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And more ....
Earth Science Ireland has been helping to increase the public understanding of Earth science throughout the island of Ireland for almost 20 years. Undoubtedly the most significant achievement of the organisation is the production of a twice yearly high quality magazine that has been distributed to thousands of people across the island and further afield. Over the years the magazine has been a key platform to share news, stories and events, playing a major role in helping to achieve ESI’s main objective.

But is this form of communication now becoming outdated? Certainly we are finding the costs, especially of postage, difficult to cover within the present sponsorship levels. This means that ESI is reconsidering the most effective way for it to operate and we would like your help.

In order for us to accurately assess the demand for the printed Earth Science Ireland magazine we would like you to send an email to rbazley@tinternet.com (the Editor) or a letter in the post to ‘The Editor, 19 Inishanier, Killinchy, Newtownards, Co Down BT23 6SU’ to let us know if you would still like to receive a copy in the post. A simple ‘Yes please’ or ‘No thanks’ will suffice. If we DO NOT hear from you, we will assume that you no longer want to receive a copy.

The future of the printed magazine will be decided later in the year but regardless of the outcome we plan to make more use of digital platforms such as Facebook, e-Newsletters and Twitter as well as revamping the Earth Science Ireland website. As a Committee we feel that in order to continue to reach a large audience we must evolve in how we operate to meet the future needs of Earth scientists in Ireland.

EDITORIAL

Thank you again to the contributors of articles in this issue. Articles keep coming and I am grateful. At a time of uncertainty about the future your support, and that of our readers, has been and is simply wonderful. Especially thanks to Peter Mahaffey our skillful designer at Dorman the printers and to Alex Donald for so promptly putting the magazine on-line.

FIRST ‘GIRLS INTO GEOSCIENCE-IRELAND’ EVENT

Fergus McAuliffe reports

The inaugural Girls into Geoscience – Ireland event took place on Saturday March 10th at the School of Biological, Earth and Environmental Science in University College Cork. The exciting one day event was specifically designed to introduce female school (Senior Cycle) and university students to Earth Sciences and demonstrate the world of careers open to geoscience graduates today. Taking its lead from the highly successful Girls into Geoscience event that has been run for the past number of years in the UK by the University of Plymouth, the Ireland edition sought to establish the programme on these shores.

On the day twenty students were in attendance. With a mix of workshops and talks, attendees got the chance to sample a flavour of the diverse career prospects within the broad geosciences field. Speakers included Marie Fleming, associate engineer at Arup, Dr Siobhán Power of the Geological Survey Ireland, Dr Anthea Lacchia of iCRAG at University College Dublin and Dr Una Farrell of the School of Natural Sciences, Trinity College Dublin. They described their career paths to date and gave excellent insights into the day to day activities of professional geoscientists. A highly successful “speeddating” session was held in association with the Irish Association for Women in Geosciences. Two, hands-on, interactive workshops also took place: the first on fossil and mineral identification led by Dr Maria McNamara of the UCC School of BEES
and Girls into Geoscience – Ireland co-organiser, and the second on the use of Geographical Information Systems for examining geoscience data led by Dr Fiona Cawkwell of the UCC School of Geography.

Dr Fergus McAuliffe, co-organiser, said, “This event was about showcasing the vast array of careers in geosciences that are waiting to be discovered. Attendees got the chance to meet professional female geoscientists, hear their amazing career journeys that have taken them around the world, and also to try their hand at mineral identification, fossil examination and Geographical Information Systems. On behalf of Girls into Geoscience – Ireland we are delighted that the event has been so well attended and we hope to see some of today’s attendees in our first year university lectures in the next few years!”

Co-organiser Dr Maria McNamara added “It was very exciting and inspiring to see so many young women who are passionate about geosciences and it was great fun to share experiences with them. It is so important to have informal opportunities like this to pass on our knowledge and experience to the younger generation, and this is really setting a precedent for making it a regular event in the national calendar for geoscience and schools.”

This event was run by the Irish Centre for Research in Applied Geosciences (ICRAG) and the School of Biological, Earth and Environmental Science in University College Cork, in collaboration with the Irish Association for Women in Geosciences and the Geological Survey Ireland.

The next Girls into Geoscience event will return in early November 2018 and will take place in NUI Galway. Further details can be found on the Girls into Geoscience Ireland website: www.girlsintogeoscienceireland.wordpress.com.

GEOMETRY & FASHION

Crepe de Chine Silk Scarves by Glowing Edges Designs

This article was promised in the last issue and shows the value of innovative thinking!

In 2001, when organising the mineral collection at Clifton Park Museum in Rotherham, Scott Engering came up with an idea for an artwork project – Glowing Edges Designs – based on photomicrographs of rocks and minerals.

Having had his work seen in various venues, published in international stone trade journals and turned into ceramic tiles and tableware, Scott has now produced a range of luxury Crepe de Chine silk scarves, finished with hand rolled hems.

As Scott recalls: 10 minutes after the opening of the Doncaster Art Market, on a Saturday morning 11 years ago, the heavens opened for the rest of the day. At some point, out of the blue, a woman in her 50’s strode up to my stall, pointed at one of my large images and exclaimed “that should be a silk scarf”.

It wasn’t until 4 years later that Scott had some of his designs digitally printed on a length of Chiffon silk, which was then cut and sewn by a local manufacturer to produce a set of sample scarves. Although their size and the quality of the hems rendered them unsuitable for sale, the reaction from potential customers was such that he investigated the potential for developing them commercially. After all, Liberty of London – via the BBC’s Britain’s Next Best Thing – had been convinced that images of polished minerals could be turned into silk scarves that could be sold for a very good price.

Having produced a formal Business Plan for a small business that would grow alongside other work, a succession of setbacks beyond his control brought this project to a standstill. Of this, Scott says “I was once described by a friend as having the fashion sense of Indiana Jones and I always had my feet on my ground in respect of these ideas as a business venture but - being denied the opportunity to even try - this completely took the wind out of my sails”.

