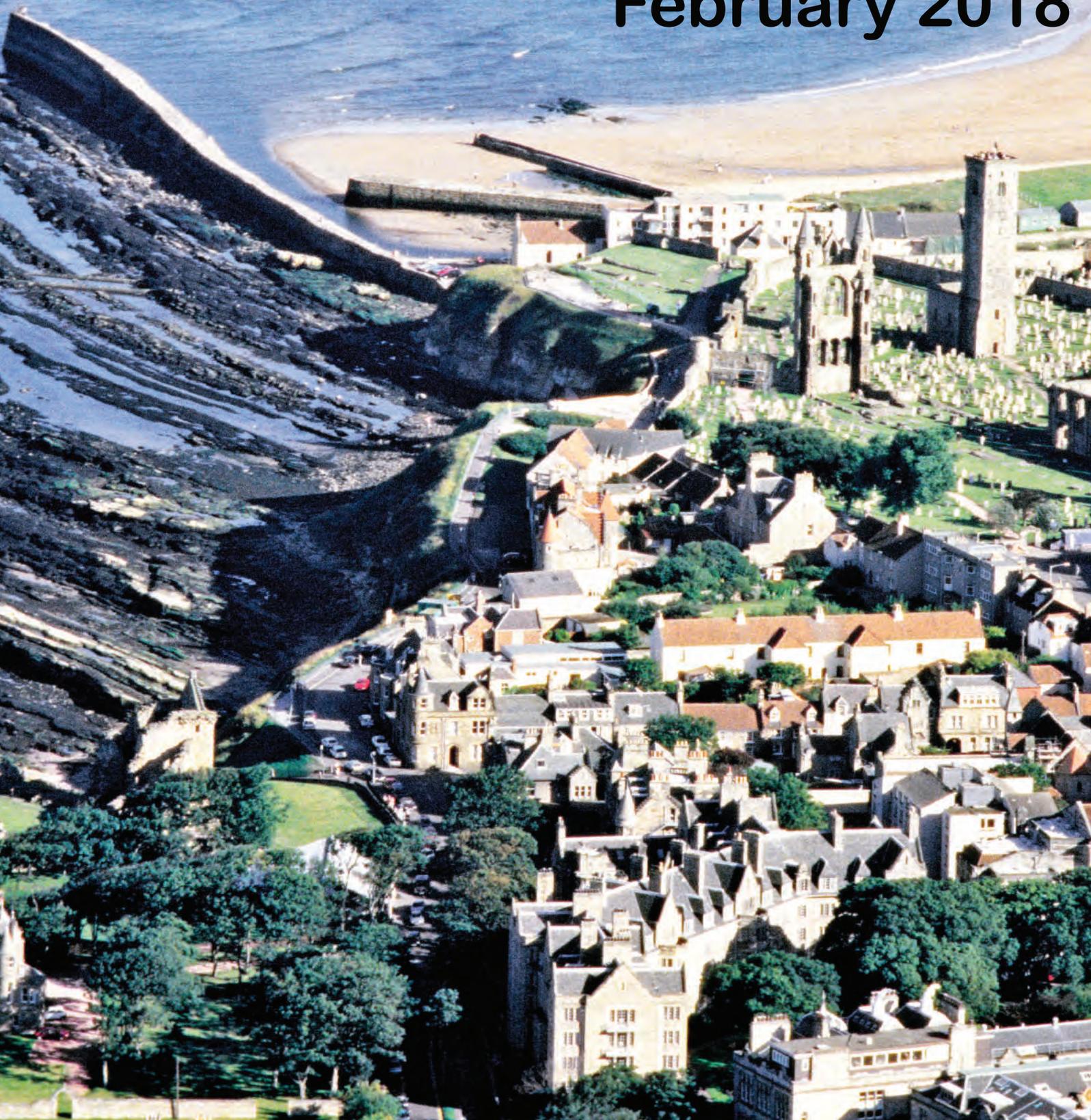


**SCHOOL
OF
EARTH & ENVIRONMENTAL SCIENCES**



University of
St Andrews

NEWSLETTER
Number 13
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Welcome to the 13th edition of the School Newsletter. As usual, there is plenty of good news that bodes well for the future of SEES.

