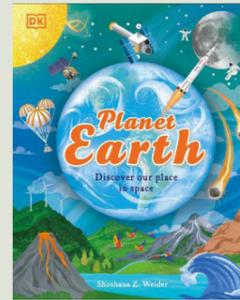
Children will love to learn about the planets in our Solar System and distant black holes as they discover incredible facts and journey through space. This space guide features fascinating topics, like how stars die, what scientists do in space and what life could look like on other planets.



Planet Earth

This ultimate guide to Earth takes 7 to 9 year olds on an exploration of our planet through stunning illustrations, photographs, and fascinating information.

This spectacular reference book for kids explores our home planet, Earth, and how it fits into our solar system. Be launched on a mission around our blue planet, starting with how Earth is seen from space and landing in a chapter all about the Earth's atmosphere.



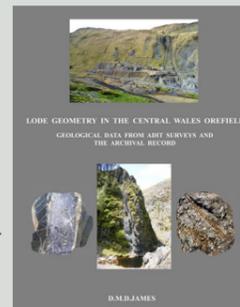
David James (matric. 1961)

After an international professional career in oil and gas exploration, David James retired to mid-Wales and switched from basin-scale sedimentology to fluid flow / mineralisation in the deformed and fractured basin fill.

Lode Geometry in the Central Wales Orefield

Adit surveys and mine plans give at least partial 3D understanding of mine workings that are not available from 2D surface survey or industrial archaeology. This book is designed both for geologically inquisitive mine explorers and for entry-level academic researchers in narrow vein ore geology who wish to utilise such data and conserve access to it. It should also assist engineering geologists concerned with minewater drainage in the Orefield.

David says of his book 'The long-abandoned lead and zinc mines of mid-Wales have the potential to be a magnificent natural laboratory but currently their study faces many obstacles. Most obvious is creation of access; many superb exposures in stopes simply cannot be reached without the skills of the caving community. Accordingly, one objective of the book is to create an appropriate level of knowledge between geologically-interested mine explorers and academic researchers in the Orefield. Such knowledge is vital in understanding the socio-economic history of the mines and may contain predictive elements for future exploration of economic ore shoots. Even in hilly country the degree of interpretational control available from surface mapping is seldom much above 2D; mines offer (at least locally) the chance to establish a 3D picture of host rock fabric and fracture geometry.'



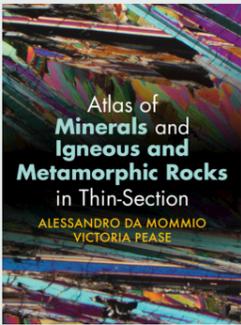
Victoria Pease (matric. 1993)

Victoria is Professor of Tectonics and Magmatism at Stockholm University. She leads a research group investigating the processes related to mountain building, basin development, terrane assembly and continental break-up, emphasizing the magmatism found in these environments.

Atlas of Minerals and Igneous and Metamorphic Rocks in Thin-Section

This book provides the geology student and geoscientist with a stunning new colour atlas of the main rock-forming minerals and igneous and metamorphic rocks in thin-section. It showcases minerals in various settings and degrees of alteration and preservation to allow users to best identify their own specimens in practice. Chapter 1 highlights the distinctive characteristics used to identify different minerals. Building on this base, following chapters describe rock textures and types, summarizing their petrogenesis within a plate tectonic framework.

We are delighted to say that this book has won the Mary B. Ansari Best Reference and Resource Award for 2025 given by the Geoscience Information Society (GSIS).

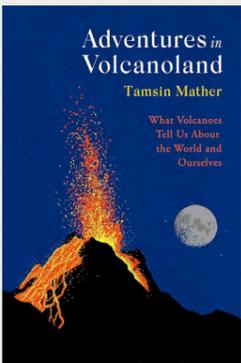


Tamsin Mather (Professor of Earth Sciences, University of Oxford)

Professor Tamsin Mather's work brings together expertise in volcanology/magmatism, atmospheric chemistry and paleoclimatology/stratigraphy. This combination allows her to tackle problems ranging from acute volcanic hazards and air pollution events in the present-day to the role of volcanism in the long-term evolution of our planet's environment over its geological history and much in between.