5 years after leaving his ideas on the Crenulated Cleavage Microcline Perthite 317
back burner, Scott finally put these into action last summer, when he had 12 new designs digitally printed on to Crepe de Chine silk and turned into a high quality product. He says that there is still a lot of work to do with the marketing, especially since Social Media and the internet open up possibilities that never existed when he set up Triton Building Restoration Ltd. back in 1989.

Even at this stage there have been setbacks, with a communication breakdown leading to a 7 month delay in having the scarves professionally modelled and photographed. It meant a loss of momentum over the winter but with an excellent set of photos to use for future marketing, Scott is confident that this will be soon regained.

From the 2 sets of scarves that have been made, several have already been sold, with most of his customers being in Italy. When notifying Scott that the package of scarves for himself and his young family had safely arrived, Alberto from Turin wrote “Hello Scott, scarves have been delivered. So beautiful: they will be such a gift for Christmas!”. As an undergraduate Scott says he never thought about working as a geologist - although he does now work in Geoconservation and as a building stones specialist when needed. He did spend a lot of ‘out of hours’ time in the laboratory, observing and drawing a wide range of rocks and minerals that he could see under the microscope. Even so he never imagined that, one day, he would be using images of barytes, lherzolite, microcline perthite etc. to make these beautiful Glowing Edges Designs silk scarves.

For further information on Scott’s work and availability of these and other unique designs that he intends to have printed in the near future, he can be contacted directly at scott@glowingedges.co.uk.

MULTI-TALENTED GEOLOGISTS

The Editor comments

The factory shop of McNutt, the fine weavers based at Downings in County Donegal, is on Mrs Editor’s holiday browsing list so whilst she was considering a material purchase I looked at the books. The Butterflies of Donegal by Bob Aldwell & Frank Smyth was top of the pile with a bright cover and even more colour within its pages …. but it was that first author’s name that caught my eye. Could it be the distinguished, now retired, senior geologist from the Geological Survey of Ireland? The answer is ‘Yes’.

This is just one example of a geologist making a name in another speciality. I have another friend who has tackled butterflies, in his case becoming an acknowledged expert in South American species. Away from aspects of natural history I have known geologists who are expert in all sorts of things including fine art, pottery, writing detective novels and, perhaps most unlikely, a fletcher (making arrows for modern day Robin Hoods).

Can you add to this list? Incidentally I purchased Bob’s book on butterflies (£12.50) and can thoroughly recommend it.
In the 1950s the origin and genesis of granites was hotly debated, with some adhering to the notion that these rocks were entirely plutonic whereas others regarded them to be the product of migmatisation of pre-existing rocks.

Herbert Harold Read, Professor of Geology at Imperial College, London, who had published the book *The Granite Controversy* in 1957, realized that the various granite masses exposed in the northwest corner of Ireland would make an ideal field laboratory to unravel some of these conundrums. That same year he established a programme of field study and persuaded his new Demonstrator in Geology Wallace (Wally) Spencer Pitcher to turn from palaeontology to petrological studies. The following year Pitcher set off to study the Thorr Pluton in Donegal where he was to become a well-known visitor, referred to by the locals as Fear na carraigeacha (‘Man of the rocks’). In time Read was to pass the mantle of responsibility and organization for the geological campaign to the younger man who later became Professor of Geology at Liverpool. Numerous geologists were involved in the study of the various granite plutons and other rocks of Donegal over twenty-five years and literally hundreds of publications emerged.

Aside from his Irish work, Read was fascinated with Scottish metamorphic rocks which he first encountered while employed by the Geological Survey immediately after the Great War. Unsurprising for a field geologist the aphorism “the best geologist is … he who has seen most rocks” is his. He was a Fellow of the Royal Society and served as President of the Geological Society in 1947-49 (as did Pitcher from 1976-78). Retiring in 1955, he avoided London for the rest of his life preferring his small farmstead in Whitstable and died on Easter Sunday 1970.

Pitcher championed the study of magmatism in the Andes of Peru, a topic he turned to in 1965 to test whether the Donegal conclusions were of application elsewhere. He retired in 1981, but continued active fieldwork and returned to Donegal at times to seek evidence for questions that niggled him over decades. He book-ended Read’s 1947 book on granite with his own *The Nature and Origin of Granite* (1993). Together they constitute a fascinating insight into evolving ideas around this wonderfully varied rock type.

On Read’s final visit to Donegal, as was recalled by Pitcher in the introduction to his Donegal book, he took off his boots and socks, placed them on a wall for posterity, and left. Aside from the boots, the Irish legacy of these two giants of granite geology remains in those colleagues they influenced, and in the huge body of work on the geology of this region that emerged from their pens and those of others.

STANDING ON THE SHOULDERS OF GIANTS
Limerick Opens its Arms to Quaternary Scientists

Martha Coleman tells us

The Irish Quaternary Association (IQUA) held a very successful two day event on the 20th and 21st of April 2018 in the public library located in the Granary building and the Hunt Museum, both in Limerick City. The events were organised to allow interested individuals, students and the general public to understand the development of the Irish landscape and some of the main historical characters responsible for it. The first day consisted of a family friendly exhibition of extinct and contemporary Irish mammals facilitated by Jim Martin of Wildlife Exhibitions, held in the Granary Library Limerick. The exhibition recreated prehistoric landscapes with maps and animal models that included the mammoth, brown bear, giant Irish deer and arctic fox. The exhibition ran over the two days was a great success with many local schools booking in to have a look at Ireland's ancient mammals.

The following morning, the Irish Quaternary Association’s annual Spring Meeting was held in the beautiful Hunt Museum. The theme was ‘Standing on the Shoulders of Giants’; a Quaternary Science Retrospective in celebration of key scientists who have paved the way for today’s Quaternary scientists. The programme opened with Dr Bettie Higgs discussing the challenges faced by women in Quaternary science since the seventeenth century. The talk celebrated the contributions of women over the centuries while also illustrating what it was like for female geoscientists throughout the centuries. Following on from the above introductory talk we heard about Sydney Mary Thompson (1847-1923) from Dr Catherine Dalton.

