

SCHOOL OF EARTH & ENVIRONMENTAL SCIENCES

Newsletter Number 20
Spring 2022



Stay in touch

We are always looking for updates from members of the School, past and present. It is a delight to continue to hear from friends many years after they physically left St Andrews, so do keep in touch. Similarly, we also encourage our more recent alumni to stay in touch and send us updates (new job, got married, finished a PhD, opportunities for current students, etc).

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The editorial deadline for this issue was 01 February 2022

FRONT PAGE Our new (old) home: the Bute building – effectively where Geology started. Geology was housed here already from 1899 to 1911, and then directly adjacent in the Carnegie Extension from 1933 until 1975. Now, in 2021, we're back after stints in portacabins, the Purdie building, and the Irvine Building. Photo © Terry Gilley

WELCOME FROM THE HEAD OF SCHOOL

PROFESSOR RICHARD WHITE

In this Issue we see a changing of the newsletter guard. After years, or should I say decades, at the helm of the school newsletter our Editor-in-Chief Richard Batchelor has decided to step down. Richard has worked tirelessly over the years to bring all the news of School happenings to the alumni and much news of the alumni to the school. The School owes Richard a great debt of gratitude for keeping us all connected. So thank you Richard for your exemplary efforts and good luck for the future. Stepping into the media magnate field boots is Dr Sebastian Fischer, or Batzi as he is known to all. Batzi is currently our geochemistry technician and completed a PhD here in 2018. Many of our more recent graduates will remember Batzi from numerous lab classes and quite a few of our field excursions, and of course for his taste in minibus music.

After a one-year hiatus in the University's promotions process we can once again send congratulations to our staff that have been promoted. Richard Bates has been made Professor, Eva Stüeken, Sami Mikhail and Claire Cousins all go to Reader and Paul Savage has been promoted to Senior Lecturer. These promotions are a testament to the outstanding efforts our staff are making in teaching and research across the board, so well done.

Congratulations are also due to Catherine Rose who has been awarded one of the University's five prestigious teaching awards for her inspired teaching and management of our sub-honours curriculum under exceptionally trying circumstances. Catherine, as our sub-honours coordinator and first year coordinator has done an outstanding job with the delivery of our largest classes yet.

On the subject of teaching, we all, staff and students alike, have got to the end of a particularly difficult academic year. Second semester 2021, as it turned out, was even more of a challenge than first semester as we went into a sharp second lockdown. Despite the challenges I

take my hat off to all the staff for rising to them and to all the students for their patience and persistence. While almost every other university had cancelled all field trips, we managed to get our senior students out into the field for critical field training in Mull and Arran, a logistical challenge of isolation, testing and forming year-group "family" bubbles. Particular credit must go to Adrian Finch and Tony Prave for organising and running these trips. We are now back to a mixed form of teaching with as many in-person classes as we can do.

Thanks to the enormous generosity of many of our alumni, we have made great progress in our petrological microscope drive. The strong support for our saintsfinder drive has prompted an additional injection of funds from the University. We have now been able to purchase the remaining microscopes from a mix of donations and University money.

Last year, unfortunately once again, we had to graduate our students remotely. Graduation has always been one of the highlights of the year for the school and while we had a great online event to celebrate, we look forward to returning to in-person graduations.

On sadder news, Tim Raub has decided to move back to the USA after a decade with the school and four of those years as our Director of Research. Many of you will remember Tim for his enlightening teaching and enthusiasm for all things Earth Science. We wish Tim all the best for the future.

And finally, after several delays, asbestos scares and material shortages the school has moved its headquarters to the Bute building. This finally gives the School our own dedicated space.

Prof Richard White
Head of School

NEWS FROM THE SEES COMMUNITY

On the following pages, you will find short news and updates on things that have happened to the people at the School of Earth & Environmental Sciences since the last newsletter came out. And to our large family we don't only count staff, we also include postgraduates, undergraduate students and of course our alumni.

If you have any news or updates that you would be willing to share with us, please don't hesitate to get in touch:

sf67@st-andrews.ac.uk

STAFF and POSTDOC NEWS

What our members of staff have been up to recently

Awards...

Congratulations to **Matthew Warke** (PDRA) for receiving the prestigious **Geochemistry Group Medal** of the Geological Society for an *outstanding peer-reviewed scientific geochemical paper*, published by a UK and Ireland-based post-doctoral researcher. Matthew was awarded the medal for his paper showing that the Great Oxygenation event preceded the ca. 2.4 Ga 'Snowball Earth' event. Matthew will present his work during a keynote at GGRiP 2021.

Matt's supervisor Mark Claire commented: "When you came here as a (very well trained) geologist, you said that you wanted to learn enough isotope geochemistry to be dangerous. This award shows that you have achieved that goal and are truly a double-threat now. There's something to be said for grinding up rocks and careful counting up isotopes, but to be able to do that with equally careful eye on lithostratigraphic context is what it's all about. Well done, and well deserved".

Warke MR, Di Rocco T, Zerkle AL, Lepland A, Prave AR, Martin AP, Ueno Y, Condon DJ, Claire MW (2020) The Great Oxidation Event preceded a Paleoproterozoic "snowball Earth". Proceedings of the National Academy of Sciences, USA.

Congratulations to **Anouk Borst**, who just after leaving the UK (see below), swooped the Mineralogical Society's **Howie award**. It was awarded

to her, along with her SEES co-authors **Adrian Finch** and **Nicky Horsburgh**, and alumnus **Henrik Friis (PhD 2009)**, for their paper REE in eudialytes.

The paper stems from X-ray absorption work the group did at the UK synchrotron facility *Diamond* a few years ago. The lead author (Anouk) receives a £1000 bursary award and the opportunity to present their work as the *R.A. Howie Memorial Lecture* at an international conference. More on the award can be read here: <https://www.minersoc.org/best-paper1.html>

Borst AM, Finch AA, Friis H, Horsburgh NJ, Gamaletsos PN, Goettlicher J, Steininger R & Geraki K (2019) Structural State of Rare Earth Elements in Eudialyte-Group Minerals. *Mineralogical Magazine*, 1-49.

Catherine Rose (lecturer, but also BSc 2005) was awarded one of the **University of St Andrews Teaching Excellence Awards** for 2020-21. Catherine was recognised by the University for her teaching and her massive efforts in steering particularly our subhonours relatively unharmed through the impacts of the pandemic.

Andrea Burke (senior lecturer) was awarded the prestigious **Leverhulme Prize** for her work on isotope geochemistry and paleoclimate. The Philip Leverhulme Prize is awarded

by the Leverhulme Trust to recognise the achievement of outstanding researchers whose work has already attracted international recognition and whose future career is exceptionally promising.

