IN THIS ISSUE:
BIG Mystery
Galway Mine Puzzle
Causeway Experience
Sligo snakes
Kerry Features
Rock Pets
Top 10 Websites
What’s On
And more ....
EDITORIAL

As this issue is released we welcome the Earth Science Teachers Association to Belfast. It is actively working to keep Earth science alive in schools and makes you wonder if there shouldn’t be an Irish equivalent. Also in Britain there is ‘The All-Party Parliamentary Group for Earth Sciences’ – informing the country’s leaders on Earth science matters from energy supplies to climate change issues. Again, nothing like it in Ireland. Food for thought.

This issue features a mystery story involving an elephant and a hippo. It looks at the Giant’s Causeway again and has a number of items schoolteachers should find useful. Vandalism, quarries, from Kerry to Kilkenny and Kamchatka, much is happening. I hope you find something to interest and amuse you.

Articles are invited from readers, even those of you who have never had anything published before. If you think your topic is interesting so might we.

Contributions, please, for the next issue to the Editor or the Provincial Correspondents – for Connaught Martin Feely, Department of Earth & Ocean Sciences, NUI Galway martin.feely@nuigalway.ie - for Leinster Matthew Parkes, National Museum of Ireland, Merrion Street, Dublin 2 mparkes@museum.ie - for Munster Bettie Higgs, Department of Geology, NUI Cork b.higgs@ucc.ie - for Ulster Alistair Ruffell, School of Geography, The Queen’s University of Belfast, Belfast BT7 1NN a.ruffell@qub.ac.uk. Thank you to contributors in this issue.

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SLIGO SNakes
DON’T BITE BACK

There is an apocryphal story about a natural history TV presenter, standing on a coastal limestone platform just north of Sligo, who said, “What are these funny markings beneath my feet?” About to present a programme about geology but not capable of recognising fossils! Not even those well-known Sligo ‘snakes’. Eventually, no doubt, the script and a good voice with plenty of enthusiasm more than covered any lack of knowledge about the subject.

It raises two questions. The first and most obvious is “why isn’t there a geologist about who is capable of presenting Earth science in a popular style”. The answer is probably that the geologist needs to have an attractive personality, must be willing to speak in easily understandable words and be properly trained. Many geologists have attractive personalities (don’t they?) but becoming an ‘easy’ presenter on radio or TV needs training and experience. Most good presenters have had years of experience, coming through apprenticeships in programmes like ‘Blue Peter’ and daytime television. Few Earth scientists are willing to give the time to gaining such experience, preferring to be involved at the sharp end of research or industry. Most are worried about what their peers will think of them simplifying Earth science for the general public, or ‘dumbing down’ as it can be cruelly, and quite wrongly, called. So unless a complete ‘natural’ comes on the scene, and some TV staff member is willing to step aside, we are going to have to accept essentially amateurs presenting our subject. You have to admit Alan Titchmarsh does a good job!

The second question is “how easy is it to recognise fossils”. They are obvious if you have spent years studying them and walk with your eyes to the ground. Those odd squiggles and lumps, to a member of the public, do not immediately jump up and shout “Hey, I was in a tropical coral reef with sharks and colourful fish swimming about some millions of years ago”. They just lie there, grey and very dead, looking like …a mark in the rock. They are not usually obvious and picturing how they lived is a big intellectual step. You might say that those ‘snakes’ don’t bite back.

So lets not be too hard on our TV presenter in Sligo.

Sligo icon

Which leads into the fine geology and landscape to be found in Sligo. There is every chance a book listing this aspect of our heritage will shortly be produced following, a couple of years ago, an audit by the Geological Survey of Ireland. Sligo is one of those counties where a landscape feature is an icon for the county. The outline of Benbulben seems to draw you into Sligo from almost every direction. Massive limestone (Dartry Limestone) forms the upper cliffs grading down into interbedded limestone and mudstone (Glencar Limestone) and the lower slopes in mostly shaly mudstone (Benbulben Shale Formation).

Benbulben is 526m high and the rocks are almost horizontal, with many fossils and interesting sedimentary structures. A perfect situation for anyone researching this part of the Lower Carboniferous (the time between 330 to 350 million years ago). It is not just for researchers because there are many landscape and rock features that will turn classroom teaching into reality. U-shaped valleys, screes, ancient landslips, corries, solution hollows and caves, springlines where limestone meets mudstone, and even old mines for barites (barium sulphate), also known as Heavy spar.