Prof Fraser Mitchell reviewed Frank Mitchell’s (1912-1997) career noting how he had entered Trinity College Dublin (TCD) to study modern languages but soon came to realise his real interests lay in natural sciences. After lunch Prof Keith Bennett talked about Bill Watts (1930-2010) and his palaeoecology research that led him to become TCD’s Provost, President of the Royal Irish Academy and indeed one of Ireland’s
BELFAST GEOLOGISTS’ SOCIETY - Interesting and informative

David Kirk shows the benefits of joining a local amateur society

The winter talks programme was full of stimulating geological insights and generally good craic. Special mention has to be made of the annual Harold Wilson Memorial Lecture in March that was supported also by the Geological Survey of Northern Ireland and the Geological Society of London Northern Ireland Group. It was a privilege to hear the world renowned volcanologist Sir Stephen Sparks of Bristol University speak on the topic of ‘Enormous Volcanic Eruptions’. We picture (l to r) the President Peter Millar, Dr Mark Cooper, Sir Stephen Sparks and Dr Ian Meighan as well as a slide illustrating the biggest bang of them all.

Now Belfast Geologists’ Society members are enjoying a summer programme of guided field trips. It started with an evening trip in May with Bernard Anderson, the ‘master’ of this subject, explaining the geology of the Orlock Bridge Fault. Another evening excursion in early June, this time jointly with the Belfast Naturalists’ Field Club, saw Kirstin Lemon and Rob Raine taking members rambling over and among the rock of Cave Hill above Belfast.

Following this on June 30 Eoghan Holohan led a trip to reveal the hidden secrets of enigmatic Slieve Gullion. A few days later, on the evening of July 3, the Society President Peter Millar led members rambling over and among the rock of Cave Hill above Belfast.

On September 5 Ian Forsythe will lead another of his popular and revealing ‘Building Stones’ series of visits to see the geological interest, often unnoticed, in our Ulster towns – this time he’s going to Carrickfergus, Co Antrim.

The summer programme ends with another look at ‘urban geology’ – this time with a train journey to Dublin to explore the geology of the buildings there and the landscape along the way, all explained by Ian Meighan and Patrick Wyse Jackson.

So, good company, healthy exercise and attractive places viewed in a new way through the chat of local experts – what’s to lose.

Acknowledgements and…. Want to join INQUA?

Funding for the exhibition was received from the Heritage Council under the European Year of Cultural Heritage 2018 Grant Scheme. Thanks to the Hunt Museum, the Granary Library and the organisers Dr Catherine Dalton and Darren Barry of Mary Immaculate College for a great two days in Limerick. If you are interested in joining INQUA please visit the new and updated website (www.iqua.ie) for details on more upcoming events and/or check us out on twitter @Quaternary_Irl or using the hashtag #IQUA and follow us on Facebook here: https://www.facebook.com/IrishQuatAssociation

And INQUA, the International Union for Quaternary Research, meets in Dublin next year – see poster. Mark it in your 2019 diary.
NUI GALWAY – NEW DIPLOMA COURSE

Having had a successful run of ten years with the Diploma in Geology, a new course, with a broader remit – and a new teaching method – is on offer from NUI Galway, to start this September (2018).

The Diploma in Scientific Studies (Earth & Ocean Sciences) will have a ‘blended learning’ format, with (online and written) material provided to students to study in their own time and place, combined with one weekend of face-to-face instruction per eight-week module. These weekends will not always be in Galway, as they will incorporate the field trips which are an integral part of any study of our planet.

The six modules (three per year) are entitled ‘Planet Earth’, ‘Earth Materials’, ‘Our Coastal Ocean’, ‘Geology of Ireland’, ‘The Peopled Planet’, and ‘Observing Earth’. ‘Our Coastal Ocean’ and ‘Observing Earth’ will be available as standalone modules to students who already have some knowledge of geology, e.g. through the earlier Diploma in Geology.

For more information visit

http://www.nuigalway.ie/courses/adult-and-continuing-education-courses/earthandoceansciences.html#course_overview

or contact the course director, Dr Sadhbh Baxter, at sadhbh.baxter@nuigalway.ie

CANA YOU IDENTIFY THIS?

Found and photographed in place by a member near Dúnaoghasa (the remarkable fort dating from about 1,500 BC) on Inishmór, one of the Aran Islands In Galway Bay.

The rock therabouts is Carboniferous limestone with shale but is this rock feature animal, mineral or vegetable?

Answers to The Editor please and we will publish your ideas.
GEOLOGICAL TRAVELS - ‘DOWN UNDER’ and HONG KONG

Ian Forsythe and Ray Preston whet your appetite for travel

We (Belfast Geologists’ Society members) made a month long trip earlier this year to Australia travelling by campervan and with a brief stopover in Hong Kong on the return journey.

The main theme was, of course, geology. We spent most of our time in Victoria and South Australia. From the volcanic rocks of Phillip Island (famous for its penguin parade) near Melbourne we headed out to the Miocene Limestone rocks (5 to 23 million years old) along the Great Ocean Road west of Melbourne; they are best seen at the Twelve Apostles a series of sea stacks that look particularly spectacular on a stormy day. Nearby is the Kanawinka Geotrail – Australia’s most extensive volcanic province which is a surprise as many people consider Australia as a ‘stable’ continent. Volcanic activity continued here until as recently as 10,000 years ago. Time only permitted us to visit a few of the volcanic cones that in some cases had lakes in the ancient craters.

Then south of Adelaide on to the Limestone Coast where we visited Naracoorte National Park (UNESCO World Heritage Site) with its extensive cave systems. Adelaide itself has an outstanding Natural History Museum which it was useful to have visited in advance of going to sites to the north that included Copper Coast and Opal Mines in the Outback.