...and Funding

Congratulations to **Paul Savage** who had a joint **Leverhulme Research Project Grant** funded in March. The main PI is Geoff Bromiley at Edinburgh, and the CO-I's are Paul, Mahesh Anand at the OU and Magali Bonifacie at IPGP. The project is entitled: "The Moon's enigmatic chlorine fingerprint and the origin of Earth's water". Paul will be getting support to undertake Zn isotope analyses at St Andrews as a major work package of the project.

Congratulations to **Eva Stüecken** who was awarded one of the very prestigious **NERC "Pushing the Frontiers" grants** in March. These large "ERC style" grants are worth over a million pounds over 4 years, so represent significant funding. Eva won her funding for a grant entitled *Did hydrothermal vents push the frontiers of habitability on the early Earth?* which aims to investigate the role of hydrothermal processes on early life, while cleverly incorporating the name of the funding scheme in the title. Eva will be setting up some new experimental and analytical equipment to

undertake the work and building a research team of postdocs to help with the research.

Congratulations to **Sami Mikhail** who, with colleagues from Cambridge and Manchester, has won **NERC Funding** for a project entitled *Unlocking the C and N budget of the Earth*. The project has three primary analytical objectives focused on the study of olivine-hosted melt inclusions from two ocean island localities, Iceland and the Canary Islands. They will develop microanalytical methods for the quantification of nitrogen and carbon (by EPMA and SIMS) and carbon isotopes to track volatile degassing and identify mantle sources. No doubt he will add to SEES' collection of Iceland samples which goes back to at least Richard Annel's samples of 1968 vintage.

Congratulations to **Will McCarthy, Eva Stüeken, Will Hutchison, Tim Raub, and Richard Bates** for landing a total of **three GCRF PhD studentships**. Will McC and Eva's project will investigate greenhouse gases related to extraction of porphyry-style mineralisations (based in Kazakhstan); Will H, Tim and Richard's project will look at hydrothermal potential of degassing magmatic systems in the E African Rift (in Ethiopia), and Richard's second project is an interdisciplinary project with the Music Centre. You can read more about the students in the PhD news (this issue).

Congratulations also to **Will Hutchison and Mike Byrne** for each securing a St Leonard's College scholarship for a PhD student. Will's future student will look into detecting massive mystery eruptions by using novel geochemical tools to interrogate the ice archive. Also on board as co-supervisors are Andrea Burke, and Richard Streeter and Ian Lawson from the School of Geography. Mike offers a project on *Extratropical continental heatwaves in a changing climate* and sums it up thusly: "One lucky

customer will spend 3.5 years with computer models, theory, and me to improve understanding how extreme temperatures vary with climate."

Congratulations to **James Rae**, who is a Co-I on a newly-funded NERC large grant project based out of UCL. The team will be reconstructing CO₂ concentrations during the Oligocene. At this time period, grazing mammals had just transformed Earth from warm and fully forested to 1/3 grassland ecology. This was associated with global cooling of 5 °C and the formation of glaciers on Antarctica, which have remained there ever since. The project will explore the interplay of CO₂, ice sheets, and climate over the Oligocene using some newly-discovered, well-preserved forams from this era. It will likely not surprise you that James will be contributing to the Boron isotopes side of the work.

Congratulations to **Andrea Burke**, along with co-investigators James Rae, Matthew Dumont, and Paul Webb (from Chemistry), for winning funding from the NERC Discipline Hopping 2021/22 funding call for her project *Carbon Capture, Use, and Sequestration with Accelerated Weathering of Limestone*. This will be a seed project over the next few months to investigate if limestone waste from quarries could accelerate carbon capture at the University's Eden Campus biomass plant.

New Hires

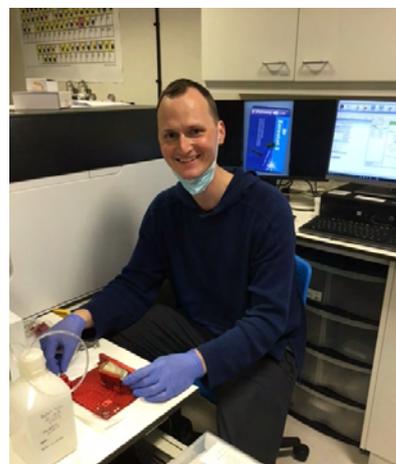
Patrick Sugden joined us as a lab technician in mid-February. He will be based in the Purdie labs. In his own words: "I completed my PhD at the University of Leeds in 2019, where I studied the geochemistry and geochronology of Quaternary post-collisional volcanic rocks from Armenia using Sr-Nd-B isotopes and Ar-Ar ages. I then completed a short postdoc at Leeds looking at how petrology

can best be used in volcano monitoring. At St Andrews, I will be measuring sulphur isotopes ratios in ice cores and authigenic carbonates, to look at the links between volcanic eruptions and climate, and the importance of methane hydrate release, respectively. Outside of research, I'm a keen hiker, and am already dreaming of when the lockdown restrictions are eased, and I can go and bag a few more Munros! And maybe even go to the pub after..."



Patrick Sugden

Adjusting to working with James Rae is new postdoctoral fellow **Jakub Sliwinski**. Jakub joins us from ETH on a Swiss National Science Foundation fellowship. His varied and enviable expertise to date spans the U-series and trace elemental composition of Tenerife magmas to confocal imaging of speleothems, and checking the speed limits of zircon geospeedometry to annually resolved laser ablation climate reconstruction.



Jakub mounting a speleothem for the laser!

And some words from Jakub himself: “Hi all! My name is Jakub, and I’ll be joining the Burke/Rae group working on volcanic climate forcing in the stalagmite record (and will bring a lot of laser ablation experience). I spent the last 9 years in Zurich, so naturally I love all things mountain- and outdoors-related: biking, hiking skiing, sailing...you name it! Looking forward to meeting a lot of you around the department, and I’m always down for a nice beer after work!”

We also welcome **Sarah Bennison** and **Laura Pels Ferra** who started work with us in mid-February. Sarah and Laura are co-coordinators of the new *St Andrews Network for Climate, Energy, Environment & Sustainability* (StA-CEES); you’ll be hearing lots more about StA-CEES over the coming weeks and months as activities ramp up!

Sarah says about herself: “My research focuses on community water management in the Andes. I completed a PhD in 2016 on irrigation customs and indigenous identity in the Peruvian highlands (Newcastle University, interdisciplinary Latin American Studies). A Fifer, my recent postdoctoral research fellowship at St Andrews brought me home. Until 2021, I worked in Social Anthropology on a khipu (Andean knotted string record) decipherment project. Outside of work, I (usually!) enjoy bachata dance and learning to ice skate. But lockdown has seen me replace these activities with learning Gaelic and gardening.”



