Department of Earth Sciences Magazine

EARTHSCIENCESNEWS

UNIVERSITY OF OXFORD

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WELCOME

by Professor Gideon Henderson
Head of Department

Does the study of climate belong in an earth-sciences department?

Sometimes, amongst the swirl of debate about wind-farms, carbon taxes, and the policy response to warming, it is possible to wonder what climate has to do with geology. I can doubtless be accused of bias, but from my perspective, the challenge of climate actually demonstrates very well the critical importance of earth sciences to society. It was study of the earth's past, as captured in sediments, fossils, and ice, which first demonstrated that climate is not constant, but can vary very significantly. Similar research continues to provide key information about the complex interplay of earth-processes that govern climate, and respond to climate as it changes.

Climate offers fundamental questions about the operation of the planet. As one example: how did the earth descend into huge, possibly global, glaciations of the "snowball earth" in the late Precambrian? How did it recover? And did these extreme climate events help to initiate a burst of evolution? Geological understanding of climate is also important for more applied questions. Past warm periods of ocean anoxia led to the preservation of hydrocarbons, still critical to global energy production. And it is the winds, sun, tides and waves of the earth system that offer the alternatives we must rapidly adopt for future energy needs (unless we turn to nuclear, which depends on finding uranium ore; another job for the earth sciences).

Of course, the earth sciences cannot work in isolation, and it is an explicit strategy of the department to support and develop our links to other Oxford departments: to the atmospheric physicists and climate modellers in Physics; the evolutionary geneticists in Zoology; to those studying past societies in Archaeology; and to those influencing policy in the Environmental Change Institute. Such fields are vital to study of the earth system, but in many ways, Earth Sciences remains at the centre of the subject. Scientific understanding of the climate system, based on knowledge of the history of our planet and observation of modern process, underpins climate science. In diverse and subtle ways, earth sciences influence the discussion of windmills and carbon taxes at the present Lima climate conference or next year's major Paris meeting.

Climate science is also important, along with many other branches of the earth sciences, in the help and guidance it provides to developing nations. Oxford earth scientists work all over the world; literally from Abu Dhabi to Zambia. Many nations have significant natural resources, fascinating geology, and are threatened by geological hazards and environmental change, but lack modern geological tools and the understanding to benefit from their resources or assess their risks. Universities such as Oxford have a huge amount to offer such nations, as evident in the department's strong links to developing nations exposed to risk from earthquakes (see p12) or volcanoes (see p16), and from our work to understand the geology of countries such as Myanmar (see p10) with its rich mineral and petroleum resources. Please consider joining us in February for our annual panel debate (following the success of last year's event on fracking) to discuss the opportunities and responsibilities of the earth sciences in the developing world (further details are on p21). We also hope to see you at the alumni dinner next May, to be held in celebration of the 200th anniversary of the publication of William Smith's first geological map of the UK. Or do visit the department any time you are in Oxford. You are always welcome. Friday

Retrieving ocean bottom pressure recorders from the CCGS Henry Larsen's fast response craft in Foulke Fjord, northwest Greenland during the Canadian Archipelago Throughflow Study. Photo by Prof. Helen Johnson

is a particularly good day to visit, with the weekly department seminar at noon, and the long-standing Happy Hour at 5pm.

What changes will you notice when you visit? After expansion of faculty with the seven new appointments reported last year, this year we have three retirements to announce: Martin Brasier, Shamita Das, and John Woodhouse have all left employment, but not the department, and each keeps a desk and an intellectual presence in the department. Research symposia organised by some of their students provided a wonderful celebration of their work – see photos below. It has not all been retirements. The faculty has been joined by Nick Tosca, an expert in sedimentary processes, with a fascinating portfolio of research including into Martian sedimentary processes, and the generation of banded iron formations. Nick takes his place as Tutor at St Peter's, replacing Steve Hesselbo, who left last year. The Department continues to take pride in close links with the Colleges. Martin Brasier's tutorial responsibilities at St Edmund Hall have been taken on in the last two years by Roger Benson, whilst at Exeter, Shamita hands over to the capable hands of Karin Sigloch.

Finally, a word about field trips. It is clear on almost every page of what follows how important field observations are for the earth sciences. We did not design the magazine this way; it just happened. It is almost unavoidable, when you gather a collection of stories about the subject, that many feature fieldwork; it is such a fundamental aspect of study of the earth. That makes it equally fundamental that we continue to teach a full field programme at the core of our undergraduate course. This is financially challenging in the era of capped student fees and reduced government funding for education (and research). But it remains something we are utterly committed to and that we will not compromise on. We are hugely grateful, therefore, for the very generous support of our alumni in helping fund undergraduate fieldtrips. There are too many names to thank you all, but let me single out two people for their generosity this year: George Bull (who writes about his reasons for giving on p4) and Margaret Joachim (who discussed the importance of undergraduate field-work movingly with me following last year's alumni dinner). On behalf of our students (and all those who will benefit from the future understanding they will generate), thank you to George, Margaret, and everyone else who has contributed.

Introducing our new Tutorial Fellow

Nick Tosca, Associate Professor of Sedimentary Geology and Sackler Tutorial Fellow at St. Peter's College

My research is focused on how Earth's climate has evolved through its early history and how this impacted biological evolution. I use both experimental and field studies to understand how changing climate and seawater chemistry are archived in the sedimentary record. My research ranges from understanding the co-evolution of life and environment around the time that atmospheric oxygen first appeared in the Archaean and Palaeoproterozoic, and also the later Neoproterozoic and Cambrian when complex macroscopic life first emerged. I am also interested in the nature of early climate as recorded in the Martian sedimentary record. I was involved in NASA's Mars Exploration Rover mission and influenced landing site selection for NASA's Mars Science Laboratory mission, which is currently exploring ancient sediments over three billion years old.

Martin Brasier surrounded by former students, colleagues and friends.

Alumni and collaborators attending the symposium "30 Years of Global Seismic Tomography".

RISING TO THE FUNDING CH

Oxford changed my life in so many ways. 1972-76 saw some of the best times, and some of the most challenging times too. 40 years on I still delight in friendships made then, with a sense of immediacy which belies the passage of time. We pulled together, and we flourished.

For so many undergraduates, Oxford is a crucible, with the tutorial system being a vital ingredient. Crucibles make me think of amalgam, visits to the dentist and short stabbing pain. But when it's over the benefit is clear. So it was for me with tutorials. The academic stimulus, sheer hard work and sense of intellectual satisfaction verging on elation equip undergraduates well for their futures, in academia, commerce or industry.

For earth scientists, studying at Oxford has one more crucial component: the field trips. Again, the best of times and the worst of times! Pouring rain; steep gradients; being blown over in a blizzard on Mull; attempts at mapping when the cloud base was at ground level; the white beaches of Assynt on a long evening; the warmth of a well-stocked bar after a soggy day; and the most superb, practical demonstrations of geology one could wish for.

However, this unique education has financial implications. For the whole University, the tutorial system requires a massive financial investment. State funding has never been sufficient to support the distinctive teaching system, and substantial cuts and changes in fee structures have had a dramatic effect. For the Department of Earth Sciences, field trip costs sit on top of that.

Over the years, I have come to the view that – even for those of us who are no longer engaged in the earth sciences – we owe a lot to the field trip system and should do all we can to help secure it for the future.

Here, I feel that for many years the University and the Department missed a couple of tricks, with the fundraising message appearing to be aimed at individuals and companies capable of making large donations. However, I am now delighted that there is a renewed awareness that, irrespective of their personal financial circumstances, every alumnus has an important role to play in supporting the work of the Department and the field teaching programme in particular.

Having considered this for a while, I was pleased to be asked to sign up for a relatively modest monthly gift. As the University has charitable status, the Department is also able to claim Gift Aid of 25p in every £1 donated by a UK tax payer. The sandy beach at Assynt is made up of countless grains of sand, and so it is with regular giving. Month by month, year by year a steady deposit of funds through the direct debit system accumulates a worthwhile total.

If an individual, or perhaps a group of friends, gives £100 a month, over five years that is worth £7,500 to Earth Sciences with a Gift Aid claim. Higher rate tax payers may also be able claim tax relief on their donations. A little can go a long way and I know that the Department is grateful for the support it currently receives.

BY GEORGE BULL
(1972 ST EDMUND HALL)

ALLENGE

Of course, more goes even further. And there is a long way to go: the six main field trips that students attend (Pembrokeshire, Arran, Dorset, Assynt, Spain and then Bermuda or Greece) cost approximately £300,000 each year.