Driving almost 400 miles north into the Outback brought us to Coober Pedy, the main centre in Australia for Opal Mining. It produces 90% of the world’s opal, a gemstone that is a quartz-like form of silica; semi-transparent, it shows many small points of shifting colour giving rise to the descriptive term opalescent. The discovery was made in 1915 and the landscape is now dotted with spoil heaps from the mining operations.

Returning south we went to the Willandra Lakes Region, another UNESCO World Heritage Site, to visit Lake Mungo with its human fossil trackways, including Australia’s oldest human remains, going back at least 20,000 years. A really remote site with its outstanding sand dunes and Australia’s second largest ancient dried out lake some 300 miles from the sea.

Gold mining is important in the history and development of the Bendigo and Ballarat region of Victoria – we visited the Central Deborah gold mine in Bendigo going to 60 metres below ground. Because so many miners emigrated from Cornwall the area became known as Little Cornwall. This was clearly seen in the displays in Moonta Copper Mine Museum which trace the stories of the Cornish diaspora. 700,000 kg of gold has been discovered there since it opened in the 1850’s when it triggered one of the biggest gold rushes the world has ever seen. Nearby Ballarat Sovereign Hill Museum is bit like Cultra Folk Museum only this has an...
exciting gold panning facility for visitors. Worth trying your luck here!

Finally a stopover in Hong Kong for three days gave us a chance to see its only Geopark and it proved to be the highlight of our visit to this Special Administrative Region (China overall has over 200 Geoparks). We took a Geocruise lasting three hours round Sai Kung Islands. Some of the volcanic geology reminded us of the Giant’s Causeway but here the rock columns are actually light coloured rhyolitic rock. The Geopark also has a region of sedimentary rocks dating from about 400 million years (Devonian) up to the present day.

Needless to say we were fortunate to have great weather for the travels in both Australia and Hong Kong, fairly warm, sometimes quite hot, dry and mostly sunny.

Australia is such a vast country – a continent much still relatively unexplored and one of the world’s last geological frontiers – well worth a visit – perhaps readers of Earth Science Ireland could commit to maybe getting together to do a geological tour in the future?
BOOK REVIEW


This is an impressive well illustrated guide produced in a compact 210 by 147 mm format, with a wipeable cover. It brings together the work of seven specialists who enhance current understanding by the fresh and often innovative methods they have used alongside traditional fieldwork. Such painstaking work can be used to refine computer models of the extent of regional Irish ice cover during repeated ice ages. In this case the primary focus is on the climate oscillations at the end of the last ice age.

About a quarter of the text is devoted to a more general introduction to the geology of the area straddling Carlingford Lough, including two sites in Co. Louth, and Co. Armagh but with a primary focus on Co. Down, including the glacial erosion of the Mourne Mountains and marine glacial deposits along the coast.

During earlier times an ice dome developed over Lough Neagh impinging on the mountains and pushing through the valleys of the Mournes, with water running underneath the ice to form tunnel valleys. This was in addition to the moving ice forming drumlin fields and U-shaped valleys, with moraines deposited along the edges and fronts of valley glaciers. Scottish ice also pushed up against the foot of these mountains leaving behind the ‘shelly Irish Sea Till’. These glacial deposits include pieces of the distinctive microgranite from Ailsa Craig, a small island off the west coast of Scotland.

Maybe the authors could have explained a bit more about the innovative dating methods, like Schmidt Hammer dating in the Annalong valley. However with many beautiful illustrations this guide should provide more than enough material to draw curious readers into wanting to know more about the area around the Mourne Mountains.

David Nowell

BOOK REVIEW

IMAGINE BEING AN 18th CENTURY SCIENTIST


When this book arrived by post I thought ‘not my cup of tea’ but seeing that Jan, an ex-colleague and friend, was the main instigator of the translation I turned the first page. The rest, as they say, is history. In fact probably the first history of the world and it has never before been completely available in English.

The introduction brilliantly sets the scene in the tumultuous Europe of the time and it is a wonder that anyone could have had the concentration to think in the way Buffon did whilst managing to meet with many of the great intellectuals of the second half of the 18th Century.

Buffon imagines seven epochs of an evolving Earth. As you read this book it is worth just trying to be that 18th Century scientist and casting aside all the science of the past 250 years. How easy was it to imagine a ‘global’ view of life? Yet this is what Buffon did. The first epoch was when the Earth formed, the third epoch when water covered the continents, the fifth epoch saw the animals proliferating followed by the continents separating. Before describing the final, seventh, epoch comes an anticipation of a ‘grave objection’, that of time because sacred traditions ‘allow only some 6-8,000 years for the formation of the Earth as we know it’.

So here was a man, well before Darwin, who, of course, got many things wrong but was indicating an understanding of evolution, continental movement and taking a secular view of the earth’s history. Finally, like scientists in today’s world, Buffon looked at the impact of Man on Nature and asked if any nation can boast to having arrived at the best government possible, which would make all men not equally happy, but less unequally unhappy?

This is a very significant translation of an epic in the history of our understanding of natural science. Not for young readers but very much for scholars who are young at heart and can ‘imagine’.

Tony Bazley
WALTHER SCHWARZACHER (1925-2018) – A tribute

Professor Walther Erich Rupert Maria Schwarzacher was born in Graz, Austria, the second son of Professor Walther and Hedwig Schwarzacher. As a child, he lived in Graz, Heidelberg and then Graz again. In 1938 Hitler invaded Austria and his father was thrown out from his position as Professor of Forensic Medicine at the University of Graz. The family spent the war years living in internal exile on the Wallersee, a lake near Salzburg. This was a hard and dangerous time but even so Walther always loved the Salzburg area where he helped his father with scientific investigations and studied the local geology.