Sarah Bennison

Laura introduced herself thusly: “Before joining StA-CEES I worked as a Research Administrator in the School of Modern Languages. Between 2015 and 2019 I was the Network Facilitator for the Leverhulme International Network for Contemporary Studies. I am also a visual artist, specialising in painting on paper and installation.”



Laura Pels Ferra

Michael-John Treanor is now working as a post doc with Adrian Finch. Michael-John has worked on the surface science of graphenes with the chemists for some years and he is bringing significant expertise in spectroscopy to SEES, notably Raman.



Michael-John Treanor

Nick Cook is joining the School as an Honorary Lecturer and will be helping out with part of our Strategic Earth Resources MSc. Nick will be based at SEES for his academic research activities. Nick is the Chief Geologist for Mawson Gold Ltd, an Australian based exploration company with Interests in Australia, USA and Finland. Nick completed his PhD at the

University of New England in Australia and has since published over 20 papers on topics ranging from mineralisation, mineralogy, geochemistry, and igneous and metamorphic petrology.

Nick on Nick: “Loves fieldwork and drill core logging, great believer in the power of the hand lens, loves the cold and the heat and generally avoids the jungle.... hard rock exploration geologist. Loves applying research-based geoscience into everyday exploration techniques. Looking forward to seeing students in the field and the classroom.”



Nick Cook

Abu Saeed Baidya has joined as a postdoctoral researcher. He will be working with Eva Stüeken on her Frontiers project. Abu is from India, where he did his PhD at Jadavpur University, Kolkata. In St Andrews, we will be working on the solubility of nutrient elements (phosphorous and nitrogen) in hydrothermal vent fluids and its connection with the origin of life. He will do experiments and use ion chromatography and mass spectrometry techniques as his main analytical tools.



Abu Baidya

Departures

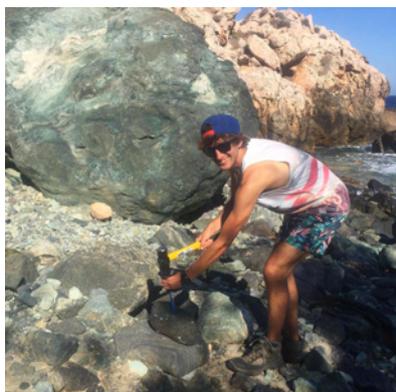
Anouk Borst left us at the end of March to take up a new permanent position in Leuven and Tervuren in Belgium. Anouk has been with us for quite a while, having arrived in 2016 as a research fellow and, more recently, as an associate Lecturer and has been an important thread in the working and social fabric of the school. She has always generously given her time to the school in helping with teaching, field training, co-supervision of dissertations. Anouk could also always be relied upon for any social events, be it the regular Friday evening gatherings or impromptu visits to pubs or bonfires on beaches. On the 1st of April, Anouk started a 50/50 split position as Assistant Professor/Senior Researcher at KU Leuven and the Royal Museum for Central Africa in Tervuren. It's essentially a 5-year Tenure Track at KU Leuven, in the Department of Earth and Environmental Sciences, which then becomes permanent. The 50/50 arrangement between KU and the Museum will be for 10 years, after that she will be fully employed at KU. She will be working on magmatic ore deposits (particularly critical metals such as Sn, W, Nb, Ta, REE, P) in the Great Lake Region of Central Africa.



Anouk on field work in Brazil in 2017

Tom Lamont, who did a post doc with Prof Richard White, finished in mid April. Tom is heading to the deep south (Bristol) to take up a new post

doc position. The school wishes him luck and would like to thank Tom for helping with the seminar series and on some of our summer school fields trips.



Tom Lamont on field work somewhere warm

Matthew Warke, post doc with Mark Claire, has also left us to take up a position in publishing. Matthew will be a managing editor in the "*Frontiers in...*" journal series. In particular we want to thank Matthew for running a wonderful seminar series over the last year or so, especially under the difficult online conditions we faced at that time.



Matt Warke on field work somewhere cold

Tim Raub has decided to resign from his job as lecturer and moved with his family back to the US. Tim was a great inspiration to many Undergraduate students. With his very broad range of interests and diverse understanding of Earth Science disciplines, he supervised numerous dissertation projects across a colourful palette of varied topics. We wish him all the best!



Tim in the field

Nicky Horsburgh (BSc 2009, PhD 2020) is leaving us at the end of October. After finishing her PhD, Nicky stayed on as a Postdoc, then maternity cover with the GeoBus (covering for Jen Brooke) and then part-time working for GeoBus and on her self-funded PostDoc. After several offers, she has decided to take up a job with GeoRope - a consultant company based in Ballachulish. Apart from fieldwork, Nicky will largely work from a home office, so will be in the vicinity and has promised to visit us regularly.



Coffee and cake for Nicky's farewell

Sam Crace (MSc, 2019) left in December. After completing an MSc with us in 2019, Sam stayed and worked for Mark Claire and Aubrey Zerkle as Lab Technician. His main job was to develop an automated sulphur extraction line for isotope analyses. Sam will move to Seattle to start a new job at Blue Origin. He will be a part of the Advanced Development Projects team as a R&D Laboratory Tech III and will be setting up their brand new R&D chem-

istry labs installing equipment, setting SOPs, developing new test equipment, and doing primary research on materials for human space flight, environmental systems, and ISRU (In-Situ Resource Utilization... aka Space Mining and Manufacturing).



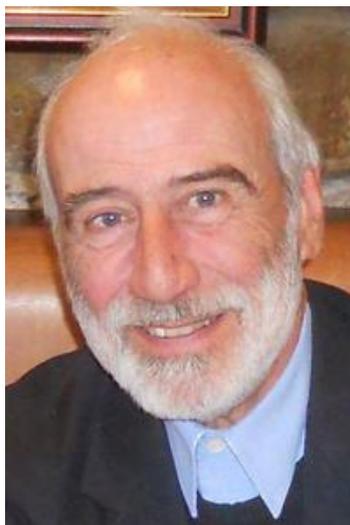
Sam with the Delta XP mass spec

Jen Brooke left us at the end of the year. Jen had already volunteered frequently with GeoBus when she was working on her PhD studies at the University of Edinburgh. Once finished in Edinburgh, Jen took the chance of a job opening at GeoBus and has been on the steering wheel of our GeoBus and other outreach activities since 2016. Jen was also part of the team that secured funding to extend GeoBus for another five years in 2019. Jen moves on to a job with an outdoor activities company, where she will, amongst other things, advise Duke of Edinburgh candidates.