Those willing and able to give more are invited to consider funding a field trip on an annual basis. The long term goal is to fully fund this programme from the Department's endowment. There are many ways to give tax efficiently including through gifts of shares, or through leaving a legacy, and the Department would be delighted to discuss this in further detail.

But back to where I started. If we all pull together, we will be able to provide vital support for this crucial teaching programme. I hope that you can join me as we act now to safeguard the continuation of the field trips that we all benefitted from, and support the future generations of Oxford Earth Scientists.

FIELD TRIPS

WHERE DO WE GO?

Many of our field trip localities will be very familiar to even our oldest alumni – some less so:

1ST YEAR

Before Michaelmas lectures start, students spend 4 days on the Pembrokeshire coast, based at Broadhaven. In the Easter vac, students develop their geological recording and mapping skills when they visit the island of Arran. Local trips to Rock Edge quarry in Headington, and Leckhampton Hill provide further introduction to geological observation.

2ND YEAR

Students start second year with a week on the World Heritage Jurassic Coast, based in Weymouth. Later in the year, students travel to Assynt for 10 days in the Caledonian mountain belt, including time spent developing aspects of independent mapping, fieldwork safety and survival in remote and rugged terrain.

3RD YEAR

After a summer completing an independent mapping project in an area of their choice, students visit South-East Spain to examine the geology and tectonics of the basins, mountains and coastal outcrops of the Almeria region.

4TH YEAR

4th year students have a choice between studying volcanology and tectonics in Santorini and mainland Greece, or discovering oceanography and climate science on Bermuda, including time spent on a research ship. These trips often provide a natural progression into the independent Master's project completed during the 4th year.

MAPPING IN SOUTH GREENLAND

an undergraduate mapping project

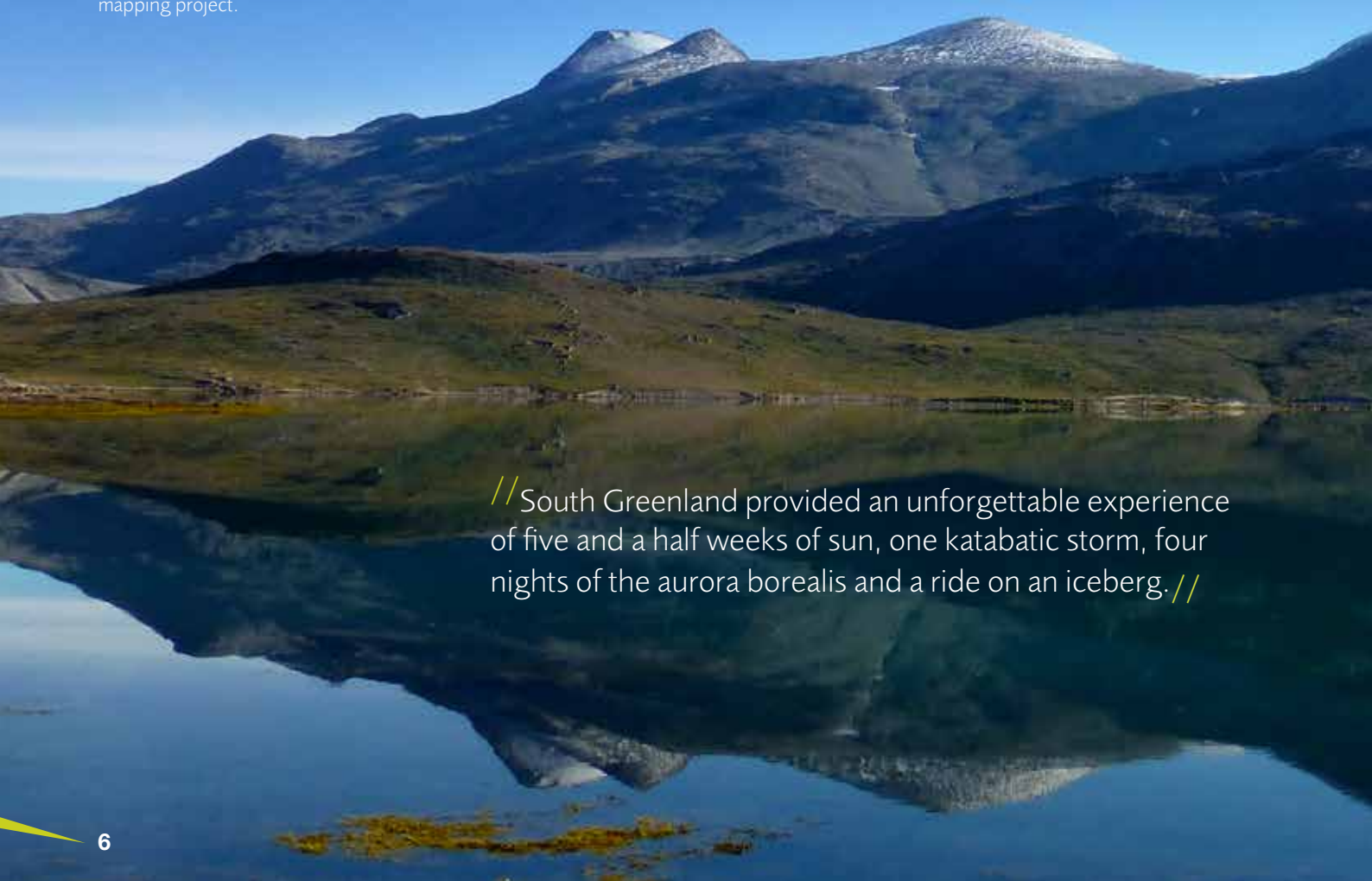
ANNA BIDGOOD (ST ANNE'S 2011)

When I realised that, by doing an earth science degree, I would be able to travel to fascinating places across the world, I immediately started to imagine all of the amazing places that I could visit, study and begin to understand from the geological perspective.

So naturally I was ambitious when it came to planning my 2nd Year mapping project. I'd thought about mapping in South Greenland ever since I'd heard about the unique geology of the area, the high exposure, the good weather and the lack of mosquitoes! To me it seemed too good to be true, and subarctic to boot. You can imagine my excitement on finding that my lecturer, Stephen Hesselbo, had undergone his own undergraduate mapping project in the area adjacent to the one that I had my eye on. Not only was it fantastic geology, but it seemed a feasible destination for an undergraduate mapping project.

With the details all falling into place, I was lucky to find three fellow earth scientists and friends who were very keen to come along. We managed to submit our proposal to various funding bodies and apply for funding to cover almost the entire cost of the expedition (a total of £11,000).

South Greenland is a great place to work in the field. The exposure in the areas free from ice is almost too good. We were based in a village called Igaliko, with 60 inhabitants in the summer, dropping to 30 in the winter. The main livelihood is sheep farming. The sheep roam the mountains in the summer months, their urine contaminating the small lakes which deters the mosquitoes from laying their eggs. After spending 2 days in the glacial valley by the airport, we really appreciated this lack of mosquitoes, especially the most tasty amongst us.



//South Greenland provided an unforgettable experience of five and a half weeks of sun, one katabatic storm, four nights of the aurora borealis and a ride on an iceberg.//

The project itself was a real challenge. We knew that the minerals were unusual; one locality was proved to contain over 60 alkaline minerals, being the type locality for almost 30 of them. Our reconnaissance over the first couple of days was a little disheartening. We were undergrads on our first independent fieldwork project, far from home in South Greenland, trying to identify minerals that we'd never seen before! We struggled at first to even identify the different layers of the syenite intrusion as the variations were so subtle. A supposedly gneissic basement had no banding. The sediment in the area consisted almost entirely of quartz. We had over 100 dykes crossing our 15km2 area and there are few fossils in the Precambrian. However, this did not deter us! Over the next 28 days in the field we got our eye in, identified the subtleties, identified the major minerals in the famous Narsarsuuk pegmatite and started to produce something which looked like a map. The phases of dykes were classified and sedimentary features photographed.

Living in Greenland was great fun. We camped for six weeks in two tents behind a barn, portable homes and a local shop which for 2 hours a day sold a variety of produce from tinned meatballs to tinned veg. We could even shower once or twice a week! The only thing lacking was a chocolate supply as ours was worrying low. Once again we rose to the challenge and armed with empty rucksacks and sleeping bags, we hopped on a boat to one of the largest towns in south Greenland, Narsaq (3000 inhabitants) and bought enough chocolate to get us through the coming weeks.

By September the nights were getting colder and our boots were starting to freeze. The days were still sunny but the winds were icy and the mountain tops were white. We weren't the only ones to notice the changing seasons: the local hotel closed, the sheep were brought in from the mountains and we were unable to access parts of our mapping area as the river became impassable. One day we set out for a day's mapping and came across a sign on the footpath saying "closed for winter".