When the war ended, he moved to Innsbruck to study at the university there. He completed both his undergraduate studies and his doctoral dissertation in a total of only four years. He then won a British Council Scholarship to Cambridge where he became a member of the University Natural Sciences Club, made lifelong friends, and participated in an expedition to Spitsbergen. While in Cambridge, his advisor, Percival Allen, suggested that he apply for an open position at Queen’s University Belfast, where he moved in 1949 and where he remained for the rest of his professional life, starting as an assistant lecturer before being promoted to lecturer, reader and eventually professor, when he was appointed to a personal chair.

His research was inspired by a deep interest in time and how it could be read from the geological record. He was one of the first to find evidence for Milankovitch cycles, periodic variations in the earth orbit, in the thicknesses of sedimentary beds and was a founder of the field of Mathematical Geology. His interest in time also extended to shorter intervals, as one of his later hobbies was to build clocks that worked using the radio signal broadcast from atomic clocks such the National Physical Laboratory Rugby Clock. He maintained his interest in Arctic exploration, leading a Queen’s University expedition to Spitsbergen and spending time on ice station Alpha during the International Geophysical Year 1957-1958.

Back in Belfast, he firstly had lived in university accommodation in Elmwood Avenue, coincidentally now the location of the Queen’s University Chaplaincy. In 1963, he met a young assistant lecturer in botany, Miss June Whish, who he married in August of that year.

As all his colleagues at Queen’s well know, Walther was a dedicated teacher and researcher. He spent sabbaticals at the Kansas Geological Survey and at the Christian Albrechts University Kiel. He wrote two books on stratigraphy as well as book chapters and many articles. He was recognized for his scientific contributions by the award in 1977 of the Krumbein Medal* of the International Association for Mathematical Geology and by his appointment as a corresponding member of the Austrian Academy of Sciences. However, probably his greatest recognition was the respect and affection in which he was held by colleagues young and old around the world and, of course, the generations of students he taught.

Although he retired officially in 1990, he was awarded the title of Emeritus Professor and remained active in research almost to the end of his life, attending many conferences and workshops in locations ranging from China to Brazil. Walther was always an interesting person to talk with - he thought deeply about subjects from politics to religion - and greatly enjoyed both music and painting. Although he could make sharp comments when he disapproved of things, he was a kind man and true friend to many.

(We thank Walther’s son, Walther (Jnr) for his help with this tribute; *William Christian Krumbein was a notable American geologist who by rejecting conventional wisdom devised innovative methods so geology could be expressed with mathematical rigour – the Krumbein scale is a logarithmic scale for evaluating particle size, modifying the older Wentworth scale)

A Planet’s Tale

I am the crystal glinting, hinting of deep treasures.
I am the challenging cliff that splits, ready to clasp the climber’s hand.
I am the restless sands, made hard, being shaped by the master sculptor’s hand.
I am the grey stone folded, moulded by the dynamics of a restless planet.
I am the tor and pinnacle soaring, reaching out from our fire-born roots.
I am the deep layers of life long gone, now silent testimony to your beginnings.
We are the chapters, to be read, of Earth’s long tale.

By David Kirk

Earth Science Ireland Magazine
“A PICTURE IS WORTH A THOUSAND WORDS”

An opinion piece by Andrew Galwey

The title implies that a picture is a more efficient method of communicating information than ‘wordy’ descriptions. How many words would be needed to describe adequately the content of the picture that was the cover photograph of Issue 20? My guess is more than a thousand.

Here, I want to make the case that selected pictures of phenomena studied by scientists can be as pleasing, aesthetically, as many, more usual subjects painted, or photographed, by artists. A pleasant countryside scene is one perspective of nature, frequently depicted by paint on canvas and used to beautify a home. A photograph of a thin rock section of rock seen through a microscope, as exemplified above, may equally be regarded as an attractive picture (equally from nature), which many ‘average viewers’ could accept as a pleasant abstract painting.

This preamble reminds me of the forthright ‘Two Cultures’ debate that followed CP Snow’s 1959 Rede Lecture. The controversial presentation discussed the premise that society, through both our educational system and intellectual life, is inherently divided into two distinct cultures: the arts/humanities and the sciences. The relationship between these aspects of our society continues to excite discussion, even argument. The artist, in holding a ‘mirror to life’, selects a subject and portrays it in a form intended to attract a viewer’s attention. That skill may provide novel insights into the scene depicted. Subjects attracting artists vary widely: from portraits and landscapes into the entirely imagined images of Abstract Art.

Pictures of familiar objects, such as people, animals and mountains, represent a large proportion of the output from artists in our society. However, this range of portrayals of natural subjects does not include the many interesting, potentially pictorial, patterns that appear during scientific investigations. These are, of course, just as ‘natural’ though much less familiar. To an uninformed viewer, what is shown in this type of picture may not be apparent (or matter) but the popularity of abstract art suggests that such science-based pictures may be easily accommodated within this category. This approach provides one type of ‘bridge’ between the ‘Two Cultures’.

History of Art

Artists resemble scientists in one important particular: it is that they are experimental disciplines. Novel techniques, methods and media have been explored to find alternative ways to provoke alternative views of familiar scenes or to give us an aesthetically pleasing pattern. My relatively large Thesaurus lists 128 ‘Western Art Styles and Movements’ (from Abstract to Vorticism). This list of ‘Movements’ summarizes the widely diverse styles developed by artists, including: Impressionists (qualities of light in everyday scenes are emphasized by small, faint brush strokes), Minimalists (a minimum of information provided to the viewer) and Pointillists (coloured dots only comprise the picture).

In contrast the aesthetic potentials of patterns found in natural materials and processes, often revealed only as part of scientific investigations, remains very much under exploited. Perhaps this is a consequence of our ‘Two Culture’ society. Many artists are probably unaware of the world revealed through scientific investigations and scientists...
may not appreciate the potential aesthetic value of scenes seen in the systems they investigate. One type of beauty, the thin rock section, has been mentioned but a wide range of similar subjects can be found in biological specimens – for example the leaf section, not usually visible, can be just as attractive as the whole plant. The scientific community does publish collections of very attractive pictures of interesting subjects but these are not widely accessible to photographers or artists. They may well remain unaware of their existence or value.