Adventures in Volcanoland: What Volcanoes Tell Us About the World and Ourselves

Adventures in Volcanoland charts journeys across deserts, through jungles and up ice caps, to some of the world's most important volcanoes, from Nicaragua to Hawaii, Santorini to Ethiopia, exploring Tamsin Mather's obsession with these momentous geological formations, the cultural and religious roles they have played in the minds of those living around them at different times throughout history, and the science behind their formation and eruptions. Volcanoes help to make and shape our world, bursting forth from inside of the earth and, in many places, looming over us. Present since the earth's beginning they continue to maintain its life support systems and, their extraordinary chemistry may even have created the ingredients needed for life to kick start.

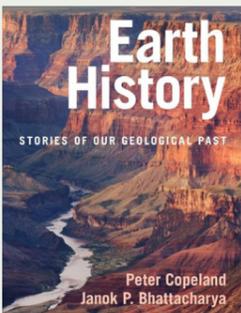


Earth Sciences Librarian Recommends....

Elizabeth Crowley is our department Librarian and is always on the lookout for the best new releases in Earth Science Literature. Our library contains books and journals relating to the teaching and research of the department and we are always looking to develop the library collection. If you have any recommendations or suggestions, please let us know!

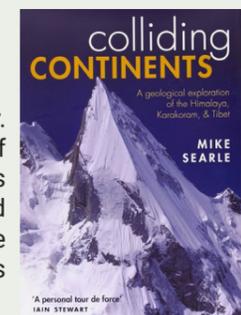
Earth History: Stories of Our Geological Past by Peter Copeland, Janok P. Bhattacharya

Providing a new approach to Earth history, this engaging undergraduate textbook highlights key episodes in the history of our planet and uses them to explain the most important concepts in geology. Rather than presenting exhaustive descriptions of each period of geological time, this conceptual approach shows how geologists use multiple strands of evidence to build up an understanding of the geological past, focusing on exciting events like the extinction of the dinosaurs and the formation of the Grand Canyon and the Himalaya.



Colliding Continents: A Geological Exploration of the Himalaya, Karakoram, & Tibet by M. P. Searle

The crash of the Indian plate into Asia is the biggest known collision in geological history, and it continues today. The result is the Himalaya and Karakoram - one of the largest mountain ranges on Earth. The Karakoram has half of the world's highest mountains and a reputation as being one of the most remote and savage ranges of all. In this beautifully illustrated book, Mike Searle, a geologist at the University of Oxford and one of the most experienced field geologists of our time, presents a rich account of the geological forces that were involved in creating these mountain ranges. Using his personal accounts of extreme mountaineering and research in the region, he pieces together the geological processes that formed such impressive peaks.



CLASS OF '72 FIELD TRIP

BRUCE LEVELL, VISITING PROFESSOR (MATRIC. 1972)

The Class of '72 has been particularly active in arranging field reunions. Trips to the Vercors, the Pyrenees, and Ingleborough were followed this year by one to Pembrokeshire. This trip marked the 50th anniversary of our last ever undergraduate field trip together, which was followed by finals in June 1975. The year group re-visited, with partners, outcrops seen on that trip as well as some new ones. It has to be said that for many, most, if not all outcrops seemed new. The trip was led by Andy Johnson and hosted by Andy Morton. It was good to see that the number of questions, the intensity of debate, and the competitiveness of the feeding-frenzy for graptolites had not abated one jot despite the intervening half-century. Next year's reunion is already planned and will be timed to coincide with the Tercentenary of James Hutton's birth in Edinburgh in June 2026. Bob Gatliff is one of the organisers of a currently active crowdfunder to raise money for a Geological trail and improved access at Hutton's unconformity, Siccar Point, Berwickshire, Scotland -<https://www.crowdfunder.co.uk/p/siccar-point>.



The party at Caerfai Bay, Pembrokeshire included nine members of the "Class of 1972" and a couple from 1973. We volunteered the photographer, someone who was just innocently sitting on a rock reading a book at the back of a cove. In one of those "it was clearly meant to be" coincidences, it transpired that he was the father of Matthew Kemp, appropriately enough then working in the Department Communications Office!