Richard A. Batchelor (Editor)

The first full year as the independent School of Earth and Environmental Sciences (SEES) has been, as you would no doubt imagine, a satisfying and gratifying one. For the first time since I arrived at St Andrews nearly 22 years ago, we have had the pleasure of being able to make decisions and define strategies as a single, self-determining entity, focussing entirely on what matters most in our educational curriculum and in undertaking our research. Geology now has a solid core of staff and the environmental science side of the School has been strengthened enormously with the hiring of Dr Michael Byrne, one of the finest early career climate modellers out there; Michael will start as a Lecturer in October and his profile and research will be highlighted in our next issue. Alas, as with most natural processes, there needs to be a mass balance. Many of you will have known Angus Calder. After a 30-year career, Angus has decided to leave the University and we thank him for his service to the School. Our *esprit des corps* is as strong as ever and our excitement about the future of Earth sciences at St Andrews remains unabated.

Best wishes to all,

Tony Prave (Head of School)

STAFF NEWS

Eva Stüeken

In last year's first MSA Reviews volume, *Non-Traditional Stable Isotopes*, Eva contributed a chapter defining and forecasting the Se isotope system as it relates to geoscience. Suboxic shales, ferromanganese oxides, terrestrial and lacustrine archives, and volcanogenic deposits are among likely targets for future study.

Stüeken, E.E., 2017. Selenium Isotopes as a Biogeochemical Proxy in Deep Time. *Reviews in Mineralogy and Geochemistry*, v. 82, pp. 657 - 682. <http://rimg.geoscienceworld.org/content/82/1/657>

Paul Savage

In a new paper in *Meteoritics and Planetary Science*, **Paul** and colleagues measure concentration and isotopic composition of Cu

and Zn in four fields of moldavite tektites plus a range of sedimentary target rocks around the Ries crater in Germany from which moldavites are presumed to have been derived. Paul and colleagues discovered that both metals were lost as volatiles but that loss was accompanied by extreme isotope fractionation only in Cu.

Rodovska, Z., Magna, T., Zak, K., Kato, C., Savage, P.S., Moynier, F., Skala, R., and Jezek, J., 2017. Implications for behaviour of volatile elements during impacts – Zinc and copper systematics in sediments from the Ries impact structure and central European tektites. *Meteoritics and Planetary Science*, 1- 15. <http://onlinelibrary.wiley.com/doi/10.1111/maps.12922/epdf>

Paul and colleagues also contributed a chapter to *Non-Traditional Stable Isotopes*, reviewing the Zn and Cu biogeochemical cycles and surveying the isotopic compositions of reservoirs and fractionation processes on Earth and extraterrestrial systems.

Moynier, F., Vance, D., Fujii, T., and Savage, P.S., 2017. The isotope Geochemistry of Zinc and Copper. *Reviews in Mineralogy and Geochemistry*, v. 82, pp. 543-600. <http://rimg.geoscienceworld.org/content/82/1/543>

Earlier this summer, **Darren Mark** and colleagues published a paper on Ar/Ar age dating of the ~25km (originally 40-50km) Rochechouart impact crater in southern France. With stunning precision (full 2σ ~0.1% of the age) at $206.92 \pm 0.20/0.32$ Ma, Rochechouart significantly precedes the Triassic-Jurassic extinction, dated previously by U-Pb on zircon at 201.33 ± 0.27 Ma. Previous age uncertainty permitted hypotheses of synchronicity; now it is clear that Rochechouart impact had nothing to do with the Triassic-Jurassic biotic turnover. Central Atlantic Magmatic Province extrusion alone matches the boundary age.

Cohen, B.E., Mark, D.F., Lee, M.R., and Simpson, S.L., 2017. A new high-precision $^{40}\text{Ar}/^{39}\text{Ar}$ age for the Rochechouart impact structure: At least 5 Ma older than the Triassic-Jurassic boundary. *Meteoritics and Planetary Science*, v. 52, pp. 1600-1611. <http://onlinelibrary.wiley.com/doi/10.1111/maps.12880/full>

Sami Mikhail was (in August) voted the new Early Career Councillor (starting January 2018)

by the Council of the European Association of Geochemistry. This is prestigious in that it is European-wide and recognises Sami as one of the rising academic stars across Europe. Also, in November, he landed a Royal Society Award for a project *New constraints on the volcanic history of Earth's sibling planet, Venus*.