An Example: The Beauty of Breaking Waves

To illustrate types of images that may have artistic merit, some ‘scientific’ photographs (or Abstract Pictures) accompany this article: the subjects are briefly explained in the captions. I fully accept, through the idiom ‘Beauty is in the Eye of the Beholder’, that these may not appeal to everyone. None-the-less, unfamiliar, but potentially attractive, patterns are sometimes revealed by viewing nature through alternative, often specialized, techniques.

The subject: ‘Breaking Waves’, a familiar enough sight, is selected as a cross-science theme. Wave energy is of geological importance in grinding and weathering shorelines rocks into ever smaller particles, stones and sand. Climatically, wave energy, derived from wind, is a band of water movements advancing across the surface of sea or lake until it breaks at that surface or a shoreline, when some of its energy is transformed into the random motion of water molecules, warming the water. Physically, the wave breaking texture is controlled by water properties: density, surface tension, viscosity. The (scientific) photographs shown here were selected for textural interest, by focussing on usually unnoticed details and thereby revealing potentially attractive patterns within an everyday phenomenon. I hope that they are revealing, of interest and attractive to some readers.

Comment

I point out that scientists have not similarly applied the use of images to communicate efficiently the wonders of nature to the general public. Science has advanced largely through the efforts of a social minority. Many people express, almost with pride, a lack of interest or understanding of ‘things scientific’ whereas, in contrast, many more individuals admit to ‘some interest in art’. Thus, despite the dependence of our life-styles on knowledge of the working and exploitation of natural environmental resources, most people understand little about the role of science in society, many being reluctant even to address the topic. We live in a time when the stress on the resources of our planet are moving towards unsustainability, yet many of our leaders have little, or no, scientific training. Surely it is incumbent on the scientific world to engage positively with as wide a public as is practicable. It seems to me that communication through pictures offers an inadequately exploited way forward, perhaps particularly in introducing science to the younger generation. It would encourage their future participation regardless of which culture they eventually follow.
The Loneliness of the Long-Distance Soil-Sampler

By Eamonn Grennan

(Background: The 1960s and 1970s witnessed an unprecedented upsurge in minerals exploration in Ireland. The principal and most successful method used was trace element analysis of soil samples. The imperial measurements used at that time have been transformed into metric units. Set out below is one man’s story).

Silently out of the bushes and the light mist he came, almost invisible in his olive green-brown (camouflage) coloured rain-wear, a large khaki-coloured bag hanging down one side, a plastic folder in one hand and a long piece of iron in the other.

“Hello”, he says, “I’m Michael and I’m collecting soil-samples. I hope that it is alright to go through your land”. “What are you doing?” I ask. Michael replies, “I’m working for a minerals exploration company and my job is to collect soil samples every sixty metres. Here is my ID and the company’s contact names”. To which I replied, “Are you looking for gold? And what gives you the right to come on to my land without my permission?”

Michael explained that the company had a Prospecting Licence, issued by the State, which allows it to search for base metals such as copper, lead and zinc, and occasionally for other metals such as gold, silver, tin and tungsten. Whilst under the terms of the Prospecting Licence they did not have to seek permission to enter onto lands, they were under strict instructions to divert towards people if they saw someone or if they were passing a dwelling.

He continued, “We try to speak to all land-owners and to obtain their permission directly, whenever we see them; but as you know many don’t work the land daily, whilst quite a few others have emigrated and have either let their land or it is being grazed unofficially by relations or friends”.

Satisfied, I look at my watch and say, “would you like a cup of tea?” Michael doesn’t hesitate, “I’d love one”, he says, “Let’s go up to the house”, I said. Having boiled the kettle, made the tea, put milk and sugar on the table, we sat down. Meanwhile Michael had taken off his coat and extracted a plastic bag containing ham sandwiches. “Put that away”, I said, “let’s have a proper lunch, or maybe you’re in a hurry? “No”, Michael replied, “normally on wet days my rate of sampling slows down, but then on a fine day I work into the evening. Today because of the big fields around here I’m going well”.

As I set about preparing lunch, Michael told me about his work. He works for a Canadian minerals exploration company based in County Tipperary. Such companies he explains are quite distinctive from Canadian mining companies and are often referred to as ‘junior mining’ companies. He collects around an average of 100 samples every day, five days of the week and eight to nine months of every year. He had left school at sixteen years of age and had worked on the home farm. He had heard about the company looking for young lads (lasses joined in this work at a later date in more enlightened times!) to collect soil samples. They had trained him to read maps, how to use a compass, how to pace 60 metres (200 feet) accurately and to check that against the location of field boundaries, the correct depth to collect the sample, how to pass through ditches without leaving a trace and how to cross streams.

Then there are the agriculturally related safety measures, beware of electric fences, never enter a field with horses because ‘they can out-run you, out-jump you and out-kick you’. Beware of bulls, keep them in sight, try to stay up-wind and uphill of the animal and do not wear bright colours or flapping coats, identify at least two exit points in every field and ‘make sure that you close all gates behind you’.

He was paid a good wage, which was great, because in the 1960s and 1970s it was important for small holders to have a permanent income. He had the permanent use of a company van and his dignity was paid for by the company. Whilst the team carried-out their work separately, they usually worked an area in twos and threes. If someone didn’t get back to the van on time, the others would be aware of the route that their colleague had taken and could therefore search for him. The samples were collected along two parallel lines, 160 metres (500 feet) apart, going-out along one line and back along the other and in the process collecting a sample every 60m, in addition to taking particular regard to any ‘uncrossable’ rivers. He had a large bundle of plastic bags, which were replaced by waterproof paper bags in the 1970s. On each bag he recorded the (company) site reference [for the benefit of the modern reader, this was over 30 years before the common use of GPS systems]. The samples were collected at 38 cm depth, which was based on studies that in general this was the optimum depth for the enhancement of metal values.