Shore and more

Then take to the shore where many fossils and structures have been etched out by the sea. Sligo has more, because if you want complicated rocks just go south to the Slishwood Gap where some of Ireland’s oldest rocks are exposed (gneisses and serpentinites) – their age is still uncertain, some put them at about 900 million years old. This is part of the Ox Mountains, which looks very rugged when compared with the flat-topped hills to the north. Again features of the last Ice Age abound, notably roches moutonnées. With all this the county has the potential to establish itself as one of the leading areas in Ireland for geotourism and teaching. But the guides must be there to point out the features – you really cannot expect people without some training to see all the features mentioned above.

Come back TV presenter and all will be made plain.

Tony Bazley with thanks to Matthew Parkes and Siobhan Ryan (Heritage Officer www.sligococo.ie) Photographs all Copyright Geological Survey of Ireland.
FANCY A LITTLE PETTING – ROCK ON

Ever dropped in on a fanatical amateur geologist? An obstacle course wouldn’t be in it as you negotiate your way through their accumulations of years of field trip trophy-taking – or as some would have it, excavations.

Lumps of rock, all shapes, all sizes, guarding the doorways, littering the window-sills, peeking out from among the shrubbery – it’s amazing how much avid collectors can gather unto themselves in a few decades of rock-hounding.

The late Herbie Black, founder and long-esteemed secretary of the Belfast Geologists’ Society, was reputed to have put the very structure and safety of his house at risk with the weight of the diversity of continental crust he had stored in his attic.

And it’s amazing how these collectors can remember where and when they picked up an individual stone from the dozens or hundreds in their care, maybe one they’ve had for 30 years – and tell you in mind-twisting detail what this or that rock is and what story it tells. Some guys would enjoy telling you the Latin names for a scratch mark on a 400 million year old piece of shale (and if pushed probably what sex it was).

But don’t be fooled by such erudite expositions! Earth scientists just love to show off. They don’t like to admit it but secretly they harbour big soft-spots for their stony friends – in fact they become nothing less than family pets (some, it is rumoured, even get given names). Stony-hearted scientific inquiry is just a cover for hauling a rock home; mostly it is ‘adopted’ for the artistry of its sculpting, its texture, its colour; let’s be honest - you fancy it.

And why not? Every rock deserves a home.

After all, fur or feathers do not maketh a pet. Think of the advantages a rock pet brings – it comes ready trained, doesn’t need feeding or grooming, won’t wander, no vet’s bills, won’t bite, gets on well with your garden plants, and it won’t disturb the neighbours (unless maybe they happen to catch you stroking one or talking to it; it’s OK between consenting geologists but be discreet).

But if you regard your rocks just as scientific specimens that you know clever stuff about you’re missing out. Stones have spirits, stones want more – if you love ‘em, get with them, get creative!

A lot of time, a lot of tides, a lot of tectonic tribulations have gone into sculpting your pets from the living rocks born in fire or shaped from the residues of ancient life. Now it’s your turn; don’t just leave them lying about the place – make something of them!

Round rocks, cobbles, admittedly do make the best pets, and give you the opportunities for some chic design arrangements on the patio – and you can give a whole new meaning to ‘rock garden’ – one that doesn’t need weeding.

Some people can transform their pets with a few deft strokes of an artist’s brush – rocks don’t mind having flowers or faces painted on them, even decorated to look like rolled up ‘proper’ pets. And of course you can give them real ‘presence’ by combining them into designs involving other materials, especially wood.

Just use your imagination and remember, rocks are people too – have fun with them!

David Kirk
World Heritage Sites with geological interest number about 100 around the world. Rather less are like the Giant’s Causeway and based almost entirely on the geology. England has one, the Dorset and East Devon Coast with its fabulous ‘Jurassic Park’ rocks. Others include the Kamchatka Volcanoes in far eastern Russia (mentioned in this issue in a book review), Nanda Devi National Park in India (part of the Himalayas) and the Pyrénées Mont Perdu. All, of course, also describe fascinating animal and plant forms living within their boundaries but without the geology they wouldn’t be World Heritage Sites.