A VISIT TO THE RICE MUSEUM OF ROCKS AND MINERALS, PORTLAND, OREGON

EDWARD FOLLOWS (MATRIC. 1983)

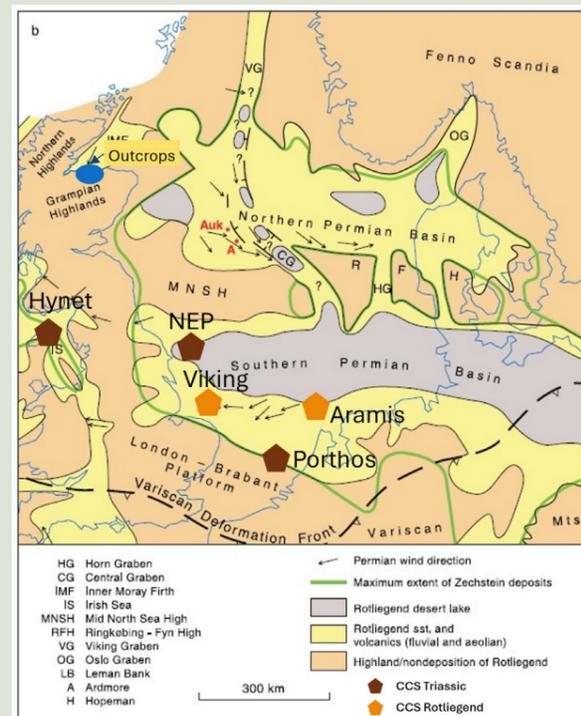
I have always been fascinated by silicified wood – ever since my sister was given a bright red chip from Arizona when we were eight. Although we have since looked for pyritised wood in the London clay of Sheppey, I was in for a treat in visiting the Rice Museum of Rocks and Minerals near Portland, Oregon. It has the most impressive collection of silicified fossil wood samples that I have seen. The museum was founded by the Rice family, a husband and wife team who set up their beautiful house and collection as a permanent showcase. Why Portland? The answer lies in the nearby Columbia River Basalt Group, a relatively young (c.17- 5.5 Mya) flood basalt series whose flows engulfed entire forests, providing an opportunity to showcase an impressive range of fossil wood types and fabrics. Among the exhibits, my favourites included a set of cubes highlighting contrasts between different fossil trees, a striking slice of hemlock with growth and branch structures, a polished sphere of wood riddled by teredo bivalve borings whilst adrift at sea prior to being silicified. And a whimsical fossil wood fireplace, perfectly suited to the elegant 1950s West Coast ranch house setting. Beyond the fossil wood, the museum boasts many other stunning specimens—the standout for me being the Alma Rose rhodochrosite, a breathtaking piece that alone is worth the visit.



FIELD TRIPS IN SUPPORT OF CARBON STORAGE

JOHN MARSHALL (MATRIC. 1971)

There is a growing recognition that the removal of CO₂ from intensely carbon-generating processes such as cement production and steel making is a necessary part of combating the progressive build-up of CO₂ in the atmosphere. The CO₂ so captured can then be injected into a subsurface storage site. A number of potentially suitable stores have been identified in UK and northern European waters and engineering work has begun on several. But what constitutes 'suitable'? The store has to allow the effective injection of CO₂, has to contain enough volume to capture potential supply, and has to support a high degree of confidence that the CO₂ will remain in the storage area indefinitely.



Map of the Permian basins around the UK with the outcrop area and analogous CCS projects indicated.

This of course requires significant geological groundwork. And given the limitations to the information that can be acquired from the subsurface, the opportunity to study well-exposed analogues at surface is of great value. Enter the Moray Coast of north-eastern Scotland, where Permian and Triassic rocks analogous to planned stores in the East Irish Sea and the Southern North Sea are well exposed. The geological contexts are somewhat different – a major 1000's of km-scale interior basin under the North Sea versus a 40-80 km wide rift system under the Moray Firth, but many depositional and structural features are similar and instructive to see in the field.