In the dark, cold winter time he worked in the laboratory, drying and weighing samples for more sophisticated tests than those carried-out on the original moist samples taken from the plastic bags. Sometimes for part of the year he worked on drill rigs, where he collected the drill-core, which are long cylindrical pieces of rock and which would have been laid-out in grooved wooden boxes, which
he brought back to the core-shed, for examination by the geologists. However experienced people like himself were also able to recognise mineralisation in the core.

“Indeed”, he explained, “one of the most rewarding aspects of collecting samples and prospecting was looking at ‘real’ mineralisation in the core”. Later, on instructions from the geologist-in-charge, he would, using a mechanical device, split the core in half, one half being retained in the box and the other half sent for analysis.

He explained that his sampling tool was basically a steel wood-auger, about 2cm in diameter, itself welded onto a T-Piece of hollow steel, which had wooden handles. It was also a very useful tool to create narrow openings in hedges. There is a paint mark at 38cm on the handle. He turns the auger into the soil and stops at the required depth and withdraws the auger vertically without turning it.

“What gives you the most satisfaction?” I ask. “That’s easy”, says Michael. He liked the variety of work but preferred the soil sampling, walking the fields, watching and evaluating cattle and meeting farmers.

“All of this work is based on experience in the use of geochemical methods for minerals exploration in Canada and is being tried out in Ireland and has been used successfully by a number of Irish and Canadian owned exploration and mining companies”, he explained. He told me that practically all of the new mines in Ireland had been discovered using this method, with minor variations including stream-sediment sampling and geophysics, neither of which he liked. He didn’t like stream sediment sampling because you met practically no one, although he knew from talking with the geologists that it was the best method of sampling for gold. Doing geophysics was very slow moving and usually it was the geophysics boss who spoke to the landowners and so one didn’t meet many people doing that either.

He showed me his equipment, compass, map, plastic bags, auger and T-piece, heavy twine and a long curved needle for stringing the bags together. He showed me how he collected the samples. ‘It was’, he emphasised, ‘very important to avoid taking samples close to buildings and roads, as those sites could be ‘contaminated’.
This type of exploration was particularly facilitated by the discovery of a very rapid colorimetric method for chemical analysis, called the Bloom test after Harry Bloom the Canadian chemist who devised it. In fact he was very proud of the fact that he had met and spoken with Dr. Bloom during one of his visits to the laboratory at Silvermines, County Tipperary where a new mine had been discovered.

In the late 1950s the samples were analysed for what were known as Total Heavy Metals, which included seven ‘heavy’ economically important metals, including three of particular interest in Ireland, namely copper, lead and zinc. The test was very routine, cheap, rapid and indicative. The maximum value was 1,000 parts per million, known as ppm for short. If the sample contained abnormal or what were known as anomalous amounts of any of those metals the green-blue chemical liquid would change to a pink or purple colour; those with a very experienced eye could give a good guess as to the element involved, depending on the actual shade of the pink/purple colour, i.e. were there undertones of pink, indicating copper, or green indicating lead or blue indicating zinc.

Values above 150 ppm, were deemed to be interesting, above 500 ppm very interesting and where a cluster at these levels were located close to each other, it was deemed to be an anomaly and therefore worthy of further investigation. A geologist would carry-out a review of the area, which would be subjected to re-sampling on a much tighter grid pattern. He liked doing this because in the event of the values producing an anomaly, it would constitute a major step towards ‘making a discovery’. Also, the more detailed sampling pattern meant less walking and indeed more talking to the farmers, explaining in more detail what was going on and how it might affect the land owners.

The laboratory Bloom test was replaced in the early 1970s by AAS (Atomic Absorption Spectroscopy) methods. Using AAS the samples were specifically analysed for copper, lead and zinc. In general copper values above 60 ppm, lead values above 125 ppm and zinc values above 250 ppm were deemed to be worthy of a detailed field investigation. Nine times out of ten however the anomalies turned out to be either human related or of no great consequence. The more coherent ones were subjected to increased scrutiny and other methods of exploration by the company’s geologists.

“Is all this routine sampling not very boring?” I ask. “Not at all”, says Michael, “it keeps me fit and the excitement at finding an anomaly is fantastic”.

I wished him well and he went on his silent way, leaving not a trace behind.

(Epilogue: During this period, the methodology described above played a major role in the discoveries of Tynagh, Co Galway, Gortdrum, Co Tipperary, Keel, Co Longford, Ballinalack, Co Tipperary, Mallow, Co Cork and Navan, Co Meath. Similar methodologies have been used for the collection of samples for the Geochemical Soil Atlas of Ireland and during the Tellus Programme currently being conducted on behalf of the Geological Survey of Ireland).
Granite and basalt are the two really important igneous rocks quantitatively – Dr. W.E. Nevill, former geology lecturer in U.C. Cork. [From ‘Geology and Ireland’, p.3, (1963).]

What are igneous rocks?
Igneous rocks are those that form when hot molten magma cools to form a solid. Magma is simply molten rock, but it can also contain gases such as water vapour, carbon dioxide and sulphurous gases like sulphur dioxide. It originates deep in the Earth – in the upper mantle and crust. If magma reaches the surface of the Earth, it is called lava. When lava/magma cools quickly, a fine-grained igneous rock forms – this can occur on the surface of the Earth. Whereas, when magma cools slowly, a coarse-grained igneous rock forms – this is usually below the surface of the Earth. An example of the former is basalt, while granite is an example of the latter.

An experiment to try at home
Dissolve household salt in a cup of very hot water until no more dissolves. Cool the solution quickly by immersing the cup in cold water. Fine crystals of salt form. (This emulates hot lava/magma cooling quickly to produce fine-grained minerals.) Next, prepare another cup of very hot saturated solution of salt. But this time leave it to cool slowly. Large crystals of salt will form. (This is representative of magma cooling slowly to form coarse-grained minerals.)