South Greenland provided an unforgettable experience of five and a half weeks of sun, one katabatic storm, four nights of the aurora borealis and a ride on an iceberg.

In addition to mapping, we produced an educational film aimed at school children to introduce them to science in the field, things you can do as an undergraduate and geology. The latter being under-represented and unknown in schools. This film, along with an accompanying blog and geological powerpoint presentation are being used to provide workshops in schools and have won awards for educational outreach using technology. We were delighted that the film was chosen to be shown at the EGU in Vienna in April 2014.

Fellow earth scientists and friends, Eleni Wood (St Peter's), Robert Fox (Exeter) and Chantelle Roelofse (St Anne's) in Greenland.

You can view our blog at
http://annabidgood.wordpress.com/

Watch the film at
http://youtu.be/Xd5H-14WLzA

With thanks to our sponsors

and the generous donations from Exeter and St Peter's College alumni

A ROCKY JOURNEY FROM THE HIGH HIMALAYA TO THE MARCELLUS SHALE

BY DR BEN STEPHENSON
(ST EDMUND HALL 1993)

When I first joined Shell 15 years ago, I was told I was a fracture expert, but I knew nothing about fractures! This is Shell's style. You get a certain role that requires certain expertise and you have to figure it out. It suits me down to the ground; I hate being told what to do! Having completed a D.Phil. in 1997 with Mike Searle and Dave Waters on the Zanskar-Kishtwar Himalaya, where I studied km-scale shear zones, being asked to start describing mm-sized cracks was a shock to my observational system. "Are they really relevant?" I thought. These days I'm working on the Marcellus Shale in the USA and excited by collaboration with the Oxford Shell Lab and the expertise of Joe Cartwright, John Hooker and colleagues, to try and answer some geological questions pertinent to the Marcellus and fundamental to shales in general.

The Marcellus is a Devonian-age mudstone with large reserves of natural gas, which covers a large part of the foreland Appalachian basin in Pennsylvania. One of the interesting technical challenges is that the mechanism by which fluids flows though shale is not well understood. So the questions being asked by industry are not only how can we maximize the recovery of the resource, but also, what can we learn about the processes that formed and deformed shales in the context of the burial and uplift history of the basin. It's an exciting time to be an earth scientist, as industry and academics alike find themselves on the steep part of the learning curve.

Many times I find myself reminding colleagues and myself alike, that in the "olden days" (about 12 years ago!) shales were mainly studied to estimate their sealing capacity for sandstone reservoirs below them. Now we extract hydrocarbons directly from them, often referring to them as "reservoirs," when before they were seals, and expend a huge effort measuring their properties. Some key questions are posed by shales like the Marcellus: what is the impact of the natural fractures? Were they formed by the overpressure generated as the source rock matured? It is universally agreed that one has to study the rocks to find the answers.

I remember when I was a D.Phil. student at Oxford in the early 90's and I heard about the funding cuts for fieldwork. I could never understand why geologists wouldn't be encouraged to observe rocks until they were sick of them. Since joining Shell, I have been lucky enough to participate in field trips to Oman, the Bahamas, the Rockies, southern France, Spain, Syria, Nicaragua, as well as the Appalachian mountains, with the highlight being the organisation of my own research program in the Zagros Mountains of Iran. As a firm believer in Professor Harold Reading's old adage, "the best geologist is the one who has seen the most rocks," these trips were invaluable training.

I have often thought about why a field-based PhD in the Himalaya might have helped me become a petroleum geologist. Indeed, Professor John Dewey asked me that very question in my viva, making me sweat in the process. Was it really the days on end scurrying around mountain-sides searching for a hint of purple garnet or blue kyanite in grey schists; was it the hours spent looking down a microscope going cross-eyed trying to decipher shear-sense from mica fish; or the late nights in the Department, pretending to be Captain Kirk, sat at the helm of Norman Charnley's microprobe? It was all important of course, each observation providing a pointillist's spot of paint, from which a coherent picture forms. But I think the real value is in the process of training the mind to turn a set of apparently disconnected observations into a rational argument. Very often in the petroleum industry, we only have a few clues for what the sub-surface might look like; a couple of wells, a seismic line or two from which we have to produce a predictive model. This gets the creative juices flowing, but the satisfying part is that you get to know whether you were right or not, when the next well gets drilled.

A view from the Himlayas in the 1990s

Oxford's John Hooker, Joe Cartwright and Ben examining Shell core samples.

DPhil Fieldwork with Mike Searle

Apart from the accrual of observations in different geological settings, the main reason why an early initiation in fieldwork is so crucial is that it necessitates the formulation of an hypothesis and

requires integrated thinking. This training is fundamental to work in the oil and gas sector, where integration and success go hand in hand.

When Mike Searle first showed me around the Himalaya back in 1993, I was mesmerized. So many mountains to climb; so many valleys to ski along; so many geological conundrums and so little time! The day Mike left me alone in a remote village I had a bout of food poisoning and was about 2 days hike from the road-head.

This could be interpreted by some as neglect, or here in North America, grounds for legal action! In retrospect this was the beginning of my training in critical and integrated thinking. I'm sure some of Mike's other D.Phil. students, who have successful careers in the energy sector - James Walker in Exxon, Richard Corfield in BP, Malcolm Dransfield in Shell, and doubtless others I am unaware of - would agree: fieldwork was the foundation of our careers and we have the old (errr, I mean eternally young) master, Mike Searle, to thank for that.

BEN IS PART OF THE TECHNOLOGY EXCELLENCE AND DEPLOYMENT TEAM WITH SHELL CANADA

COLLIDING CONTINENTS

YOU'VE READ THE BOOK, NOW TAKE TO THE TRAIL!

The crash of the Indian plate into Asia is the biggest known collision in geological history and continues today. The result is the Himalaya and Karakoram – the largest mountain range on Earth. This region has half of the world's highest mountains and a reputation as being one of the most remote and savage ranges of all. Professor Mike Searle, who has researched and mapped extensively in this region, will accompany a moderate level trek to Annapurna base camp along the Modi Khola Valley. If you enjoyed Ben's account of working in the region, why not give it a closer look with this accompanied tour?

A geological trek through the Himalayan Mountains of Nepal

- Trek through the Greater Himalayan Sequence from the Main Central Thrust up to the base of the Tethyan Himalaya
- Moderate level trek with five to eight hours of daily walking
- Ascend to about 4,100 metres in altitude
- Enjoy Professor Searle's personal accounts of extreme mountaineering and research in the region
- Discover the fascinating culture, customs and traditions of this region
- Stay in authentic mountain lodges

Date: 11 - 25 May 2015
Price: £2,780*

How to book:

This trip is organised by the University's tour operator partner Distant Horizons.

Please contact them on +44 (0)151 625 3425 or email info@distanthorizons.co.uk

*Price is per person based on 2 sharing a room, including flights from London.
Single supplement: £260.

This trip is part of the Alumni Travel Programme. In August 2014 Dr Matt Friedman led a geological trip to Madagascar, examining the evolution and zoology of a Gondwanaland Island. The full Alumni Travel Programmes is available online: www.alumni.ox.ac.uk/oxford-alumni-travellers

MINERALOGICAL MEANDERINGS IN MYANMAR

DR NICK GARDINER (ST PETER'S 1991)

Myanmar, one of the largest Southeast Asian countries, lying at an historically crucial juncture between India, China and SE Asia, is slowly emerging from decades of oppressive military rule. The country is extremely attractive to geologists for two principal reasons. Firstly, it is hugely rich in natural resources: copper, tin-tungsten, lead, zinc, iron ore, gold, silver, REEs (not to mention jade, rubies and sapphires!), and contains at least three "world-class" mineral deposits. Secondly, it is sited on the eastern end of the Cenozoic India-Asian collision, immediately south of the Namcha Barwa Eastern Syntaxis, and therefore provides a key link between the northern Tethyan suture in India-Himalaya-Tibet, and that found within SE Asia - crucially where it swings southwards. However, due to the recent political situation, and despite sterling work by indigenous geologists and a few notable western-sponsored programmes, it remains a geologically enigmatic and little understood terrain.

Oxford geologists have hitherto spent three decades unravelling the story of the Tethys suture across Oman, through Karakoram-Himalayan-Tibet, and more recently in SE Asia (Thailand and Malaysia), but Myanmar has always been the blank on the map. The political and economic change within Myanmar over the last 4 years has allowed Oxford scientists unprecedented access to areas that, in many cases, have not been visited by western geologists since the 1950's. We also have the opportunity to start working with local scientists.