How lucky we are!

Do the authorities now controlling the Giant’s Causeway realise how lucky we are to have this gem or understand its scientific significance? You do wonder sometimes. Over the past few years there has been an unseemly struggle over development at the Causeway. Luckily the ‘theme park’ idea with pubs and fast food outlets has been firmly put behind us. Common sense has prevailed and the future looks good – but can we rest on our laurels?

A new ‘Interpretive Centre’ has been approved and an ultra-modern structure that neatly fits into the landscape has been chosen. It is scheduled to open in 2009.

What is given can be taken away.

Development at and around the Causeway obviously must be sensitive to the remarkable natural feature. After all, World Heritage status can be given but it can also be taken away, as has been threatened at Kamchatka. This is probably the time when local people with an interest in the Causeway Coast should be taking stock and steering the way it is developed. Making their feelings known and, with local politicians in charge, perhaps their opinions will not fall on deaf ears. After all, this is ‘the’ major attraction in the north and brings with it seriously big economic benefits, both locally and nationally.

A slow start

A glance at the web sites relating to recent actions at the Causeway will not fill you with confidence. Little positive seems to have been done. The Action Plan for the last year suggests required staff posts have not been filled and the proposed review of the effectiveness of the throw lines and, if appropriate, implementation of a less visually intrusive scheme, does not appear to have taken place. The latter, it is stated, are to be retained for the foreseeable future. And these are small things.

Visit the Causeway and, in season, you will find roads already starting to snarl up with the volume of traffic, queues of cars waiting to get into the car park and many people waiting to cross the Carrickarade Rope Bridge. The infrastructure and organisation has yet to be developed to cope with all the visitors likely to arrive on the new flights from all over the world. People don’t wait. Go onto the Causeway and listen to the accents and languages. You will know the first wave of new visitors is here. The National Trust is doing its best with well-kept cliff top and inland walks but losing the old centre to fire was a huge blow.

What do geologists want?

As geologists, what do we want? Is it too much to ask for a reasonable representation of geologists on the decision-making committees and working parties? Not just one or two, but a cross-section from the public and private sector – and they need not necessarily all come from the north of Ireland. Why not geological experts from the south of Ireland, the UK and Europe. So far we have seen committees of dozens of people but never more than one or two geologists, and some of those possibly compromised by the positions they hold. Geographers could also complain that they are underrepresented.
Yes, we want *the obtrusive throw lines on the Grand Causeway removed.* That is an example of Health and Safety legislation going too far. It was not, however, going too far to have closed the Lower Path after part of the pathway slipped away into the sea around 10 years ago. Even so we question the more recent shortening of access along the Lower Path, meaning the general public can no longer view Port Na Spaniagh and Lacada Point, on which the Spanish Galleon Gerona foundered in 1588. They massacred all the sailors staggering ashore from the Gerona! Then the Victorians built the paths, including the Lower Path, by cutting into the Cliffside, which itself destabilised things. However, over many years paths were replaced as they decayed, cuts were made to make fresh access etc. and accidents were few.

**A new perspective.**

Now it seems the struggle has been given up and the coast beyond the Amphitheatre will be kept for genuine researchers only and left to go wild. The decision has been made to keep the Lower Path closed to the public for a long, long time. Opening it has been put into a vague ‘medium term’ and even a feasibility study seems many years away. Yet a big part of the Giant’s Causeway ‘experience’ used to be walking this Lower Path on the way to or back from the cliff top path. The whole point was and is to get a feeling of the massive nature of the basalt lava flows and how they are changing along the cliffs - and the geology does change towards Hamilton’s Seat. **Walking the Lower Path gives a quite new perspective to the whole of the coast.** There are more imposing views and a feeling of... nature at work. Anyone who does it will understand the complete Giant’s Causeway experience. Until the Lower Path is re-instated your experience will not be complete. Just walking the cliff-top path is no substitute. If you have ever been in the bays of Part Na Spaniagh, Port Na Callian and Port Na Tober you will have to agree.