The Permian sediments are largely aeolian deposits, interpreted as a dune and interdune system where the finer-grained interdune deposits can act as baffles to fluid flow. The outcrops are extensive but still, the architecture of the two types of deposit can be explained in different ways – the products of a star dune system or a seif (linear) dune system. There is also a well-exposed fault system where impermeable fault core rock can be compared to the surrounding fault damage zone and to the undeformed host sandstones.



Field trip participants studying Triassic fluvial sediments at Burghead Harbour.

The Triassic sediments are less well sorted than the Permian, and show strong indications of a fluvial origin, a braided stream / sheetflood system where the stream sediments have the best properties for fluid flow, followed by sheetflood sands and then discontinuous mudstone layers that can impede vertical fluid movement – significant when quantifying the likely extent of injected CO₂ plumes.

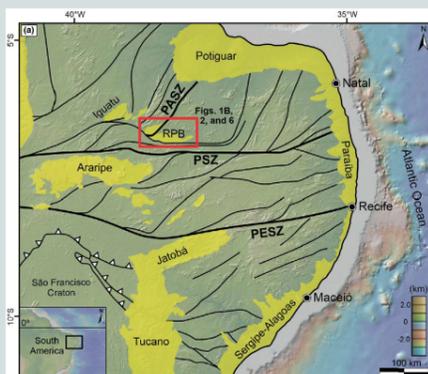


Field trip participants standing in front of the Clashach Fault which cuts through Permian aeolian sandstones.

The reservoir and storage properties of these systems have been captured by direct measurement (for the fault zones) and by analogy with comparable systems at various depths of burial (for the host rocks). This allows a spirited discussion between the geoscientists whose task is to create static representations of reservoir and storage systems, and reservoir and facilities engineers who work with that information to design plans for viable projects. Fieldwork brings them all together, opens eyes to the complexity of these systems in real life, and helps people work out how to capture key characteristics to assess before enabling a project to go ahead.

INDUSTRY AND ACADEMIA UNITE TO BUILD A WORLD-CLASS STRUCTURAL GEOLOGICAL FIELD AREA

MICHAEL STRUGALE (MATRIC. 2018), PETROBRAS E&P RESERVOIRS, RIO DE JANEIRO



Location of the Rio do Peixe Basin (red square). PESZ, PSZ and PASZ are pre-Cambrian shear zones.

Geologists from humid tropical countries such as Brazil often struggle to find good rock exposures for research and teaching. One exception is the countryside of the Northeast region, the only semi-arid region of Brazil. It also has some of the poorest development indicators of the country and is mostly covered by an exclusively Brazilian biome, the Caatinga.

Despite the predominance of Pre-Cambrian rocks, it hosts over 20 small rift basins that recorded the first extensional events that lead to the opening of the South Atlantic during Early Cretaceous (Matos, 1992). They are bounded by ductile shear zones reactivated as brittle rift faults and filled with continental deposits, from alluvial fans to lacustrine shales. The Rio do Peixe Basin sets in the westernmost part of the Paraíba State. Different from its counterpart basins, oil shows pushed an exploratory effort during the 2000s. As legacy, it generated an interesting data set of 2D and 3D seismic and well data (Nogueira et al., 2015).



Drone footage of students acquiring structural data along a 250m long scan-line on the hanging wall block of a major rift fault. Fault zone is near the top of the hill, to the right.

Oil companies in Brazil must spend 1% of their gross income in R&D. Petrobras Research Centre (CENPES) coordinates research projects that take advantage of this resource. In 2015, the Federal University of Campina Grande (UFCG) was granted with a budget to investigate the geology of these interior basins. During a project presentation in 2016 in Rio de Janeiro, they presented some remarkable photos from outcrops of faulted rocks and fault zones in sedimentary rocks. After an exploratory field trip with focus on the Rio do Peixe Basin, we established a still working partnership. Petrobras designed a field trip of applied structural geology for reservoir characterisation that was already attended by 16 groups and over 100 professionals, not only geologists, but also geophysicists and reservoir engineers. The combination of outcrops, seismic and well data combined with data acquisition in the field and classroom interpretation and discussions settled this



Set of clusters of deformation bands in coarse sandstones.

geological characterisation and modelling, and flow simulation. It happened because the cooperation give room to several research projects that collected and analysed an unprecedented quantity of data. These projects often invite collaborators from other Brazilian universities and abroad.