Jen teaching a GeoBus workshop

On a similar note, and as hinted in the welcome by the Head of School: **Richard Batchelor** has decided to step down from producing the school newsletter after many, many years. We would like to thank Richard for all his efforts in keeping us in touch with our former students. The newsletters wonderfully highlight the changes the school has undergone, and the comings and goings of staff and students over the years.



Richard Batchelor

Promotions

After the uncertainty of the pandemic made the university halt all promotions in the last year, we have good news from this years promotions round:

Paul Savage was promoted to Senior Lecturer,

Eva Stüeken, Claire Cousins and **Sami Mikhail** are now Readers,

and **Richard Bates** has been made Professor.

Many congratulations to the four on their promotions!

Family affairs

Andrea Burke and **James Rae** announced the arrival of **baby Rebecca** in early April, a sister for young John.

In January, **Will McCarthy** and his partner **Kate Leavy** (working as disability adviser with student services) welcomed their second child: baby Liam is the new brother to their daughter Skye.

POSTGRADUATE NEWS

Updates from our growing postgraduate (PhD and MSc) community

Vivas

Bethan Gregory successfully defended her PhD thesis in December 2020. Co-supervised by Mark Claire and former St Andrews postdoctoral fellow Sarah Rugheimer (now at Oxford), Bethan's PhD is titled *Development of a 1-D oxygen isotope photochemical model and its application to atmospheric O₂*. Bethan identified key photochemical instabilities which rule out atmospheric compositions between ca 1 ppm and 1 % oxygen concentrations. Using oxygen isotopes, she then developed a qualitative atmospheric model which helps constrain the palaeo CO₂/O₂ ratio using measurements of oxygen isotopes in sedimentary sulphates. Bethan stayed on St Andrews for a short bridge postdoc, but then headed to Boulder, Co, USA for a postdoc using spacecraft observations and modelling to constrain hydrogen escape rates from Mars and Venus.

Natalya Zavina-James successfully defended in May 2021. Under the supervision of Aubrey Zerkle, Paul Savage and Bob Steele, Natalya worked on Cu and Ni isotopes in ancient sediments. She wrote a thesis entitled *Using metal stable isotopes to investigate methane cycling in Late Archean sediments*. Natalya then went on to work as Portfolio Manager in Transformative Technologies at BBSRC.

Eloise Littley successfully defended in May 2021. Supervised by James Rae and Andrea Burke, Eloise's thesis is titled *Rapid climate change in the glacial North Atlantic: New insights from geochemical records of temperature, CO₂, redox and circulation*. Eloise made a series of intricate geochemical measurements on the shells of foraminifera from a North Atlantic sediment core to examine the causes and impacts of rapid climate change during the last ice age. She showed, for the first time, that CO₂ burped

out of the North Atlantic Ocean during intervals of rapid climate change. She also found, unexpectedly, that during events typically thought of as extremely cold, shallow waters experienced some warming, which may have destabilised regional ice sheets. Finally, by measuring a wide range of different elements in her shells, Eloise found novel ways to reconstruct changes in ocean oxygen and circulation. Alongside her geochemical prowess, Eloise brought humour and craft to her PhD years, and is currently finishing up some lab work and manuscript preparation as a research assistant in St Andrews. Eloise has now left St Andrews to take up a post doc position in Barcelona.

Jianxun Shen successfully defended in June 2021. Jianxun was supervised by Aubrey Zerkle and Mark Claire, and looked at stable isotopes and other ecosystem proxies in the soils of the Atacama desert, an analogue environment to the Mars surface. His thesis is entitled *Microbial ecosystems and nutrient cycling in the Atacama Desert as a Mars analogue system*. Jianxun is now a postdoctoral researcher at the University of Beijing working with the Tianwen-1 Mars Rover team.

Sarah Boyd (BSc 2013) successfully defended in November 2021. Sarah was supervised by Richard Bates, Tim Raub, and Tim Kinnaird and for her thesis she focused on unravelling the combined effect of glacial isostatic adjustment (GIA) and sea level changes on the coastline of Scotland. During her PhD research, Sarah did a 3-month internship with SCAPE Trust and Dynamic Coast, where she investigated historic coastal change around the Scottish coastline and tested models of coastal erosion susceptibility against a database of coastal heritage sites. Even before completely finishing her PhD, Sarah joined the SCAPE team as Project Officer earlier in 2021. She

is based on the Eden Campus of St Andrews University.

Awards

Double congratulations to **Maddie Murphy**, who got a 'best student talk'-commendation for her presentation on Si isotopes in Archaean gneisses at the (virtual) 40th Research in Progress Meeting of the Metamorphic Studies Group (a specialist group of the Mineralogical Society and the Geological Society of London). This is pretty impressive, considering that metamorphic geologists often panic when they hear the word *isotope*. She presented work that she did for her MSc (Geochemistry) dissertation at St Andrews.

A few weeks later, she then won **best student poster** at the Geochemistry Group Research in Progress Meeting (another specialist group of aforementioned societies), where she presented the first results of her PhD project on a poster entitled *The Si isotope evolution of the continental crust: spatial and temporal trends from glacial diamictites*.

New arrivals

This year, thanks to project funding in addition to the NERC doctoral training programme *IAPETUS2*, we have a very healthy cohort of new PhD students who started at the end of September.

Toni Galloway (BSc 2020) will be supervised by Claire Cousins, Eva Stüeken and two external supervisors (Sophie Nixon, University of Manchester; Jon Telling, University of Newcastle) and will work on a project entitled *Carbon and Nitrogen Fixation on Early Mars and Sequestration of Geochemical Biosignatures*,

which is funded by the UK Space Agency/STFC. Toni is looking at hot springs in Iceland as analogues for Early Mars geothermal environments.



Toni Galloway (centre) on field work in Iceland

Matthew Goodey (MSc Geochem 2021), also funded through IAPETUS2, will be based half at BGS (supervised by Simon Tapster) and half at SEES, where he is supervised by Nick Gardiner. His project focuses on critical metal (Sn-W-Ta) formation in granite batholiths. Granite provinces can be emplaced over millions of years, yet the exsolved volatiles do not always produce magmatic-hydrothermal ore deposits. Matt will use high precision geochronological techniques to link the hydrothermal events to the host granite and track the melt evolution over time. This will evaluate how pluton construction influences ore formation.



Matt Goodey

Margeaux Grandjean (BSc 2018) is supervised by Rob Wilson. She graduated in 2018 with a BSc (Hons)

in Environmental Earth Sciences from our School. Her PhD project is on the dendrochronological investigations of Scottish Oak trees and their response to climate and disturbance.