The Oxford Myanmar project, comprising Mike Searle, Laurence Robb and your humble author, has one simple but broad aim: to unravel the tectonic history of the country and relate these tectonic settings to the variety, pattern and genesis of the varied mineralizations. We would like to answer some fundamental questions: Why is Myanmar is so rich in natural resources, whereas the majority of the main Himalayan suture belt is so barren? What is the relationship between the various orogenic events within Myanmar to those chronicled further north and further south? What exactly is the 'Jade' belt (is this an UHP ophiolite, and if so how did it obduct, subduct and then return to the surface?). Where exactly is the Indian-Asian suture within Myanmar?

In the last year, during field trips to the area, we have started to build contacts with the Myanmar Geosciences Society, the local mining community, and where possible the universities. Local knowledge and cooperation is a key aspect of the success of the project. Notwithstanding, we remain indebted to Dr Andrew Mitchell, an Oxford alumnus and former student of Harold Reading, who since the early 1970's has been one of the few western scientists working consistently and tirelessly within Myanmar

Panning for Gold

BURMA OR MYANMAR?
Take your pick; the Myanmar government and the UN use 'Myanmar'. Aung San Suu Kyi and the British Government prefer 'Burma'. It could be argued that the name of the country was changed without due reference to the will of the people. The same can be said of the capital, Yangon, formerly known as Rangoon.

Bawdwin mine

Logistically, it remains a tricky country to access and travel about. Permits are required for visiting much of the country outside the central Yangon-Mandalay basin. These take several weeks to be issued, and usually need coordination with the Ministry for Mines, so flexibility is key! There are numerous ethnic groups (Kachin, Karen, Shan, Chin, Wa, Mon etc.), mostly with at least one associated armed faction, struggling for self-determination or independence from Nay Pyi Daw; in a brief tally we listed 20 insurgent armies fighting the Myanmar Government. One journey required us to surrender our passports to the local Myanmar 'immigration' office to travel to a region that was out of Myanmar Army control but still in Myanmar...you will be glad to read Oxford geologists are still putting themselves on the front line.

Getting samples out of the country is also not straightforward. Your author only narrowly succeeded in exiting the country with granites and the odd rough sample from the Mandalay jade market. Perhaps surprisingly, Myanmar is not a cheap country to work in. Hotels in Yangon are now $100 per night or more, 4x4s cost $200 per day, and you are usually obliged to have a local guide/translator wherever you go. We are therefore hugely grateful to receiving industry funding thus far for the Myanmar programme.

There are, however, huge upsides to travelling and working in Myanmar. Despite their oppression, the people remain some of the kindest and friendliest on the planet. While travelling around to areas less-trodden by western tourists, children and adults alike will come up to say hello ("Mingalaba"), give you a toothy grin and shake your hand, being instinctively and friendly curious. This is a profoundly Buddhist country, a common sight being golden pagodas rising above the trees and monks in red robes zooming about on the back of motorbikes; travelers may also enjoy the sight of bullock carts travelling the wrong way down the sole dual-carriageway, which uses furlongs as a measure of distance.

The country contains a variety of landscapes - the hot central plains, a patchwork of rice paddies, is usually baked to dust by late May waiting for the monsoon, in contrast to idyllic, pristine beaches with thousands of palm trees in the deep south. In the north, the Himalayan foothills grade from teak forests to rise to Hikabo Razi; in the east intractable jungles host tigers and elephants.

Fieldwork is a key element of the project, despite the attractions of sampling out of context in the Mandalay Jade Markets. We have had the unique opportunity to visit the Bawdwin Mine, one of the most famous mines in Myanmar. First mined by the Chinese in 1412 for silver (Baw means 'silver' in Shan), in the early 1900's its potential as a major lead-zinc deposit was realized, most notably by Herbert Hoover, future US president and mining engineer by trade. We have seen tin-tungsten mineralization in the tin granites in the south, near Dawei, where some 50 plus alluvial and primary mining operations are in play. We have sampled the famous Mogok metamorphic belt - host to extraordinarily pure ruby marbles; and hopped over the Sagaing Fault to the magmatic arc, where Pliocene stratovolcanoes and quaternary basalts nudge Cretaceous granodiorites, and where the Myanmar Seismic Zone yields earthquake signals down to 250km.

A visit to the famous Kachin Jade Mines and the far north remain the next steps, but we feel we are on the brink of going some way towards unlocking the tectonic and geologic secrets of this magical country.

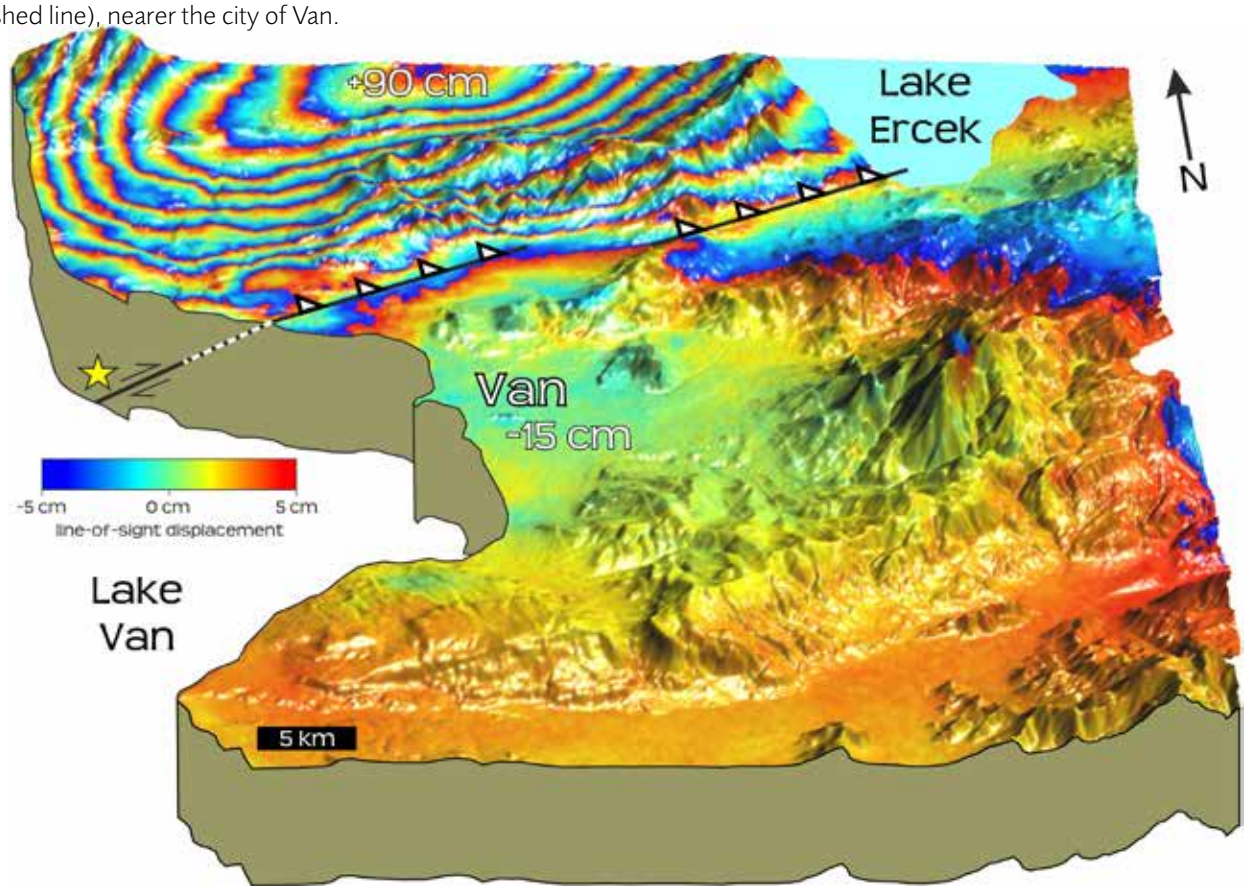
Further details regarding Economic and Tectonic Geology at Oxford can be found on the group's home page at hardrock.earth.ox.ac.uk or contact the author directly on nickg@earth.ox.ac.uk. We are grateful to Raphael Martin of Dark Capital for financial support.