Eleanor Mare, our newest postdoctoral scholar, recently submitted her PhD at the Australian National Universities Research School of Earth Sciences. Her background is a BSc (Hons) at Monash University with a double major in geoscience, and a minor in mathematics. Her PhD specialised in experimental petrology (*Cation coordination changes in silicate melt with pressure*). Eleanor will be with us for 3 years collaborating with **Sami Mikhail** and some colleagues at Cambridge and Edinburgh. Eleanor will be working on high-pressure and high-temperature nitrogen geochemistry. Eleanor is no stranger to St Andrews, having spent 2-months at St Andrews collaborating with the NMR team in Chemistry. Eleanor loved her time at St Andrews so much she's come back for more! In October she gave a Departmental seminar on how an element's co-ordination number can change with increasing pressure, which has implications for distribution coefficients between element X and mineral Y.



Eleanor

Tim Raub is due hearty congratulations for obtaining funding from the Global Challenges Research Fund for his lead on work aimed at *Understanding Drought Cycles Across South-Central Africa*.

New Staff

Dr Bob Steele and **Dr Tommaso Di Rocco** joined the school in November as research

officers in the isotope and geobiology labs, looking after the metal and gas isotope instruments respectively. Bob and Tommaso are outstanding scientists (both keen on solar system and planetary formation and meteoritics) and instrument wizards (fixing chillers, gas tanks, and gas lines in their first week!).



Bob and Tommaso

New Lectureship

After a day of presentations and interviews, held last Autumn, from 5 shortlisted candidates for a new Lecturer post, the successful candidate was Dr **Michael Byrne** who is currently at Trinity College, Dublin. He will be taking up his post here next October. His speciality is mathematical modelling of atmospheric circulation and thermal regimes on Earth.

Richard Batchelor had a paper accepted by the *Earth & Env Sci Trans Roy Soc Edinb.* after its long period in gestation. The paper entitled *Do Neoproterozoic (Moine) calc-silicate rocks represent metamorphosed tuffs? A geochemical re-appraisal* was the product of research carried out while he held a Leverhulme Emeritus Fellowship. The controversial aspect of this work hinges on the fact that he argued that thin white beds found in the Moine rocks of Scotland are in fact tuffs metamorphosed to amphibolite facies.



A calc-silicate bed in Moine schists, Arisaig

Professor Nigel Trewin

It is with sadness that we report the death last autumn of **Nigel Trewin** of Aberdeen University who had acted as external examiner for Geology at St. Andrews between 2009 and 2012.

A round of applause to **Jonathan Cloutier** and **Will McCarthy**, and to **Simon Jones** and **Vincent Twomey** (the latter two being PhD students) who have just been awarded support-in-kind for their projects using NERC's isotope facilities to study *Midcontinent Rift System geochronology* and the *Impact of Magma Supply Rate on Pluton Architecture*, respectively.

Many of you will likely not be aware of the effort that **Eva Stüeken** has put into getting the 253 lab in the Purdie functioning, (it having sat idle for well over a year). Eva, with the help of **Tommaso Di Rocco**, have got the Elemental Analyser up and running and it is rewarding to see Eva smiling and Tommaso with his head down working!



Tommaso and Eva

Andrea Burke.

Andrea was successful in her collaborative NERC proposal: *Earth's weathering reactor: carbon source or sink over short and long-time scales?* and she was also successful in a St Leonard's Scholarship PhD bid (joint with Mathematics & Statistics), *Modelling CO₂ and Climate Change*.

Sami Mikhail was successful in a St Leonard's PhD Scholarship bid with Chemistry: *Negative Side of Geochemistry*.

New Professor Induction

At the December graduation ceremony, Professor **Tony Prave** was formally inducted to the Chair. Here is seen in his finery. Congratulations, Tony.



Tony in full regalia

Maaret Karjalainen, School Finance Officer, graduated M.Litt in Management at the December graduation ceremony. She achieved this while working full-time for the School. Hearty congratulations.