Margaux Grandjean

Lyan (Ilyana A.) Guez, supervised by Mark Claire, comes to us with a first degree in astrophysics (with minor in anthropology) from the University of Washington and will work on a project centred around using atmospheric features to infer and categorise the surface features of terrestrial planets.



Ilyana 'Lyan' Guez

Kayleigh Letherbarrow is funded by *St Leonard's Postgraduate College World-Leading St Andrews Scholarship in Environmental Science*, and is supervised by an interdisciplinary team: Rob Wilson from our School

and Althea Davies and Keith Bennett from the School of Geography. Kayleigh is working with bog-pine and peat, using dendroclimatology and palaeoecology to disentangle how climatic and local land-use conditions interact to determine long-term pinewood viability. Her project also aims to develop more climate-resilient woodland management and restoration strategies.



Kayleigh Letherbarrow

Claudia Lubao is supervised by Richard Bates and Bede Williams (Music). Claudia is a musician from Tanzania, and performs under the name of Chemical. In her PhD project she will work on “musicalizing heritage”, which will include writing new songs and documenting musical practices through recording and films.



Claudia Lubao

Emily Madoff (BSc 2018) is supervised by Will McCarthy. Her University matched-funding for IAPETUS2 will allow her to study how the regional and local structure of

Ilimaussaq, a famous layered intrusion in southern Greenland, influences the formation of the intrusion's world-class economic ore deposits.

Following the completion of her BSc (Hons) Geology degree at the University of St Andrews, Emily went to work as an exploration geologist within the Archaean greenstone belt in the Upper Peninsula of Michigan. She then worked as an engineering geologist for a civil engineering firm in Aberdeen, where she conducted fieldwork across Scotland for various development projects.



Emily Madoff

Abate Assen Melaku is supervised by Will Hutchison, Richard Bates, and Eva Stüeken, and his project is funded through GCRF. Abate is studying magmatic degassing at East African Rift volcanoes, and he will be evaluating geothermal resources and hazards associated with the rift volcanism.



Abate Melaku

Amanda Woods is supervised by Richard Bates. Amanda is a retired Doctor living in the Outer Hebrides, where she worked as GP, before she undertook an online Masters in Archaeology at UHI in 2016. Her PhD project will follow up on an interest developed during her Master's dissertation, and she will be investigating the relationship between Neolithic sites of the Outer Hebrides. Amanda is a mother of three, an embroiderer and a writer.

Chen Xu is supervised by James Rae, Andrea Burke, and partners at the British Antarctic Survey on an IAPETUS2-funded project on the Southern Ocean's role in CO₂ change. Chen comes to us from ANU and will make boron isotope measurements on fossil shells to examine CO₂ uptake

and release in the Southern Ocean over the quaternary ice ages.



Chen Xu

In addition, after last year **Lot Koopmans (BSc 2020, MSc(res) 2021)** was the first MSc by research in a long time (Lot is now in Oxford to do a PhD), we now have three students working on a project towards an MSc by research:

Rory Abernethy (BSc 2020) is supervised by Rob Wilson, and works on a dendrochronology project.

Curtis Rooks (BSc 2019) works on alkaline magmas, especially carbonatites, and is supervised by Adrian Finch.

Robert Webster (MGeol 2020) also looks at alkaline igneous rocks, but focusses on Greenland, and is also supervised by Adrian.

UNDERGRADUATE NEWS

BSc (Geology) / BSc (Env. Earth Science) / MGeol – student news

Research assistants

The University's **Undergraduate Research Assistant Scheme** aims to introduce undergraduate students to aspects of research by funding a few weeks of internships, which previously included, for example, curating our sample collection.

In the past year, the School had these three projects:

Unravelling the history of seawater chemistry and climate captured in the rock record. **Theodore Reeves**, supervised by Hana Jurikova.

Building Stones of Dunfermline. **Erin Campbell**, supervised by Richard Batchelor.

Terraforming Mars. **Vinayak Shastri** supervised by Mark Claire.

We would like to include more news from our undergraduate community. So if YOU, dear students, have some news that you think would fit in here (fieldwork, internships...), please do get in touch.

ALUMNI NEWS

Left but certainly not forgotten - where are former students and colleagues now

News and updates

Already in October 2020, **Andrew Mackenzie (BSc 1977)** received a knighthood in the Queen's Birthday Honours List for services to Business, Science, Technology and to UK/Australia relations. (Unfortunately the Winter 2021 Newsletter had already gone to press when your editor heard about this event.)

And more recently, UK Business Secretary Kwasi Kwarteng has selected Sir Andrew Mackenzie FRS as the preferred candidate for chair of UKRI. Sir Andrew has an impressive background in both science and business. Building upon a successful early career as an academic geochemist, he moved into industry and was Chief Executive Officer for BHP Billiton, Melbourne, Australia, a world-leading mining company, from 2013 to 2020. He was appointed Chair of the Board of Royal Dutch Shell plc, May 19, 2021.

David Swinbanks (BSc 1975) and family left Japan in 2012 for Australia and have lived in Sydney since then. He is still working for the journal Nature (now Springer Nature) and is now approaching retirement but still enjoys reading the SEES Newsletter!

Sean Johnson (BSc 2012) is now Principal Geochemist - Exploration & Mines at Boliden Minerals AB Sean.Johnson@boliden.com

John Morgan (BSc 1998) visited St Andrews recently and briefly met up with Stuart Allison and Richard Batchelor. John runs his own consultancy in Aberdeen specialising in wellsite and operational geology. Find out more at www.grampian-geoscience.co.uk

Alexander Finlay (BSc 2006) announced his wedding to Kate in May. Many congratulations to the couple!



Kate and Alex

Ronnie Guthrie (MGeol 2014) revealed on twitter that he got married to Melissa, his mapping partner on the 2nd year Spain trip. Many congratulations also to this couple!

Again, according to twitter, **Gavin Tolometti (BSc 2016)** passed his PhD viva at Western University, Ontario, Canada. Congratulations, Gavin! Interestingly, he was co-supervised by St Andrews alumnus **Gordon Osinski (BSc 1999)**.

And, you guessed it: twitter revealed that **Drew Drummond (BSc 2017)** was awarded his PhD, for which he researched the Tara Deep Zn + Pb deposit funded by Boliden Tara Mines. Congratulations, Drew!

Messages from alumni

Alan Fyfe (ORD BSc 1972, MSc 1986) "I was delighted to read (in the last Newsletter) that the department

is moving back to St Mary's Quad (or nearby), which is so close to where we were when I studied geology in the late 1960s - early 1970s. I have many happy memories of working in that old department."