//Oxford geologists have hitherto spent three tireless decades unravelling the story of the Tethys suture across Oman, through Karakoram-Himalayan-Tibet, and more recently in SE Asia.//

CAPTURING MOUNTAIN BUILDING IN THE ACT – EARTHQUAKE HAZARD IN EASTERN TURKEY

DR JOHN ELLIOTT (UNIV 2005)

This image shows the ground deformation due to the October 2011 Van earthquake in Eastern Turkey. The rainbow colours show 10 cm contours of ground motion, with up to 90 cm uplift in the mountains north of Van and 15 cm subsidence under the city of Van, measured using radar on the COSMO-SkyMed (ASI) satellite. From these observations, the location of the buried fault (black line and arrows) on which the earthquake occurred (yellow star) can be found, as well as where this fault outcrops at the surface (white triangles). This highlights which portions of the fault ruptured in the quake, and more importantly for examining future seismic hazard, which portions did not break – in this case the shallow section of the fault (dashed line), nearer the city of Van.



In October 2011, a magnitude 7.1 earthquake struck the cities of Van & Ecri in Eastern Turkey killing over 600 people. These cities lie at the eastern end of Lake Van, a saline soda lake 74 miles long and the largest in Turkey. This region is caught in the collision between Arabia and Eurasia that has built the high Turkish-Iranian Plateau and Caucasus to the north. This convergence has resulted in numerous faults and volcanoes across the region.

International Space Station photograph of Lake Van, Eastern Turkey, taken from orbit in 2007. The city of Van (estimated population half a million) lies to the eastern end of the large lake. The earthquake occurred to the north of the city and the motion on the faults is raising the land out of the Lake, building the peninsular at the eastern end A volcanic crator can just be seen in the north-west corner.

New apartment flats built at the northern end of the city of Van after the earthquake. The fault outcrops at the surface in the immediate foreground. The proximity of buildings to the fault highlights the importance of assessing the earthquake potential on this fault.

The earthquake in 2011 occurred on a previously unrecognised active fault that was just on the northern edge of the city of Van. Using satellite radar measurements, scientists in Oxford's Department of Earth Sciences were able to precisely map the fault segments that ruptured in this event (Elliott et al., 2013). They showed that the hillsides to the north had been raised by almost a metre in this single earthquake, contributing to the long-term growth of the mountains. These observations were also critical in showing that the slip in the earthquake remained buried between 8 and 20 km underground. However, this leaves a large shallow portion of the fault nearer the surface that has not broken, and field observations show that this fault is capable of rupturing in earthquakes, posing a continuing hazard to this city of half a million people. Making timely assessments of the ongoing hazards in a seismic zone are important in the rebuilding effort that occurs in the period after an earthquake disaster. New building stock has been constructed following the earthquake in 2011, and some of this has been positioned right on top of the hanging wall of the fault (see photo above).

Field excursions to the earthquake area were made by departmental members in 2013 and 2014 to collect samples along the fault and measure the height of the scarp. These measurements will be used to calculate the slip rate along this fault segment. Also, additional splay fault segments have been identified in and around the city from the satellite radar that may also have the potential to rupture. Understanding the behaviour of faults is crucial to determining whether they are able to stably slide over many years, or whether they are locked and can rupture seismically. Precise measurements of the deformation of the ground can be made use laser scanning technologies such as that shown below left. This data collection provides a very dense cloud of height points across a fault scarp from which offsets can be measured. This information is combined with the dating of samples collected from fault displaced fan material to assess the rate of slip for this fault.

This work is done in collaboration with partners in Turkey at the University of Eskisehir (Prof Erhan Altunel and Master's student Yunus Kurban), and forms part of David Mackenzie's (St Edmund Hall 2012) DPhil project. ***(On the right, in the bottom left photo)*** This work is funded by the Natural Environment Research Council as part of the Earthquakes without Frontiers (EwF) partnership to increase the resilience to natural hazards. You can follow their work on the EwF website and blog: http://ewf.nerc.ac.uk/blog/

Reference:
Elliott, J. R., A. Copley, R. Holley, K. Scharer & B. Parsons (2013) The 2011 Mw 7.1 Van (Eastern Turkey) Earthquake, Journal Geophysical Research, doi:10.1002/jgrb.50117

FIELD WORK IN SOUTH AFRICA

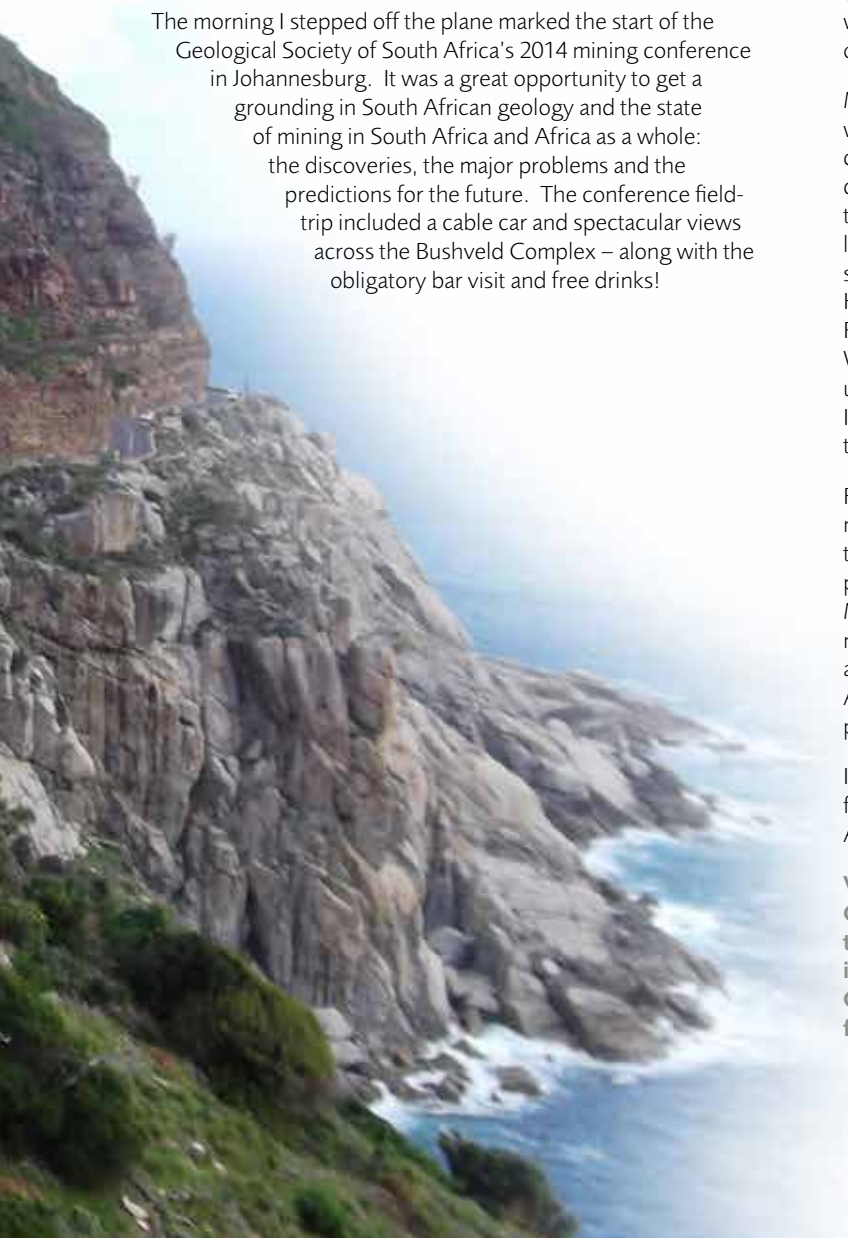
BY VICTORIA HONOUR (UNIV 2010)

I spent last summer in northern South Africa, working with a mining company for my Masters' research project: gathering crucial data, gaining an insight into the mining industry and experiencing the wonderful sights that the country has to offer.

Choosing my masters project was difficult; Earth Science at Oxford opens up many career paths for graduates, with the oil industry being a well-trodden path. This wasn't a path I was fully convinced by and mining sounded more exciting, and more applicable to my interests of volcanology and minerals. I was, and remain, excited in pursuing a career in the mining industry and so undertaking an economic geology-based project made realistic sense! After discussions with my project supervisor, Professor Laurence Robb, I was put in contact with a South African junior mining company: Bushveld Minerals Limited.

South Africa is known for its reserves of coal, platinum and diamonds; but it is also the third largest supplier of iron-ore to the Chinese economy and I would be working on an iron and phosphorus deposit in a well-established mining region of South Africa, the Bushveld Complex. I booked my flights, liaised with the company and began to get very excited about spending two months in an interesting, new country.

The morning I stepped off the plane marked the start of the Geological Society of South Africa's 2014 mining conference in Johannesburg. It was a great opportunity to get a grounding in South African geology and the state of mining in South Africa and Africa as a whole: the discoveries, the major problems and the predictions for the future. The conference field-trip included a cable car and spectacular views across the Bushveld Complex – along with the obligatory bar visit and free drinks!