Maaret

Claire Cousins had an article published the "i" newspaper, 11 January 2018, on her contribution to the scientific experiments to be included on the planned European Space Agency's *ExoMars* rover. Her instrument will analyse drilled material for evidence of biosignatures, which would give a clue to the

existence of former biological activity on Mars. She occupied 19 column inches in total!

New Staff

We welcome **Adrienne MacArtney** who will be here with us this semester. Adrienne will be teaching the Astrobiology module this semester and comes to us from Glasgow where she has just finished her PhD on *Crust - atmosphere coupling on early Mars*.

Ed Stephens grant award

Hearty congratulations are due to Ed (Senior Research Fellow) for turning his expertise as a geologist into becoming an internationally recognised expert on addressing the health hazards in vaping, following on from his work on mineral contamination of tobacco. He is probably the only geologist ever to crack the Cancer Research UK's research barrier and be awarded a CRUK grant. The title of his research proposal is: *Modelling the harm reduction impact of electronic nicotine delivery systems, heat-not-burn and other innovative technologies in terms of the risks of cancer in the UK*.

The Atacama desert: sampling soils in the driest place on Earth.

The Atacama Desert in Chile is well-known for being the driest place in the world, with mean annual precipitation less than 1 mm/year in some areas! In this extremely arid environment, the study of geobiological processes in soils can shed light into the past and present evolution of the atmosphere and life on the Earth, as well as being an analog for other planets like Mars. Interestingly, most soils in Atacama show extremely high concentrations of salts, including sulphates, nitrates and perchlorates. Atmospheric deposition of aerosols generated from oxidation of gaseous compounds (NO_x, SO₂, etc.) reacting with ozone in the stratosphere is the main source of these salts, which are exceptionally preserved in the Atacama because it does not rain. The study of these salts can provide valuable information about oxidation pathways of gases in the modern and ancient Earth's atmosphere, and how organisms in this

extreme environment can utilize them for food.

In December 2017, Dr. **Mark Claire** led a team of five SEES members, to the Atacama to conduct a survey along a 1200 km-transect from the hyper-arid area (~21°S) through the increasingly wetter "transition zone" (~30°S). Dr. Mark Claire, Dr. **Fernando Gázquez** (postdoc) and **Bethan Gregory** (PhD student) sampled soil profiles in pits (3m deep!) to investigate the distribution of salts in the soils with depth and their triple oxygen isotope compositions. Concurrently, Dr. **Aubrey Zerkle** and **Jianxun Shen** (PhD student) collected soil samples for geobiological and microbiological analyses, including quantifications of spatial distribution of extremophile microbial communities and their nitrogen usage by measuring nitrogen isotopes. In addition to the main scope of the trip, we found interesting soil structures in the form of polygons made of gypsum (CaSO₄·2H₂O), which formation mechanisms will be subject to a new research project. Happily, not all was about digging pits and sampling. We had also time to visit some amazing monuments, like the "hand of the desert" near Antofagasta city, and to taste some interesting local food, including Chilean sushi and the Chilean national drink, the Pisco sour!!!





POSTGRADUATE NEWS

Robert Campbell Postgraduate Prize

Congratulations to **Jess Crumpton-Banks** who was awarded the 2017 Robert Campbell Postgraduate Prize. The citation states that the prize was awarded in recognition of Jess' leadership in organising the IAPETUS DTP conference at St Andrews and her broader contributions to the School, and especially the postgraduate community during 2016-17.

Rob Campbell was a final year research student in DEES when he died in August 2013. This award for research postgraduates in the Department was established in his memory. Previous winners are Sebastian Fischer (2014), Cristina Evans (2015) and Colin Mettam (2016). Rob was awarded a PhD posthumously in 2014 and is commemorated by an oak tree and bench in front of Andrew Melville Hall placed there as a mark of gratitude and respect by the Andrew Melville students he cared for while serving as an assistant warden.