Peter Bridges (BSc 1969) "Thanks for another comprehensive Newsletter. I really enjoy them even though it's all very different these days, both in student numbers and the scope of work covered by the Department. There were four of us in final Honours in 1969: Dan Greig, Ron Thom, Julia Martin (married Ron Thom) and me. I remember the XRD machine being operated by Tony Weir in the photo. It really was hi-tech in those days!"

Martin Perry (BSc 1993) simply wrote: "Love these (Newsletters) - keep them coming!"

Andrew Gize (BSc 1976). "A note of thanks for all your work and skill in producing the latest news letter. Always a drop-everything-else moment when it hits my Inbox."

David Kay Ferguson (BSc 1964). "Thank you for the latest newsletter. The photo of Tony Weir brought back happy memories of playing squash and accompanying him to Creetown. In those days we were taught to believe in geosynclines, so it was interesting to find ripples in the turbidites!"

Cathy Brown (Secretary, 2010-2014) wrote: "Many thanks for sending me the newsletter. I realise I recognise fewer and fewer names in there but it's still a fun read."

FIELDWORK and LABORATORIES

The aspects that define our discipline

UG field trips resumed

As an integral part of our degrees, fieldwork – like everything else – was severely hindered by the pandemic. Although we put all efforts into virtual field work alternatives, and believe that at least the fundamental ideas still came across, it was no doubt that we should try to take students out to look at rocks and other aspects of our environment as soon as possible. Already last autumn, after the (first) lockdown was eased, we held two local field trips with our first year students: one to the Rock and Spindle as an introduction to classic (igneous and sedimentary) geology, and one to the raised beach deposits at Elie as an introduction to reading the environmental record. This little bit of “fresh air” amongst what needed to be all virtual teaching (albeit on real rock samples we had handed out or shipped to first years) was much appreciated by the students. But, alas, the second lockdown put another stop to all field training.

The more we all were excited when, after a lot of effort in convincing the University that we could not let students graduate without any advanced field exercises and how we intended to run these in a responsible way, we got green light for some urgently needed (domestic) field work. This was carried out in early April. You can find out more about those trips, including pictorial evidence, a few pages down the line in *Return to the field*.

Equipment updates

The old Logitech **thin section machine** we have had for decades died late last year. The University has agreed to replace it with a new (much fancier) one. The Logitech PM6 has arrived, and it comes with its own enclosure and is computer controlled! We had to wait for an opportunity when our and the manufacturer’s calendars aligned so that Stuart and Donald could be trained in how to use it. The machine is now up and running, just in time for dissertation student projects.



Grant and Tommy from Logitech with the new PM6

Alumna **Gillian McCay (BSc 2005)**, who is curator at the University of Edinburgh and is still in frequent contact with our curator and allround-legend Stuart Allison, heard of our problems with thin sectioning equipment. When Edinburgh was clearing out some equipment, the donated some polishing equipment to us. Gillian very much enjoyed several Fisher & Donaldson fudge doughnuts as a facilitator reward.

Other good news is that the University and the IOM3 will be helping out with a modest amount to **Nick Gardiner** to set up the **geochronology split-stream lab**. Here, Nick and Batzi Fischer are working on reviving an older multi-collector ICP-MS (Nu plasma, bought second hand several years ago from ETH in Zurich) and a quadropole ICP-MS. These will be connected to a laser ablation system, which has just arrived from Portsmouth, where it has been used until very recently by St Andrews alumni Catherine Mottram and James Darling, amongst many others. We already managed to have Hf from solution going around the Nu multi-collector and hope to begin method development soon. Stay tuned for more in the next issue.

New microprobe

In a joint big grant proposal, SEES and the School of Chemistry have jointly bought a brand new electron microprobe – a JEOL iSP100. This

is the first of this model in the UK. This piece of kit will permit the chemical analysis of samples down to the micron-scale, for example straight on a (polished) thin section. It has five wavelength-dispersive spectrometers, a ‘dry’ energy-dispersive spectrometer, cathodoluminescence capability, and back-scatter electron mapping. It is the first time that we acquired a new microprobe, the ones in the past were always second hand - so it is a leap over several iterations of model development. To microprobe guru Donald Herd’s relief, it comes with user friendly software and a nice new sample exchange system.



JXA-iHP200F arrives at Purdie Building

It will enhance the analytical facilities of our school and keep us at the forefront of geological research. Beyond our and chemistry’s research, we will be collaborating with national and international colleagues, do commercial analyses, but also be able to train our students on this state-of-the-art technology. Also delivered was a Jeol JSM-F100 FEG electron microscope with a SXES detector (one of only 2 in the UK). On an ‘entertaining’ side note: the new probe is housed in the Annexe to the Purdie building, the place that already housed our first probe back in in the 1980s, before it was moved to the Irvine building.

SPONSOR A SCOPE – AN UPDATE

Where we got to with our microscope drive thanks to your generosity

Many of you may remember that we had started a crowd funding campaign to replace our ageing petrological microscopes¹. We were surprised and touched by the great generosity that many alumni, parents, and other friends of the school showed towards this funding call. So, a big THANK YOU to all donors.

Thanks to the clear signal that your donations sent, the University has recognised the necessity and importance of the endeavour to update the microscopes. Your response made it clear that petrological microscopy is still very much a core skill of all Earth Scientists. As a result, the University has agreed to financially support our microscope drive. This allowed us to buy all the petrological microscopes that we need to continue to deliver ex-

cellence in teaching.



One of the new microscopes with an inbuilt WiFi-capable camera module

We now have 45 new *Leica DM750P* microscopes. Five of those are models that have an extra module giving

them reflected light capabilities, e.g. for ore microscopy in our Earth resources classes; another five have in-built WiFi camera modules for taking pictures and accessing them straight on the smartphone (great for dissertation students as well as remote teaching).

As the next and last step we will aim to get a few good quality stereo microscopes for our Environmental Earth Science courses. This will allow us to study for example microfossils (including forams used in palaeoclimate reconstructions), (carbonate) sedimentology of unconsolidated material, or biological communities that tell us something about environmental conditions (ecosystem health).



2nd year undergraduates in one of the first lab classes that used the brand new microscopes. At this moment they were looking at a garnet-micaschist from Grantully.

¹<https://saintsfunder.st-andrews.ac.uk/p/SEESgeologymicroscopes/>

MESSAGE FROM ALUMNA ANNA GRAYSON

Geological specimens make their way to an Art Museums - a different way of looking at fossils

Anna Grayson (BSc 1974) sent us a message in which she updated us about her career since leaving St Andrews:

“Thank you for your recent newsletter. I am always pleased to receive these. I thought it was probably high time I sent you an update into what I am doing now:

After leaving St Andrews in 1974 I embarked on a career with the BBC, eventually becoming a writer and presenter of several dozen programmes (both TV and Radio) about Geology. One or two of my films, and excerpts from films are still available on the BBC Website, and my little books about Geology seem to pop up on Amazon still. Astoundingly in this day and age I still have to send stern letters now and again to people making false claims about the authorship of this body of work, and even claiming false collaborations! Yes, women really can, and do, write about Geology, folks and St Andrews has produced a good number of successful women geologists over the years. In the course of that work I was awarded the RH Worth Prize by the Geological Society of London,

and a Glaxo-Wellcome/ABSW prize for TV science writing.