**Making it worth going a long way to see.**

The cost of engineering reasonably safe access will not be small but, with the potential returns for the region, must surely be seriously considered. It is said only 10% of visitors would want to walk the complete Lower Path route, but with one or two tunnels and maybe another rope bridge along the way what an extra attraction it would be. At least let a feasibility study, by professional engineers, be carried out in the short term so costs can be properly assessed and an informed decision taken. Everyone deserves the chance to get the full experience of the Giant’s Causeway and the Causeway Coast. Once and for all we need to knock on the head that saying “It is worth seeing but not worth going to see”.

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**CORK GEOLOGICAL ASSOCIATION**

This active Association will have a full programme over the winter. Please contact Irene Twomey, 44 Wilton Gardens, Cork, Tel: (021) 4545317 or irenemtwomey@eircom.net if you would like details. New members very welcome. These are the first 3 talks:

**Sept.26th.** New Trace Fossils in Ireland. **Dr. Lance Morrissey.**  
**Oct.31st.** Geoconservation - the role of areas of special Geological interest. **Dr. Cynthia Burek.**  
**Nov.28th.** Mass extinction, catastrophes and mountain building - what we can learn from fossil plants. **Dr. Jennifer McElwain.**
Carlow Granite book sparkles

Picture a totally different landscape for the well-ordered arable fields of County Carlow. A scene where nearly everywhere is covered by large granite boulders and few walls divide recognisable fields.

Although Carlow is now one of the most productive agricultural areas in Ireland, large parts of today’s organised, tidy landscape must have been very different 200 years ago. A new book on the exploitation of granite in Carlow provides a well-researched and well-presented picture of the backbreaking hard labour of the stonecutters who transformed the landscape.

Michael Conry, with a lifetime career spent in soil science and agricultural research, much of it in Carlow, is well qualified to record the story in Carlow Granite. He is also blessed with an easy reading style and a lyrical turn of phrase that makes this book a pleasure to read. This is no dry and dusty tome for geologists or turgid local history for Carlovians! It is a sparkling integration of geology and human endeavour showing how a valuable stone resource has been used to create lasting architectural treasures and a distinctive local landscape, both urban and rural.

From the smallest agricultural worker’s cottage to the grandest estate house, granite cleaved from the boulder fields was dressed and shaped to construct enduring buildings. Conry provides the geological and geomorphological background for the reader to visualise large parts of Carlow covered with granite boulders. He paints a vivid picture of the hundreds of individuals working as stonecutters taking their tools out and splitting these boulders into manageable sizes and shapes. The debris cleared to make walls and the better quality rock carried on primitive carts to the building site to be further dressed according to the architectural designs.

There is a descriptive ‘catalogue’ and liberal use of full colour photographs of Carlow’s granite buildings and many other structures. They help the reader to see how the landscape changed as fields were cleared. Many of the so-called quarries were simply prolific boulder fields. Part of this visualisation of human endeavour is achieved because the author also brings to life some of the people involved. We often only know the sponsor and the architect’s names for most building projects from the 18th and 19th centuries. In this book Conry has delved deeply into various documentary and oral history sources, and salvaged at least some of the names of individuals who worked as stonecutters. He paints brief portraits of their life, work, and characters as far as the records allow. It is enough to provide a tribute to these men and their skill as craftsmen, a skill which shaped the Carlow landscape.

Carlow Granite: years of history written in stone. Michael J. Conry, 2006. Published by Chapeltown Press Ltd., Carlow. ISBN 0 9535876 4 9

Matthew Parkes, National Museum of Ireland

WHAT’S ON

Irish Geological Association
(www.geology.ie for details)

September
w/e 15-16 Field trip: Quaternary landforms and deposits of the Sperrin Mountains led by Dr. Mark Cooper (GSNI)
Thu. 20 Lecture by Prof. Mike Williams (NUl Galway) Tsunami - myths and threats Venue: Room G01, UCD School of Geological Sciences, Belfield, Dublin 4 Time: 8pm. Tea/coffee from 7.30pm

October
Thu. 11 Lecture by Dr. Chris Nicholas (TCD) Into the Heart of Darkness: Field geology and frontier oil exploration in East Africa Venue: GSI, Haddington Road, Dublin 4. Time: 8pm. Tea/coffee from 7.30pm w/e 20-21 Field trip to the Beara Peninsula led by Dr. Pat Meere (University College, Cork)
Wed. 31 Joint IGA/Cork Geol. Assoc. (CGA) Lecture by Prof. Cynthia Burek (University of Chester) Geoconservation and Geodiversity: the way forward for Ireland? Venue: Department of Geology, UCC, Cork Time: 8pm. Tea/coffee from 7.30pm