On receiving the award Jess provided us with a summary of her recent research activities:

“My research uses boron isotopes to investigate atmospheric CO₂ change over the last glacial cycle. The Southern Ocean has been thought to have played an important role in glacial-interglacial CO₂ variation as it is a major region of deep-water ventilation and CO₂ outgassing today. Boron isotopes in foraminiferal carbonate allow us to reconstruct the palaeo-pH of the water the foraminifera grew in. My preliminary data shows that the pH of the glacial Southern Ocean was higher than during the previous interglacial and provides the first direct evidence that carbon exchange

between the deep ocean and atmosphere was limited in the Southern Ocean at this time. This points to a major role for the Southern Ocean in glacial-interglacial CO₂ change.

This studentship is funded by NERC as part of the IAPETUS Doctoral Training Partnership. In May, the School hosted the 3rd annual IAPETUS student conference, which included a poster session in the Bell Pettigrew Museum, talks in the School and a post-conference walk to the Rock and Spindle. The conference was a huge success – thanks to everyone who was involved!”



Jess being presented with the award by Professor Tony Prave, Head of School.

PhD successes

Chris Sargeant successfully defended his PhD last November: *The Application of Highly Resolved Tree-ring Isotopes for Reconstructing the Ecohydrological Interactions within Riparian Forests*

Cristina Evans passed her PhD viva in December: *Modelling Subsurface Hydrology in Riparian Environments*

In December, **Sebastian (Batzi) Fischer** successfully defended his PhD: *Behaviour of Zircon and its Isotopic Systems during Intracrustal Differentiation*

UNDERGRADUATE NEWS

During Orientation week (mid-September 2017), SEES held a welcome reception for new and returning students. Food and drinks were

served. Afterwards, a prize-giving event was held for recipients of various achievements.



Prizewinners, L to R: Charlotte Barlow, Jordy deVries, Katie Delahooke, Emily Madoff, Jessica Crumpton-Banks (PG), Alba McClinton, Marie Marsden, Ian Cawood, Abigail Robinson, Hannah McAuley

Charlotte Gordon, currently President of the SEES Geological Society, has had her Laidlaw-sponsored research in Iceland last summer voted top for Science students at St Andrews.

First MSc Geochemistry graduates

At the December 2017 graduation, seven students graduated as the first tranche of this new course, co-ordinated by **Dr Paul Savage**. Five members of the class are pictured below.



L to R: Abdul Malik Ismaila, James Crosby, Andrew MacIntyre, Laura Crick, Joshua Rhodes-Hook

Laura Crick offers her assessment of the first year of the Geochemistry MSc course.

"About 18 months ago I found myself heading towards the end of my undergraduate studies in Chemistry and Earth Sciences at Durham University with no particular plan in mind. I could look for a job, though in many cases this would require me to abandon geosciences; a prospect which I did not relish. An alternative came in the shape of a newly-

formed MSc Geochemistry course at St Andrews University. I was a little dubious initially - this would be the first year of the course and I would need to get to grips with many unfamiliar aspects of Earth Sciences in a completely new department and town. I took the plunge and found myself in a small, diverse cohort containing everyone from field geologists to a nuclear chemist. United together at a prestigious university in a small Fife coastal town we were welcomed into the department by undergraduates, PhDs and staff alike before being thrown into lectures.

Throughout the first semester we found ourselves in third year chemistry labs and visited the facilities of the Scottish Universities Environmental Research Centre at East Kilbride in the second semester. A week-long fieldtrip to the Río Tinto area in southwestern Spain concluded the course. This assortment of activities brought the usual highs and lows; I was very much at home in undergraduate chemistry labs whereas fieldwork - a welcome change for many with a strong geology background - was completely new to me. After fighting through a sea of deadlines followed by May exams we began work on the final stretch of the course - dissertations. Our close-knit group found itself spread across the university, and other countries, each pursuing their own interests. August soon came around and, after battling equipment failures and many late nights in the Playfair room, we each printed, bound and successfully submitted the results of three months work, thanks to significant support from supervisors and the course coordinators. Although this has been an intense year it has been incredibly rewarding and I look forward to continuing in academia alongside many good friends and colleagues that I have made over the course of this last year."

Geologists' Association Tupper Prize

Stella Linnekogel was awarded second prize for the Geologists' Association Tupper Prize. Her commitment to the subject impressed the panel and she was awarded £500.

ALUMNI NEWS

Rosalind Garton (BSc 1978) has taken on the role of Evening Degree module co-ordinator for ES1901 and ES2901.