I then moved north, from Johannesburg to the company's field-house in the northern limb of the Bushveld Complex and started trying to find my feet in researching for my project: 'Possible controls on Fe-Ti-P mineralization in the Upper Zone of the Bushveld Complex. ' The idea for the project was sparked by recent debate in the literature over the potential for liquid immiscibility in the Bushveld Complex and other layered intrusions.

I analysed a number of cores drilled by the company in their search for iron and vanadium, particularly focusing on a key depth which sees a sudden spike in the percentage of phosphorus present throughout the Complex. It was time-consuming work, analysing and comparing the different textures and mineralogies; a steep, practical learning curve.

Back in the UK, the samples I collected were thin sectioned and petrologically described; this complimented the micro-analysis I conducted, and the company's bulk-rock geochemistry. The different data sets helped build-up an idea of the mechanism which could account for the observed fluctuations in the amount of magnetite and phosphorus-bearing mineral, apatite.

My two months out in South Africa could never have been all work. Coinciding with the public holiday: 'National Women's day' in South Africa, I took a long weekend off work and flew down to Cape Town. I crammed in as much as possible, hiking to the top table mountain, meeting the 'Dassies' (a small rodent-like animal!) and getting stunning views out to Robben island. I saw penguins on Boulders Beach and reached the Cape of Good Hope looking out to where the Indian and Atlantic oceans meet. Renowned for its 'Big 5', the Kruger national park, equivalent to Wales in size, was not to be missed. One Saturday morning I got up ridiculously early, ready for a short visit but long-drive there! I was not disappointed and the park lived up to everything I was told it would be.

Fast-forward to nearly a year since I started planning and I have now written up my Masters research and graduated. I have thoroughly loved academic research and really enjoyed my project. From this research I have presented a poster at the Mineral Deposits Studies Group (2014), I am collaborating with my exploration manager at the company to present the research at the International Mineralogical Association meeting in South Africa this autumn, and am currently extending my research for a paper on our findings.

It was an amazing summer, and I thoroughly enjoyed getting a first-hand on-the-ground perspective for my Masters in South Africa.

Victoria has also written about her fieldwork for University College, kindly adding a more geological focus for us than the report published in Martlett earlier this year. She is now studying for a Masters in Mining Geology at the Camborne School of Mines. Victoria also provided our fetching cover photo from her trip to Cape Town.

LONDON VOLCANO

FROM WORKSHOP TO WONDER

The London Volcano was the centrepiece of Universities UK Week at the Natural History Museum in London. With Universities from across the UK wowing audiences with a range of taster stalls dotted around the museum (from smoothies to cycling, robots to wrestling), our stall was a little large and lively for anywhere but the front lawn!

London Volcano was a scale model of Soufrière in St Vincent, a volcano which Professors David Pyle and Tamsin Mather and their team have been studying in collaboration with Professor Jenni Barclay at University of East Anglia. As part of the STREVA collaboration (Strengthening Resilience in Volcanic Areas) funded by the Natural Environment Research Council, the team is working with local researchers on the island and at The University of the West Indies Seismic Research Centre to understand the risks posed by the volcano to the local population. Such understanding helps in so many ways, from where to plan housing and vital infrastructure, to early warning systems and evacuation plans.

In order to bring home their research to an audience in London, the team decided to bring the volcano to life – quite literally – on the lawn of the museum. Over 5 days, the tension built up, as the volcano rumbled and smoked its way to an impressively explosive climax. In its quieter moments, school groups were able to assess the risk, monitor the rumblings on seismometers in the 'London Volcano Observatory Tent' and plan their settlements around the island with care. Those brave enough to return the next day could find out whether their houses were covered in ash, or had been swept away in pyroclastic density currents, lahars, and rock falls, or whether they had assessed the risks more successfully and survived.

Bing Bang

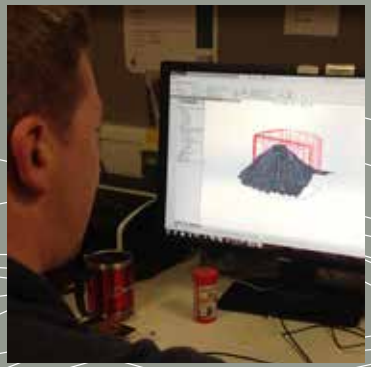
The exhibition greeted over 2,500 visitors during the week, with regular 'bin bang' explosions complementing the larger-than-life model. Never ones to waste an educational opportunity, volunteers (both children and adults) were recruited to help monitor the distribution of 'tephra' – in this case, plastic balls and glow-in-the-dark rubber ducks. There was also an opportunity to reflect on the very real impact of living in areas of volcanic risk, with readings from accounts made at the time of the 1902 eruption of Soufrière, recounting the terrible devastation suffered.

"People seemed to have left with a better understanding of the risks associated with living in close proximity to a volcano. Learning has never been more entertaining as fizzy drinks, coloured balls and ducks wonderfully demonstrated the mechanics behind volcanic eruptions for awestruck children and adults."
Alia Juman, UWI Seismic Research Centre

For a volcano that started life as a tiny hand-held resin replica, produced by Jamie Long via CAD in our very own workshop here in Oxford, it certainly made a massive impact!

Read up on all the action, day by day, with the many wonderful photos taken during the week, on the London Volcano blog: http://londonvolcano.com

Jamie Long working on the original miniature model



London Volcano Observatory Tent

Colleagues from UWI Seismic Research Centre

Earlier this year, the STREVA collaborators created a brand new volcano-packed set of the popular card game 'Top Trumps.' Designed to raise awareness of the deadly impact of living near the world's largest volcanoes, the card game gives facts and figures about 30 volcanoes, including field trip favourite, Santorini, the recent Eyjafjallajökull eruption and 'Top Trump' Krakatau.

Packs cost just £5, with all profits going to fund STREVA's work on education and outreach for people living in volcanic areas. Top Trumps is available to buy from the Alumni Office and from some online retailers.

Dr Mel Rodgers is one of the postdocs in the Volcanoes group in the department, and was heavily involved in the London Volcano project. Here we ask her more about her work behind the scenes...

Q: What's your role in the research group?

A: I am a volcano seismologist, so I research the types of earthquakes volcanoes generate before, during and after an eruption. I am interested in understanding what the seismic signals can tell us about the dynamic processes happening inside volcanoes.

Q: What is your involvement with STREVA?

A: The STREVA project is quite a unique project as it brings together physical scientists, social scientists and communities to strengthen the resilience of communities around volcanoes. My work with STREVA is focussed on developing new techniques for analysing large amounts of geophysical monitoring data and working with Volcano Observatories to implement these ideas.

Q: Can you give us an example of some of your recent project work?

A: We recently held a workshop in Colombia, talking to survivors of the Armero disaster. In 1985 an eruption of Nevado del Ruiz Volcano melted part of the summit glacier, creating a massive mudflow that destroyed the town of Armero, and killed over 23,000 people. We wanted to hear from the communities about the recovery and the resettlement processes over the last 30 years, to find out what worked and what didn't.

Q: What makes this sort of work important?

A: Many physical scientists rarely get the opportunity to interact with affected communities, to see the impact their work has on real people, and on real lives. I am fortunate in that the work I do with the STREVA project lets me interact with the communities. We have to understand that communication goes both ways and we need to listen to what the communities have to tell us - they are the ones living day to day with the volcano. I have learnt so much from listening to the stories of people who have lived through volcanic disasters, and we as scientists take home from these meetings a sense of what we must do better in the future so that these disasters never happen again.

STUDENT OUTREACH

Members of the Department are engaged in various outreach efforts which promote the study of earth sciences to a range of different audiences.

Not all of these are direct 'student recruitment' activities; our annual Disaster Zone stall at the Museum of Natural History each March is a wonderful mechanism to capture young minds on the subject of volcanoes and earthquakes. School visits by researchers and students, both at primary and secondary level, help to further cement that engagement. Some of the activities fall into the all-important categories of widening access and participation, bringing the expertise of Oxford to audiences who might never have engaged with us before, and opening up the possibility of study at Oxford to school pupils who might never have considered the option before.

Recently, the University held awards for those involved in such outreach, and we were delighted that three of our students and postdoctoral scientists received awards for their efforts. L-R: Dr Mel Rodgers and DPhil student Jackie Ratner (Wolfson 2011) for their work on the London Volcano project (see P16) and undergraduate Anna Bidgood (St Anne's 2011) for her contribution to the Greenland Mapping project (see P6).