When I retired a few years ago I went to Art School for a year, with the intention of learning some new skills and having some fun. But it turned into a whole new career. I have become best known for re-making famous works of art as photographs, and three of these have been hung in the Royal Academy, including in 2018 in Grayson Perry’s famous Yellow Room. I exhibit regularly in England and my work has found its way into private collections around the world from New York to New Zealand. As well as framed work, I sell limited edition unframed prints - see my website www.annagrayson.com

After studying Dutch Still Life paintings at the Rijksmuseum, and the Wallace Collection in London, I decided to make my own version, but using geological specimens. Many years ago my mother had asked me if I thought ammonites would have been nice to eat and, based on the qualities other cephalopods, I said yes I thought they would. The result is called Dutch Still Life with Fossil Seafood. A framed version of this is

currently part of a solo show at the Royal Albert Memorial Museum in Exeter.

All good wishes, Anna.”

Since her letter, Anna found out that “Still Life with Fossil Seafood” was accepted to the Royal Academy. Congratulations! Anna expanded:

”[The picture copied] the composition and lighting of a Dutch Still Life but with fossils for the cheeses etc and geodes instead of silver vessels. The message of these Still Life paintings is the memento mori - reminding us of the fate that awaits us all, we’re all gonna die. You can’t get much more dead than a fossil!!

I’d like to share this news with the department. This picture has effectively been a lifetime’s work and would not have happened without the grounding I had at St Andrew’s. All of the specimens come from our own collection and many were hewn from the rock with my own bare hands and geological hammer. The exhibition runs from 22 August to the New Year at the Royal Academy, Burlington House, Piccadilly.”



Anna’s work “Dutch Still Life with Fossil Seafood”

RETURN TO THE FIELD

A brief report, and pictorial impressions, from our first post-lockdown field trips

Batzi Fischer, **St Andrews**

In April, 4th and 3rd year geology students spent 14 days on Mull and Iona - a long standing staple of our normal field programme that we extended and adapted to teach essential advanced field skills to those who were short changed by the pandemic. Normally, we take students to Durness or Ullapool for a week of regional mapping, and then they come to the Ross of Mull for another week to map different aspects of granite emplacement and interaction with the country rocks. This year, we spent two weeks based at Scoor house, and first mapped the succession of metamorphosed sediments of the Moine and the contact relationships with the Ross of Mull granite, followed by a second week spent on Iona, getting to grips with mapping the variability of its Lewisian gneiss and mylonitised sediments.

receiving the area for potential student mapping projects. While we were overall lucky with the weather, there was a day or two when the weather behaved in the reliably (Western) Scottish way: totally unreliable and following the rule “if you don’t like the weather, wait for 5 minutes”. And indeed, glorious sunshine alternated with thick snowflakes dancing in a gale.



Students honing their field skills on Iona, whilst mapping in small groups but otherwise independently

As the students independently mapped, staff covered the same area, bumping into small mapping groups but also



Nick and Batzi bracing the weather on Iona (top), but also embracing better weather (bottom) on the Ross of Mull, modelling a classic outcrop at Ardalanish

The (by now newly graduated) 4th year students then complemented their observations and interpretations from Mull and Iona, and topped their field training off with a further trip which took them to Arran. Here, they looked at some of the younger parts of Scotland’s geological past. Ultimately, from their field observations, they were able to piece together three billion years of Earth history – from the Lewisian gneisses of Iona to the Tertiary magmatism on Arran.



4th year students on Arran

But it was not only the rocks that were finally visited again in the field, also the students on the Environmental Earth Science degree stream headed back out in the field. One of their exercises led them to the shores of Fife, where they studied the environmental impact and water chemistry related to acid mine drainage.



Acid mine drainage studied along the Fife coast, where iron precipitation from historic mining activity stain the rocks along the coastal path; water samples were later analysed in a lab exercise

Similarly, the 4th year environmental students headed over to the Scottish Association for Marine Sciences (SAMS) at Oban, where we run a field and lab course on oceanography and marine geochemistry. Students sail out onto Loch Etive on one of SAMS research vessels and collect water and sediment samples, which they then analyse in the laboratories.



Boat trip attendees

Normally, just before the start of their 4th year at St Andrews, Geology students go on the Alps field trip, where they do a transect across the Alpine orogen to understand 'the anatomy of an orogeny'. Since the pandemic prohibited international travel, we ran a field trip to dissect the Geology of Scotland (the trip was variably called the MacAlps or the Alpsterative). Batzi, Maddie Murphy, Richard (White), Paul and Nick took the group through the Barrovian and Buchan metamorphism of the Caledonian orogen, crossed the mother of large faults that is the Moine Thrust, and got intimate with Britain's oldest rocks in the Lewisian gneisses of Assynt.



The then 3rd, now 4th year geology class at one of the most famous outcrops in British UG education

And lastly, because they missed the mapping trip to Spain in the spring, just before the lectures kicked off again, Will, Tony and Batzi took the now third years to the Isle of Arran (the SpArran trip) where they practised their mapping skills in short exercises across the Highland Boundary Fault and along a section of the Old and New Red Sandstone, as well as looking at key sites including Hutton's Unconformity and the Drumadoon sill. We got all so excited on Arran that I sadly cannot get my hand on a picture.

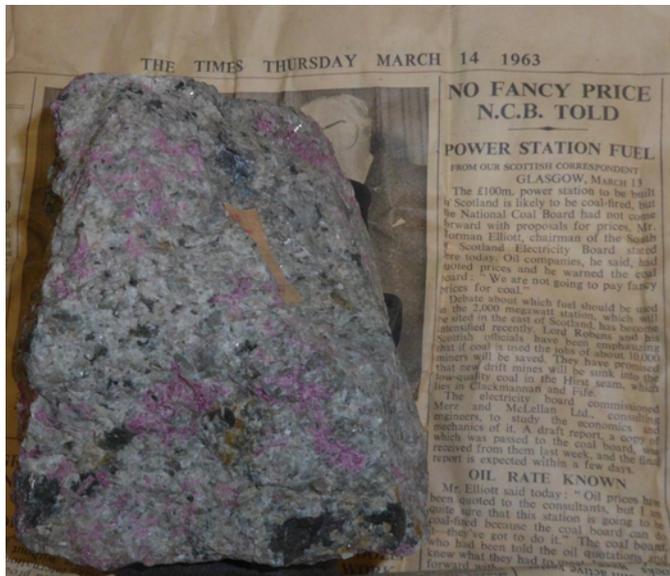
STORIES FROM THE STORES

A few highlights of samples that resurfaced during a move of the collection

Stuart Allison, **St Andrews**

Some recent housekeeping amongst the Geological collection revealed these interesting samples (and their wrapping):

In 1963, while the British government was pondering which fossil fuel to run the new power stations on, William T (Bill) Harry was collecting rocks (Naujaite) in Greenland with the striking pink mineral eudialyte. This mineral is a potential ore mineral for rare earth elements, zirconium, and niobium, all of which could prove vital in the production of new technologies for providing efficient future green energy solutions.