At the Open University Geological Society (OUGS) annual symposium last August in Edinburgh, geodiversity was the theme and **Rosalind** was an invited speaker. She gave a presentation about the work of *geoHeritage Fife* over the last 18 years. Two other alumni attended, **Andrew McMillan** (BSc 1974) and **Steve Blake** (BSc 1978). **Andrew** has retired from BGS and is thoroughly enjoying retirement. **Steve** is still working for the OU and, as President of the OUGS, gave the closing address. He is still active in research on mathematical modelling of magmatic systems and volcano plumbing. **Steve** was interviewed on New Year's Day by BBC Radio 4 about his latest paper on volcanic eruption prediction.



L to R: Andrew McMillan, Steve Blake, Rosalind Garton.

Justin Dix (PhD 1995) has been promoted to a Chair in Marine Geology & Geophysics at Southampton University.

Aerona Moore (BSc 2010) started a new job in early August as a seasonal Geopark Ranger on the Isle of Arran. Everyone there seemed shocked that St Andrews students never came here on a fieldtrip! Her role is to help set up Arran as a Geopark, as well as helping to organise Geofest 2017 in September.

[*Note from the Editor:* In the mid- to late-1970's, St Andrews 2nd year geology students held their Easter field trip on Arran and were based at the Corrie Hotel.]

Pat Foster (BSc 1974) contributed this item.
Triathlons-why would you bother at my age?
 Good question and one I've often asked myself – especially in the latter stages of events when the aches and pains kick in.



Half-way round the recent Age-Group World Championships in Rotterdam

I'd been a runner but, with my Achilles tendon packing up, it meant a rethink. Triathlons were in the news as an up and coming sport (this was 17 years ago – amazing how popular it is now). Swimming and biking replaced running until the injury healed. Six months were spent re-learning swim technique, and membership of the Serpentine Running Club provided support and advice as well as the opportunity for early morning, chilly dips (not always welcome).

My bucket list contained some iconic events/rides with qualifying for the Age-Group Triathlon World Championships being the final and most difficult challenge. Highlights have been cycling up Mont Ventoux 3 times in a day;



500m to go and the strain is obvious

Swimming across the Dardanelles from Europe to Asia and twice completing the Escape from Alcatraz Triathlon. One of the more exacting elements was swimming from Alcatraz Island to the mainland. Remember that no prisoner ever escaped from the jail as the water is far too cold!

Over the years I've raised money for a number of charities. The more extreme (for that read painful) the challenge the more hands reach into pockets to support. The aim has been to raise about £10,000 each year, much of it from matched funding programmes. So why continue? A sense of wellbeing, feeling fit and healthy, enjoying the competition and meeting loads of new people all contribute. But I think the photo below says it all. This was taken after the three of us had just competed in the Age-Group aquathon Championship in Penticton, Canada this August.



Pat in the middle

This year's racing is over and training is on the back burner for now. Next year the World Championships are in Denmark – did I mention the excuse of travelling the world as a bonus?

Bob Black (BSc 1973)

Roving reporter Richard Batchelor met up with Bob in Cupar.



Bob and Richard

After leaving St. Andrews, Bob joined the Anglo-American Corporation as a mining geologist in Zambia. In 1978 he joined a UK abrasives company as marketing manager, but after 3 years he returned to geology and joined Shell UK. Over the next 26 years his work took him to Brunei, Oman, Malaysia and finally Kazakhstan. From 2007 he spent 3 years with British Gas which involved travel to Brazil. He has retired to Cupar, Fife.

Jamie Frew (BSc 2011) wrote:

"I am working as a land surveyor and am being sent all over the country with Carillion. I feel like I've now been to every RAF base in the UK. I even made it out to the Falklands for a few days in November. It's a fantastic place though it feels like they take you up in a plane and circle for 22 hours before landing on a Hebridean island. Even in late spring there were wintery showers so I was glad of the mile-long corridor that linked the mess bar with the dorms, meaning I rarely had to go outside in the evenings! I rented a Land Rover to complete my works so I managed to get off base and see Stanley and some penguins which made the trip worth while."