Most undergraduates have had little or no experience of geology before starting their Earth Sciences degree. Less than one in four of the current undergraduates have done Geology A-level, so it is a subject that most A-level pupils know little or nothing about.

In Oxford, there are many projects in local schools, some run by SciencePlus, a volunteer project for existing Oxford students to tutors school pupils in science. A range of our undergraduates and postgraduates are involved, including a number from the department who have helped to spread the word about earth sciences. I served as president during 2014, and helped to organise events including a school visit to the department. Despite pupils living so close, many of them have never been inside an Oxford department and this was a perfect opportunity give A-level pupils a taste of geology, as well as showing them inside an Oxford department.

One afternoon in February, seven A-level pupils from St. Gregory's School visited the department for an afternoon of activities created and organised by fourth-year undergraduates, with first and third year helpers. Initially, to introduce pupils to fieldwork, a large (and fun) part of Geology, we showed the video created by current third years on their mapping project in Greenland (see P6).

We then split them into groups for three workshops covering aspects of palaeontology, volcanology and tectonics. My lasting memory of the day was during the volcanology session. It's easy to forget your first look down the microscope, but one boy at the session probably won't. Whilst examining olivine on cross polars, when he first rotated the stage and saw the change in birefringence he exclaimed 'Woah... this is weird!'

RUTH AMEY
(ST ANNE'S 2010)

STUDENTS AND SCHOOL PUPILS ENJOYING A DAY OF GEOLOGICAL DISCOVERY.

SPOTLIGHT on the Museum

The Oxford University Museum of Natural History is evolving! Once quiet and rather austere, over the past decade or so it has transformed into a buzzing, bright, lively place where school students, families, undergraduates and tourists all mix together. Displays feature fine geological and zoological specimens from all over the world, with plenty to touch as well as see. Weekends and school holidays offer special activities such as children's crafts or science experiments, many led by our team of volunteers. The Museum is a fantastic place for people to discover the natural world, and for many, it's where a fascination for the Earth sciences begins. Some go on to study geology at university. For others, it is an interest to be shared with children and grandchildren.

But the specimens on display are just the tip of the iceberg. As the second largest natural history museum in the UK, we have an estimated half a million fossils, minerals and rocks behind the scenes, carefully organised for use in teaching and research. Oxford students use them; indeed many samples in the Earth Science Department's teaching labs belong to the Museum's collections, and tutorials featuring our Martian meteorite are now legendary! Student groups come from many other universities too, and we supply specimens for researchers all over the world. This year, we've introduced our own Research Fellowships for talented young professionals, and Dr Allison Daley and Dr David Legg are currently researching different aspects of arthropod evolution.

We want to have our collections well-used, and so we share information about them through online databases. You can now explore 3D laser scans of some of our British type fossils (www.3d-fossils.ac.uk), see all 1,000 specimens in the Corsi decorative stone collection (http://www.oum.ox.ac.uk/corsi), explore the William Smith archive (www.williamsmithonline.com), and search through thousands of records on our main website. As funds permit, we are upgrading our software which will enable us to include many more images.

When it comes to cataloguing and imaging, we really welcome our undergraduate interns who help sort, number and database specimens. Four came from the Earth Sciences Department this summer, with projects that also included scanning electron microscopy of foraminifera, identification of Jurassic fossils, and use of infrared spectroscopy for mineral identification. It was, as one commented, a 'fantastic experience to catch a glimpse of the behind-the-scenes work of the Museum and the many collections it houses.'

If you, too, would like to find out more about the work of the Museum and the resources it can offer, or wish to get involved, see our website www.oum.ox.ac.uk, read our blog at morethanadodo.com, and follow us @morethanadodo on Twitter. The Museum is open daily from 10.00 to 17.00, and admission is free.

Monica T. Price
Head of Earth Collections
Oxford University Museum of Natural History

CELEBRATING WOMEN IN EARTH SCIENCES

This year marks 40 years since some of the first all-male Colleges decided to open their doors to female students. The University has marked this anniversary with a series of events celebrating the impact of women in collaboration with the relevant colleges: Brasenose, Hertford, Jesus, St Catherine's and Wadham.

Our own alumni dinner, held in May in St Hugh's College, provided our own opportunity to celebrate women in earth sciences. St Hugh's was the first College to have regularly sent women to study Geology, and indeed a number of alumnae took the opportunity to return for that particular dinner. As we went to press, the University rounded off the year with an event celebrating "Women in Academic Sciences" for alumni, current research staff and students which provided great inspiration for all who attended.

We are delighted to include below excerpts from an account by our earliest female student, Jennifer Rogers (nee Lucas, St Hugh's 1950), of her time here in the 1950s.

A HISTORICAL CORDIAL

Caution: Not to be taken seriously. Details have not been checked but this is not expected to cause any unwelcome side effects.

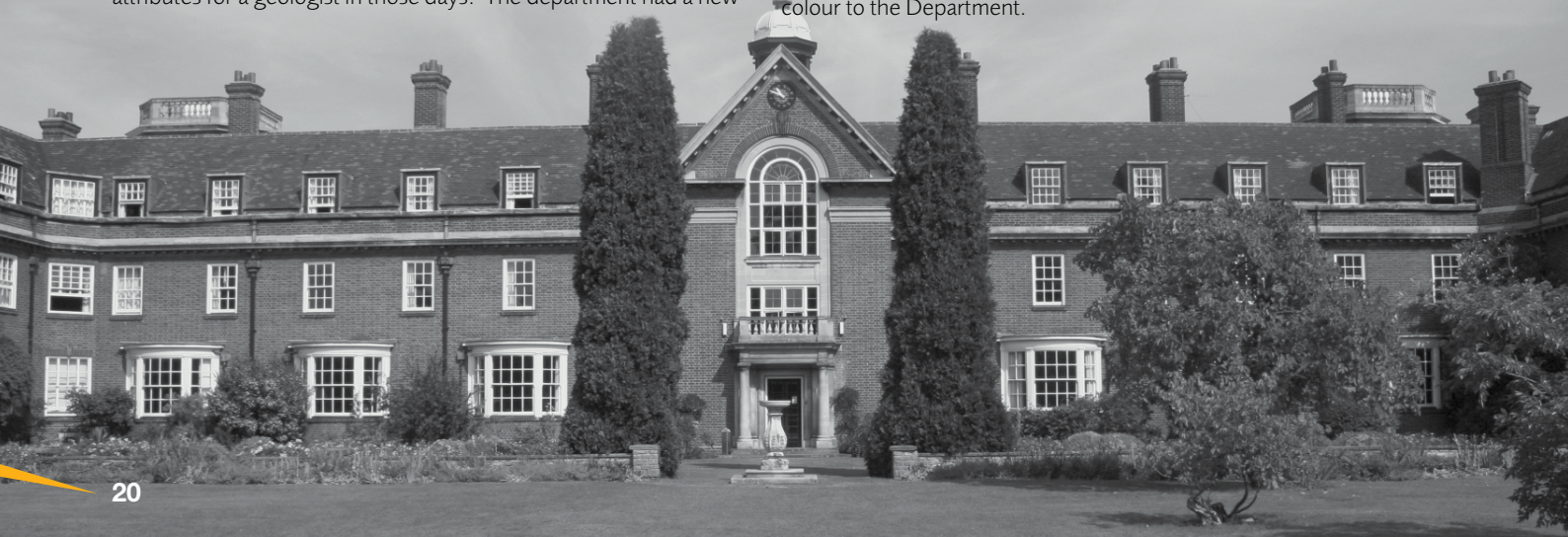
I went up to St. Hugh's in 1950 to read Zoology. Traces of the Oxford of Zuleika Dobson and Brideshead Revisited could still be found and wartime austerity was over. My room was in a charming early Victorian house, The Lawn, on the south side of the beautiful College garden. We shared the drive with the Bureau of Animal Behaviour which had premises in what remained of the Head Injuries Hospital built in the grounds of the College during the war. To a Zoology student this was mind-blowing. Niko Tinbergen founded the bureau. He was already well-known & received the Nobel Prize for Physiology in 1973. I felt I was treading on hallowed ground.

Although I entered Oxford to read Zoology I wanted to have a broader scientific base and took the Science Honour Mods Course, a two year course studying three subjects. I naturally chose Zoology and Chemistry, and for the third I chose Geology. The head of the Zoology Department at the time was Sir Alistair Hardy who was sounding alarm bells on the problems of over-fishing. My Chemistry tutor was Dorothy Hodgkin, the famous Crystallographer who received the Nobel Prize for Chemistry in 1964. She was a very gentle, soft-spoken person. I found her quite terrifying. One memory I have of chemistry is doing gravimetric analysis in the Dyson Perrins Laboratory. This old building had internal iron supports and all analyses showed unnaturally high values of iron. Each analysis seemed to take forever because weights, down to 0.01gm, were painstakingly put on the scales using tweezers. It was slightly more exciting than watching paint dry.