Outcrop-scale polished section of a cluster of deformations bands.

During the last 10 years, researchers and students have the chance to work together with Petrobras' professionals, not only in the field investigating and collecting new data but also during data analysis and interpretation. Researchers and professors are also involved in the logistics and lead part of the course program. Summing up, a spark of an idea in 2015 has become a broad program of which mutual benefits for Petrobras and academia are clear.

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Nogueira, F. C. C., Marques, F. O., Bezerra, F. H. R., de Castro, D.L., & Fuck, R. A., 2015. Cretaceous intracontinental rifting and post-rift inversion in NE Brazil: Insights from the Rio do Peixe Basin. *Tectonophysics*, 644-645, 92-107.

course as a benchmark within Petrobras' field training portfolio. Moreover, the region offers the chance for training in advanced structural geology, reservoir geophysics and petrophysics. On the academia side, UFCG has become a national reference in advanced petrophysics,

ANOTHER ISLAND REUNION - VISITING A "DIAMOND IN THE CROWN OF BRITISH GEOLOGY"

THE CLASS OF 1973

Following a very successful 50th reunion in Islay (Alumni Magazine, Spring 2024), the class of 1973 continued the island-geology theme in April 2025 with a visit to the Isle of Wight (IoW). A member of our class, Steve Sweetman, grew up on the IoW and returned after several decades to 'retire', only to revive his passion for local geology and complete his PhD. He has since become a recognized expert on IoW geology and paleontology. Steve's knowledge, and the hospitality provided by him and his partner, Pru, made for an outstanding weekend for 17 former Oxford geology students and 9 partners.

A social evening on the first evening confirmed that the group is intact and more or less unchanged. The following day began with an informative IoW overview at Steve's farm, including a chance to see and handle Steve's impressive fossil collection, followed by a visit to Dinosaur Isle Museum at Yaverland.



Group photo at Dinosaur Isle Museum at Yaverland

Why did we pick the IoW for our second reunion? As Steve explained, the IoW has attracted scientific interest since the birth of modern geology, earning it the "diamond" title. It has also been the focus of palaeontological research since the late 18th century. Inland exposures are poor but the constantly eroding cliffs provide an almost complete sedimentary succession ranging from the uppermost Hauterivian (Early Cretaceous) to the Rupelian (early Oligocene).



Culver Down looking east from Yaverland

The IoW is best known for its Early Cretaceous Wealden Group dinosaurs. This assemblage is the most diverse in Europe and rivals many from vastly larger areas elsewhere in the world. Dinosaurs attract enormous public interest, but the IoW also yields a huge diversity of other fossils. This diversity results from sedimentary deposition in fluctuating paleoenvironmental conditions that supported plants and animals in fully marine, marginal marine, freshwater and terrestrial habitats over a period of approximately 100 Ma.

Sedimentary deposition of the fluvial, terrestrial and lagoonal Wealden Group in the Early Cretaceous was controlled by normal movements on two faults in the Variscan basement. As movement decreased, a major marine transgression occurred in the early Albion with marine conditions persisting at least to the end of the

Cretaceous when doming of the Icelandic mantle plume resulted in uplift and erosion that exposed the Campanian Chalk. Renewed subsidence allowed deposition of fluvial-terrestrial deposits followed by a marine or marginal marine complex of early and mid-Eocene age. These strata are now wonderfully exposed in classic sections at Alum Bay in the west and at Whitecliff Bay in the east. Inversion of the basement faults led to a complex history of uplift, resulting ultimately in deposition of the fresh and brackish water late Eocene (Priabonian) Solent Group which yields a highly significant mammal assemblage. Continued inversion resulted in formation of the striking IoW monocline.