Seeing the minerals in fine-grained igneous rocks
The component minerals in fine-grained igneous rocks cannot be clearly seen unaided. Even with a hand-lens, they can be difficult to distinguish. Usually, the minerals can only be seen very clearly by preparing a thin-section of the rock and viewing it under a suitable microscope. Preparing a thin-section involves a laboratory procedure, which entails attaching a thin slice of the rock to a microscope slide, using a suitable adhesive and then grinding the slice down to 30 microns (about the thickness of a page of this publication).

The chemical composition of igneous rocks
By studying the chemical composition of igneous rocks, some light can be thrown on the constituents of material deep in the Earth. In the laboratory, an elaborate device, called an X-Ray Fluorescence Spectrometer, can be employed to obtain the chemical analyses of igneous rocks (and other types of rock). Quite recently, a portable version of this spectrometer has been developed and, using this, geologists are now able to analyse rocks in the field.

The different types of igneous rocks
Igneous rocks can be classified as acid, basic or intermediate, depending on how much silica (SiO₂) they contain. In the case of acid igneous rocks, they have 65%-75% silica in their composition. Why are they called ‘acid’? This is because most of the silica is in the form of silicates, which are the salts of silicic acid (H₂SiO₃). An example of an acid igneous rock is granite. In chemistry, the term ‘base’ is the opposite of ‘acid’. Igneous rocks low in silica, that is 45%-55%, are (relative to acid igneous rocks), high in iron, magnesium and calcium and the oxides of these elements are known as bases. (A base, by definition, will react with an acid to form a salt and water only.) Such igneous rocks are called basic. Basalt is a good example of a basic igneous rock. Igneous rocks halfway between acid and basic are called intermediate igneous rocks. They would contain 55%-65% silica. Andesite is an example of an intermediate igneous rock. But these rocks are not abundant in Ireland. Larvikite, from Oslo in Norway, is an example of an intermediate igneous rock and, when it is cut and polished, it produces a very decorative stone, which can be seen as cladding on some buildings in Ireland. It is also used as a grave headstone.

Rhyolite and dolerite
These two igneous rocks are not as common in Ireland as granite and...
**Discussion piece by Barry Long:**

### DEEP BIOSPHERE, HYDROCARBONS, LIFE & EVOLUTION

Before 1977 it was thought that life depends directly or indirectly on sunlight that is converted to chemical energy by photosynthesis. This understanding changed following the discovery of communities of extremophile microorganisms, mainly archaea and bacteria that depend on chemical energy from submarine volcanic vents (black smokers) on ocean ridges. These micro-organisms are thought to have evolved from surface ancestors that inhabit cooler oxygenated environments. Clams, crabs, shrimps and large tube worms at black smokers almost certainly did evolve from surface forms and became dependent on the extremophiles.

Micro-organisms get buried in sea floor sediment that compacts by its own weight and becomes sedimentary rock. Igneous crustal rocks also contain micro-organisms. In both cases, life is present to 10km or more below rock surface and has evolved from surface life.

Thomas Gold, a distinguished scientist, presented evidence in his 1999 book opposing established views on the principal origin of hydrocarbons (oil and gas) and the direction of evolution. His views remain generally rejected but make for interesting discussion. Only an outline of the story is possible here.

Following his earlier papers, Gold argued that hydrogen is abundantly available in the universe and easily combines with carbon to form abiogenic hydrocarbons. This implies that decayed micro-organisms are not the principal source of hydrocarbons that come instead from deep in the mantle (the interior part of the Earth). The commonly accepted biogenic origin is from decayed surface dwelling organisms that matured at various temperatures and pressures at quite shallow crustal depths.

Gold claimed that ancestral life on Earth originated in the mantle from the deep hot biosphere where it depends on chemical energy supplied as hydrocarbons. Life evolved upwards towards the surface and gave rise to all surface dwellers, including mammals and humans, as the real extremophiles.

Thinking his work was new and challenged conventional understanding, Gold was surprised to find that a century of published Russian and former Soviet Union work (in Russian) had preceded him, so he acknowledged this.

Known exoplanets (i.e. beyond the solar system)totalled 3,711 on 5th April 2018 [NASA Archive]. Hydrocarbons are known on some of the few exoplanets and their satellites already studied spectrosocopically, as well as some asteroids, meteorites and comets. Gold regarded some hydrocarbons as primordial and incorporated by accretion during a planet’s origin; some formed or were modified in a planet’s mantle; some were later arrivals on a planet’s surface.

Although abiogenic oil remains controversial, the accepted view may change if hydrocarbons are found commonly on more exoplanets. Decaying micro-organisms seem unlikely to be the main source of those hydrocarbons.

Do exoplanets support life, either past, present or perhaps future? Our understanding of evolution could soon change. The present view of early life at or near Earth’s surface that evolved downwards could change to early life in the mantle or deep crust that evolved upwards to the surface as the real extremophiles that include humans.


*Extremophiles are organisms that live in extreme conditions of temperature, acidity, alkalinity, chemical concentration or pressure.*

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basalt. Rhyolite is a light-coloured, fine-grained, acid igneous rock with the same composition as granite. It forms when granitic lava/magma is extruded over the surface of the Earth.

Dolerite is a dark, basic igneous rock of the same composition as basalt. The only difference is that it is not just as fine-grained as basalt. It forms when magma/lava is intruded into gaps in pre-existing rock. When this occurs, structures called sills (horizontal or almost horizontal) and dykes (vertical or almost vertical) are produced.

Some places in Ireland where granite and basalt can be seen:

**Granite**

Co. Donegal: Barnesmore Granite; age: around 400 million years

Co. Down: Mourne Granite; age: around 56 million years

Co. Dublin: Leinster Granite; age: around 400 million years

**Basalt**

Co. Antrim: Antrim Basalt; age: around 60 million years.

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**A specimen of rhyolite from Tardree, Co. Antrim.**

**Sample of dolerite from the Doraville Dyke, Co. Fermanagh.**
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