Pink eudialyte in naujaite sample, on a newspaper from the same time it was collected

While in the present, a long way away in a solar system near to us, a rover called Perseverance is starting its quest to search for former life on a cold barren planet. It should be looking for features in the rocks like this – laminated domed structures called stromatolites built up by cyanobacteria, some of the simplest life found on our planet. These were collected by Roy Macgregor from the late Precambrian (700 million years old) Bonahaven Dolomite on the Island of Islay. Could we find that stromatolites have been growing on Mars even before these?



Stromatolites from Islay

And to finish, something cute – a corkscrew flute mark from Ken Waltons collection of sole structures from Silurian turbidites at Kirkcudby Bay (would benefit from some photogrammetry).



Corkscrew flute mark

FROM THE ARCHIVE

A (brief) history of the newsletter you are holding in your hand

Richard Batchelor, **St Andrews**

While clearing out my office, I came across a collection of Newsletters. The earliest one was a joint Geography & Geology one produced by cartographer Graeme Sandeman in 1999 when we were part of the School of Geography and Geosciences. It was an A5 format with glossy covers. That was followed by a series of newspaper-style A4 productions on green paper produced and edited by Richard Batchelor.

When secretary Cathy Brown joined Geology in 2010, she initiated an Alumnus Newsletter in A4 format with lots of colour images. When Cathy left us in 2014, Richard took (back) over and has continued the tradition to this issue, for which he passed the baton to Batzi Fischer, who volunteered to continue the newsletter. At the time of writing, 270 paper copies are posted to alumni

in the UK and across the world, and 600 electronic pdf files are sent out by the Development Office. Richard regularly receives a number of favourable responses to the Newsletter (see this issue).

If you currently receive a paper copy of the Newsletter, but would be happy to receive it as an electronic file via e-mail, let Batzi know as it would save the School some money in printing and postage:
sf67@st-andrews.ac.uk

A single disc features five chapters covering: Cornwall 1967, Ullapool 1968, Haltwhistle 1971, Southern Uplands 1972 and Ullapool 1972. The disc runs for 1hr 25mins. On first viewing, I identified Prof Davidson, Barry Dawson, Peter Bowden, Roy MacGregor and Bob Johnston. I recognised a few students given I only arrived in St. Andrews in 1972.

I have had several copies made and am selling them at £12 each (including p+p). Contact me if you would like a copy: Richard (rab@st-andrews.ac.uk)

Archive film of field trips

As an executor of the late Dr J Anthony (Tony) Weir, I inherited 8 mm cine film of geology field trips in the late 60's – early 70's. I've now had them transcribed onto DVD.

ECLOGOS

If anyone has a copy of the in-house Geol Soc magazine "Eclogos" that they can scan or photocopy or donate, please let me (rab) know, as my collection has gone missing.



A set of the Newsletters have been deposited in the School office for posterity (and reference).

THE LAST PAGE

Iconic geology on the coast(er)

The Castle golf course restaurant has sussed out the local geology with this coaster. Was this inspired by groups of yellow-vested students marching every autumn past their driveways onto the beach below their restaurant? Or is it alumna Rosalind Garton (BSc 1978) asking for access through their grounds for geology field trips to the Rock and Spindle? Or Richard Batchelor getting help from their staff with moving the heavy cast rubber mould of Hibbertopterus tracks up the cliff? Whatever it is, a fitting name which will hopefully spark interest in rocks amongst those just coming to drive a golf ball.



In the news

You may have spotted James Rae's recent paper featured in the news media, including BBC and several papers. See below for the 'i' newspaper example.

SCIENCE

Research lifts lid on history of climate change

By Jane Clinton

Humans have driven carbon dioxide (CO₂) up to levels not seen since about three million years ago, a study has found.

An international team of scientists led by St Andrews University collected data spanning the past 66 million years to provide new insights into the kinds of climates we can expect if CO₂ levels continue to rise at the current rate.

They found that the projected rise would result in prehistoric levels of warmth that have never been experienced by humans. Researchers said the study provided the most complete history to date of how CO₂ has changed over the past 66 million years since dinosaurs last roamed the planet.

They added that the data collected shows more clearly than ever before the link between CO₂ and climate.

Working with colleagues from Southampton University, Texas A&M University in the United States, and the Swiss university ETH Zürich, the team collated data collected over the last 15 years using high-tech laboratory techniques.

The researchers analysed microscopic fossils and ancient molecules from mud samples taken from the deep-sea floor to paint a picture of what CO₂ and the climate looked like at the time.

They sent these ancient atoms through super-sensitive instruments and were able to detect the chemical fingerprints of past changes in CO₂, which can be compared with present day changes.

The study explained how through fossil fuel burning and deforestation humans have now driven CO₂ back to levels not seen since around three million years ago.

Dr James Rae (*inset*), from the School of Earth and Environmental Sciences at St Andrews, who led the team, explained: "For instance, the last time CO₂ was as high as it is today, enough ice melted to raise sea level by 20 metres and it was warm enough for beech trees to grow on Antarctica. "If we allow fossil fuel burning to continue to grow,

our grandchildren may experience CO₂ levels that haven't been seen on Earth for around 50 million years, a time when crocodiles roamed the Arctic."

The study has been published in the journal *Annual Review of Earth and Planetary Sciences*.



i Dr James Rae said: "CO₂ has transformed the face of our planet before, and unless we cut emissions as quickly as possible, it will do it again."

James' research covered in the 'i' newspaper (02 June 2021, p.23)

Sample of the 'month'

Nick Cook (see staff news) has sent us a picture of his favourite hand sample. It so pretty we had to show you:



Cake in St Mary's Secret Garden

At the start of the academic year we welcomed our second year students with coffee and cake. It was a chance to meet staff in real life, after their first year was essentially all online.