The Needles

Excellent field excursions were organized to illustrate many of the above features. At Brook Bay on the southwest coast, we examined the Early Cretaceous Wessex Formation including remarkable dinosaur foot casts. The Wealden and overlying marine Cretaceous succession were also examined on the southeast coast at Yaverland. The Paleogene succession was seen from the cliff top at Alum Bay after a lovely walk to the Needles to see the iconic chalk cliffs and sea stacks. The island's eastern Paleogene strata were observed in some detail at Whitecliff Bay and evidence for the Island's complex Eocene tectonic history was seen there and at Thorness Bay on the northwest coast.



Dinosaur footprint casts, Brooke Bay - Steve Sweetman and John Thompson are suitably impressed!

We were very fortunate with beautiful spring weather. The logistics were managed with patience and expertise by Phil Handcock, supported by Steve, even when tested by seemingly random road closures and inevitable tides. The social highlight of the weekend was a fabulous buffet supper at Steve and Pru's farm.

The group reminisced about field trips in 'the good old days', and demonstrated that our interest in rocks remains, which is impressive given our widely diverse careers. We have a very special group that fortunately Phil was able to prod in the right direction without too much stress! Here's to our next reunion in 2027!

Finally, a very big thank you to Steve for all his preparation and geological insights, Pru for cooking and catering, Phil for his long-range planning (from Calgary!), and Anne Thompson for the photos.

A NEW WAY TO EXPLORE DEEPLY UNCERTAIN SEA LEVEL RISE

JENNIFER WEEKS, (MATIC. 2014), CLIMATE SCIENTIST IN SEA LEVEL, MET OFFICE

As an island nation with densely populated estuaries, critical coastal infrastructure and long planning horizons, it is essential to understand how sea levels will change around the UK over the coming decades and centuries. Climate models are useful tools for generating projections of sea level change to assist adaptation planning and decision-making. They simulate physical processes such as thermal expansion and we are now seeing interactive, dynamic ice sheets incorporated into state-of-the-art Earth System Models. This is important since the contribution of ice sheets to global mean sea level rise has quadrupled in recent years, yet remains the largest source of uncertainty in sea level projections. These vast reservoirs of ice have the potential to contribute several metres of sea level rise over the coming centuries. However, the rate and magnitude of that contribution depends on incompletely understood feedback processes. Of particular concern is the potential onset of marine ice-cliff instability in Antarctica, where the collapse of tall ice cliffs could expose even higher, structurally unstable faces that may then fail in a self-sustaining sequence.



The Thames Barrier in London, one of several defences along the Thames installed in response to the Great Flood of 1953.

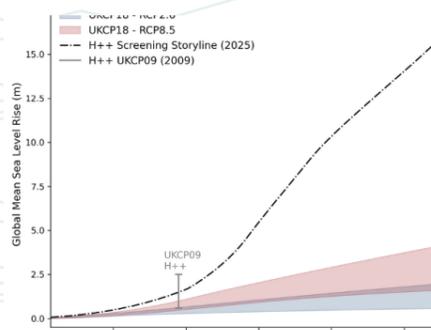
practitioners. The H++ scenario was revised in 2009, informed by physical constraints and palaeoclimatic evidence, and presented as a single uncertainty range at 2095. In practice, the upper bound of 1.9 m has typically been stated in flood risk guidance. However, scientific advances now enable us to provide more detailed information to fully explore the range of plausible outcomes.

The Met Office (who are responsible for developing national sea level projections) and the Environment Agency (who widely use these sea level projections in their guidance) have worked together to build a more user-focused update to H++

information (Weeks et al., 2025). The H++ update includes sea level “storylines”, where projections are presented as physically-plausible future timeseries that are available locally and extend continuously to 2300 to support long-term planning (Palmer et al., 2024). These storylines allow us to incorporate emerging process understanding and expert judgement that may not yet be fully represented in probabilistic projection frameworks. To explore these storylines in a particular context, the H++ update also advocates using “decision-gaming”, where scientists and practitioners walk through the storylines together and consider what adaptation decisions would need to be made in our future warmer world.

The pace of discovery in ice sheet science is accelerating. New satellite missions, improved regional climate modelling, and advances in understanding ice-ocean interactions will all help refine our picture of future sea level rise. The new approach to H++ will allow the UK to explore emerging evidence rapidly and consistently, ensuring that coastal planning remains informed by the forefront of climate science.