At the end of the two year course I decided to change to Geology. I enjoyed the four dimensional nature of the subject and its emphasis on fieldwork. Also, anything one searched for in the field might be very well hidden, but at least it could not run away. Fortunately I like beer and was quite competent at Liar Dice – useful attributes for a geologist in those days. The department had a new building which was light, airy and compact but it lacked recreational space for students. There were few Geology Honours students. Those graduating in 1951 and 1952 were mostly people who had already done their military training and were older. There was only one Geology Honours student in 1953, a delightful Australian, Tony Smith, who was in the Blue boat. During the Hilary Term he frequently rang his lecturer – sometimes Professor Wager- to say that an extra training session was taking place, so he could not come in for the lecture! In the event, the 1953 Boat Race was memorable because the Oxford boat sank. Tony had a somewhat horrified expression on his face as the Thames claimed the boat. By contrast, there were seven students in my year. Steve Moorbath was the most dedicated student and his inimitable style of wit has not changed. Our formal trips were to Arran, Assynt and the Welsh Borderland. Of course the only equipment was a notebook and pencil, hand lens and hammer – no hard hats or mobile phones.

What about the academic staff? In 1950 a seismic change took place in the Geology Department. A hard-rock Geologist, namely Professor L R Wager, was appointed to the traditionally soft-rock Chair. This must have created some tensions and being of a reserved disposition, Wager's first few years were probably very challenging. As students we were very impressed by his mountaineering record and came to know a lot about the Skaergaard intrusion. J.V Harrison was a somewhat intransigent Scot who always wore a kilt in the field. Dr Spiller had a very gravelly voice, looked very anaemic and usually carried radioactive minerals in his breast pocket. Mr Kingsbury was a typical Oxford anachronism. He was a brilliant amateur mineralogist, being able to identify not only the mineral, but also its place of origin.

Our introduction to plane table surveying consisted of two afternoons with a bluff military man, Brigadier Bomford. Our chosen area was The Parks. If the traverse did not close up exactly, then 'fudge it, fudge it' he would say. All this was more than ten years before the discovery of plate tectonics, but Dr Sandford and Dr McKerrow made sure that we considered carefully the ideas of Du Toit & Wegener. The various research workers added valuable colour to the Department.



Forthcoming Alumni Events

Thursday 12th Feb 2015
London Panel Discussion

"Opportunities and Responsibilities: Earth Sciences in the Developing World"
Venue: Kohn Centre, Royal Society, Carlton House Terrace, London

The earth sciences are important for all nations. They inform policy on issues ranging from environmental sustainability to resource potential, and from climate change to volcanic and earthquake hazard.

Developing nations can have limited capability in the wide range of earth-science disciplines critical to understand their environment. Universities such as Oxford have much to offer these nations as they work with multinationals to develop resources, and as they plan environmental policy. We also have much to offer in education; teaching individuals, and helping institutions in developing nations to improve and modernise curricula. But it's definitely not a one-way street. Many developing nations have spectacular geology, offering unique insights into the way that earth-systems work, and they have a wealth of local and regional expertise from which we can learn.

How should earth scientists interact with developing nations? What do we have to offer in research and education? How can we best deliver it? Should we work with related industry, with government, or with universities in these nations?

Panelists include:

Professor Tamsin Mather, volcanologist and one of the lead members of STREVA (for more information see London Volcano article on P16)

Professor Mike Daly, Visiting Professor in the Department of Earth Sciences, formerly Executive Vice President of Exploration at BP

Sir Richard Gozney, KCMG CVO
retired Governor of Bermuda, British High Commissioner to Nigeria and British Ambassador to Indonesia.

Tickets available online soon.
Email **alumni@earth.ox.ac.uk** for further details.

Saturday 16th May 2015
Alumni Dinner

2015 marks the 200th anniversary of the William Smith Geological Map of Britain. To celebrate this milestone in our geological history, we are working with the Oxford University Museum of Natural History to provide an afternoon of insight into his work and the wonderful archive currently being digitised as part of the William Smith Online project.

Dinner will be held in St Cross College, home of Professor Barry Parsons, Dr Dave Waters (Linacre 1971), Dr Helen Johnson and Dr Stuart Robinson (St Edmund Hall 1995). As well as an opportunity to toast our fine academics, and our mapping milestone, dinner in a graduate college gives us an opportunity to encourage as many graduate students as possible to attend the dinner, regardless of matriculation or graduation year. We also encourage year group reunions for those who matriculated in 2005, 1995, 1985, 1975, 1965 and 1955.

If you can spot yourself in a finals photograph right, we'd love to see you at the Alumni dinner!

SNAPSHOTS OF THE YEAR: 2013-14

MICHAELMAS TERM

The department played host to a unique recruitment event – the **Shell Formula 1 Pitstop Challenge.**

Professor Joe Cartwright received the **Distinguished Educator** (Grover E Murray) Award from the American Association of Petroleum Geologists**.**

Professor Bernie Woods was awarded the **Roebling Medal** by the Mineralogical Society of America.

Dr Lars Hansen was awarded the **Mineral and Rock Physics Graduate Research Award** by the American Geophysical Union. Lars lectures in Mineralogy and Petrology, and is the new Sollas Fellow at University College.

Tobias Keller received the **2013 Student Author Award** from the Geophysical Journal International.

Professor Lindy Elkins-Tanton delivered the **Inaugural Lobanov-Rostovsky Lecture** in Planetary Geology.

DPhil student Owen Weller (Exeter 2010) received the **Early Career Geologist Award** from the Geological Society and the **Mike Coward Prize** for best postgraduate talk at the 2014 Tectonic Studies Group

DPhil student John Clarke (St Hugh's 2010) was awarded the **President's Prize** at the Palaeontological Association Meeting in Zurich. John's supervisor, Dr Matt Friedman, received the **Hodson Award**.

Members of the 1973 matriculation year met for a reunion in a pub in London, organised by James MacDonald (Brasenose 1973)

HILARY TERM

Harriet Rawson (Univ 2012) won the inaugural **McKerrow Cup** at the first Oxford Young Geoscientist competition. The cup was awarded by Mac's sons Graham and Andrew.

Graduate Alan Cherry (Exeter 2009) was awarded the **Curry MSc prize** by the Geological Association.

A symposium celebrating **'30 Years of Global Seismic Tomography'** was held in the department to honour the career of **Professor John Woodhouse** as he retires. The event was organised and attended by many of John's former students and collaborators.

37th Annual Winter Meeting of the **Mineral Deposits Studies Group**, organised by Professor Laurence Robb and Dr Nick Gardiner (St Peter's 1991), saw almost 200 delegates representing a range of industry and academia.

Students and staff manned the **Disaster Zone** stall at the Museum of Natural History's annual 'Wow! How?' event, offering demonstrations and information about earthquakes and volcanoes.

TRINITY TERM

Professor Tony Watts was elected a **Fellow of the Royal Society**.

Dr Stuart Robinson (St Edmund Hall 1995) and alumna Corrine Fay (Worcester 2006) met the **President of Ireland, Michael D. Higgins** during his State Visit to the UK at an event organised by Science Foundation Ireland and the Royal Society in partnership with the Science Gallery, celebrating Ireland/UK research collaborations.

Professor Jim Kennedy became the first recipient of the **Palaeontographical Society Medal**

Professor Martin Brasier was awarded the Lyell Medal at the **Geological Society's President's Day** on Wednesday 4th June. At the same presentations, Dr Edward 'Ted' Rose (St Edmund Hall 1960) received the Sue Tyler Friedman Medal.

Professor Alex Halliday FRS, Head of Mathematical, Physical and Life Sciences Division and Professor of Geochemistry was elected as the next **Physical Secretary and Vice-President of the Royal Society**.

Three of our hard-working academics were a**warded the title of Professor**: Tamsin Mather, Conall MacNiocaill and Hugh Jenkyns.

WHAT KIND OF LEGACY COULD YOU LEAVE?

EXPERIENCE? ADVENTURE? LEARNING?

To learn more about the impact a gift in your will could have, or to find out how to remember the Department's work in your bequest, please contact:

The Alumni Relations Officer, Department of Earth Sciences, South Parks Road, Oxford OX1 3AN
Email: alumni@earth.ox.ac.uk Call: +44 (01865) 429448

EARTHSCIENCES

UNIVERSITY OF OXFORD