Gordon Osinski (BSc 1999)

"I wanted to write to wish you all happy holidays and also pass on the news that I received news (mid-December) that I have been approved for promotion to the rank of Professor here at University of Western Ontario (effective July 2018). For Tony, Ruth, Ed, Colin (and all the others who taught me as an undergrad.) I am where I am today because of what I still consider the best undergraduate geology education in the world. I hope the success and expansion of the department that has occurred in the past few years continues."

OUTREACH

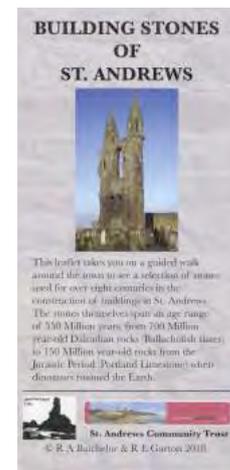


Hermione Cockburn (left), Scientific Director of Dynamic Earth, formally launches the "51 Best Sites". Richard is standing by the white carpet corner.

Richard Batchelor (Honorary Research Fellow) attended the formal launch of "**51 best places to explore Scotland's Geology**", sponsored by the Scottish Geodiversity Forum, at Our Dynamic Earth in Edinburgh in late-September. As Chairman of *geoHeritage Fife*

he was instrumental in getting East Fife included in the “51” (*Folds, Fire and Fossils in East Fife*). **Richard** also had a stall to display all the geological trail leaflets that *geoHeritage Fife* has produced.

The latest production from *geoHeritage Fife* is a “**Building Stones of St Andrews**” geological trail leaflet. It was part funded by the St Andrews Community Trust. Copies of the leaflet are available from the Editor.



GEOBUS

The GeoBus team attended the formal launch of “*51 best places to explore Scotland’s Geology*” at Our Dynamic Earth, Edinburgh, in late-September 2017.



L to R: Andrew Whyte, Lauren Hockenhull, Charlotte Gordon, Jen Brooke, Ella Oakley-Slater

Lauren Hockenhull describes her experiences with GeoBus.

I joined GeoBus last August, and since I started we have been to 69 Schools and seen almost 5,000 pupils. This brings the project up to a total of 691 schools and 64,000 pupils in the 5 years it’s been running!

We’ve been all over Scotland, making it all the way up to Shetland for a great week in September, and all the way down to Gretna just a few weeks ago. As an English person who

had never had the chance to explore Scotland, having the opportunity to do it as part of my job has been fantastic. I have visited parts of the country that I had never even heard of, let alone would get the chance to visit of my own volition.

My highlights so far include Shetland (it only rained 2 out of the 5 days we were there, and the other three were beautiful!), driving through the Highlands to Gairloch, and all of the field work courses we've taught outdoors in the Cairngorms and Glen Clova. I love how varied my job is, teaching such a wide range of workshops from giant sand tanks to teach about river systems in the classroom, to the practical skills needed for data collection in real river systems.

I've learned a lot on this job that I never expected to and definitely wasn't in the job description. I'm now an expert at GeoBus van Tetris, fitting all the kit we need for the week into what feels like a constantly shrinking van! I've always been fairly good at DIY, but I can now say I've tested my abilities to tight deadlines!

It has been great to put my MSc in Science Communication to practice, and I look forward to whatever the rest of this year has in store!



Lauren packing the van.

GeoBus has recently celebrated its 6th Birthday. Congratulations.



SCHOOL OF EARTH & ENVIRONMENTAL SCIENCES

USEFUL LINKS

<http://earthsci.st-andrews.ac.uk>

<https://www.facebook.com/standrewsgeologyalumni>

<http://soi.st-andrews.ac.uk>

<http://www.geobus.org.uk>

<https://www.st-andrews.ac.uk/development/alumni>

<http://www.st-andrews.ac.uk/development/alumni/reconnecting>

CONTACT

E: earthsci@st-andrews.ac.uk

T: 01334 463940

MAIL:

School of Earth & Environmental Sciences

Irvine Building

North Street

St Andrews

Fife

KY16 9AL



Irvine Building



Raised beaches, Kinraig, Elie

We are always interested to receive news from our alumni which we are pleased to publish in the Newsletter and the SEES website.

Contact the editor: Richard Batchelor (rab@st-andrews.ac.uk)