This scientific uncertainty poses a challenge for risk-averse practitioners (e.g. nuclear facility operators and Thames Barrier planners) who require information that captures not only the most likely future but also the highest plausible scenario for sea level rise. These stakeholders require credible ways to consider these “high-end” outcomes, even if they are low probability or deeply uncertain. Recognising this need, the UK’s high-plus-plus (H++) scenario of mean sea level rise was first developed over 15 years ago to provide plausible high-end information for



The central range of UK sea level projections compared with plausible high-end sea level projections. This includes the central (5th-95th percentile) range of extended sea level projections presented in the UK Climate Projections Marine Report in 2018 (UKCP18) under low (RCP2.6) and high (RCP8.5) greenhouse gas emissions scenarios (Palmer et al., 2018), the H++ scenario range at 2095 presented in the UK Climate Projections Marine Report in 2009 (UKCP09) (Lowe et al., 2009) and a new H++ “screening storyline” to help flag vulnerabilities in adaptation measures (Weeks et al., 2025).

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OBITUARY

SARAH TREVARTHEN

1971 - 2025



Born in Truro on 26th October 1971 to Hugh and Ivy Trevarthen and raised in Cambourne, Sarah came up to Hertford College to study Geology in 1990. Whilst at Oxford, Sarah threw herself into college and university rowing, her accomplishments including winning blades, acting as stroke for the Hertford Women’s First Eight, being secretary of Hertford’s Women’s Boat Club and rowing for Osiris in the 1993 boat race. Sarah continued to row after Oxford, taking up Cornish pilot gig racing on her return to Cornwall.

Sarah went on to complete an MSc in Mining Geology at Cambourne School of Mines in 1996, and from there blazed a trail for women in mining, working underground as a production geologist in South Africa.

She returned to the UK in 1998, moving in to contaminated land assessment and remediation. In December 1998, whilst working for Arcadis in Cambridge, she met her future husband, Noel, at a party. They were subsequently married on 29th May 2004, unconventional as ever, wearing hard hats, underground, in Poldark Mine, Cornwall.

2000 saw Sarah and Noel relocate, initially to Manchester, then Salford, with Sarah transferring to URS in 2003. Sarah became involved with Environmental Health and Safety Audits, which provided new opportunities and, in 2007, they moved to Brisbane, Australia, then, three years later, Melbourne.

Whilst in Melbourne they became regulars on its comedy scene, not so much for participation, but for their regular attendance and support of the arts. At the 2015 Melbourne International County Festival Sarah competed in the annual challenge to

see as many shows as possible over its 3 ½ week run. She won by a mile (178 shows). In true Sarah style, all planned out meticulously beforehand on a spreadsheet.

They returned to Manchester in 2015 where Sarah became a Principal Consultant at WSP, working in Environmental Auditing and Risk Management. A role which took her across the globe, often to unusual places such as Kazakhstan, Tajikistan, Kyrgyzstan, and Azerbaijan. Typically bringing home regional craft-based souvenirs which now adorn her home, or the local alcoholic tipples. Sarah maintained a high standard of work and ethics throughout her career; often asked for by name by clients, and declining to work for companies whose perception of environmental responsibility did not match with the reality.

Sarah was a woman of many talents. Lockdown gave her the opportunity to focus on her hobby of quizzing, using her extensive, and random, general knowledge. Hitting the scene like a rocket, she made a dramatic entrance as a beginner, straight to being one of the top 50 quizzers in the country. Sarah and Noel found a warm welcome with the quizzing community and met many new friends. Sarah’s quizzing successes include winning the jackpot on Pointless (with Noel) in 2020 and Grand Final runner up in Mastermind in 2022. She is the only woman to have won both Radio 4’s Brain of Britain (2022) and Counterpoint (2025).

In 2022 Sarah was diagnosed with Stage 4 breast cancer. She continued her work as an EHS auditor, travelling to Europe and Asia, and also to quiz. She died on 20th August 2025 with Noel and Rachel, her oldest school friend, at her side. Sarah is survived by her husband Noel and father Hugh.

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