November
Thu. 1 Lecture by Prof. Cynthia Burek (Univ. Chester) Geoconservation and Geodiversity: the way forward for Ireland Venue: GSI, Haddington Road, Dublin 4. Time: 8pm. Tea/coffee from 7.30pm
TBA Lecture by Dr. Chris Nicholas (TCD) Into the Heart of Darkness: Field geology and frontier oil exploration in East Africa Venue: Department of Earth and Ocean Sciences, University College Galway Time: 8pm. Tea/coffee from 7.30pm
Wed. 28 Joint IGA/CGA Lecture by Jennifer McElwain (UCD School of Biological & Environmental Science) Mass extinction, catastrophes and mountain building - what we can learn from fossil plants Venue: Department of Geology, UCC, Cork Time: 8pm. Tea/coffee from 7.30pm

December
Thu. 6 IGA AGM and President’s Address Venue: Room G01. UCD School of Geological Sciences, Belfield, Dublin 4 Time: 8pm. Tea/coffee from 7.30pm

2008 January
Thu. 17 IGA New Year Lecture by Prof. Monica Grady (Open Univ.) Seeing the universe in a grain of sand Venue: Davis Theatre, Arts Block, Trinity College Dublin. Time: 7.30pm
TOP TEN WEBSITES

Karen Parks chooses her classroom favourites:

http://csmres.jmu.edu/geollab/Fichter/Fichter/websites.html
This website provide links to rock types and plate tectonic and is very good for A level Geology on all rock groups.

http://gpc.edu/~pgore/online/physical2.php
A range of good images related to rock types. Many of the images on the Internet do not provide clear images of rocks.

http://earth.leeds.ac.uk/learnstructure/index.htm
An excellent website for diagrams and simple facts about geological structures.

http://www.earthsci.org/mineral/rockmin/sed/rcycle.gif
One of the best websites for a clear and colourful diagram on the rock cycle and I use this with all my Geography and Geology classes.

http://www.trilobites.info/
A good website for trilobites and can be used for Powerpoints and teaching in the classroom.

http://www.nrcan.gc.ca/mms/scho-ecol/toc_e.htm
This Canadian website provides information about the uses of metals and minerals and has a range of posters and interactive activities.

http://www.ukge.co.uk/
If you want to purchase any equipment e.g. hammers, sieves and rock samples this is a very comprehensive online catalogue that has also links to the UK Fossils Network.

http://www.worsleyschool.net/science/files/toiletpaper/history.html
A website you can adapt to suit the needs of your classes in relation to producing an Earth History time line and appeals to all ages.

http://www.geopix.org/
Here you will find a range of useful images and simple explanations about key geology and physical geography topics such as glaciation, weathering and erosion, and sedimentation. There is also a selection of CDs that can be purchased and used as resources for students.

UK School Seismology Project ‘real science with School Seismology Project’
Last but not least and two for the price of one! The British Geological Survey website has some very useful links that are suitable as a teaching resource but also provide students with an opportunity for extending their own knowledge and provide opportunities for independent research using the internet.

Examples of very useful links within the BGS website are included below:

http://www.bgs.ac.uk/education/school_seismology/home.html
A website providing a link to the new UK school Seismology project promoted by BGS.

Science is not a set of abstract ideas; it explains how the real world works.

The project is building a UK school seismometer system which is sensitive enough to detect the minute vibrations from earthquakes on the other side of the world and affordable enough for schools to purchase.

Using earthquakes in the classroom. This is a comprehensive set of resources to get you started. It will help you understand the data recorded from recent earthquakes and will be available for download and classroom use.

Schools will be able to exchange data that they have recorded from recent earthquakes using the school seismometer system. For example, here is data from the Kent earthquake of 28 April 2007 recorded by schools. And you can compare the trace of this earthquake, as recorded by one of the SEP school seismometers in Edinburgh, with a trace recorded on one of the BGS’s professional quality seismometers here.

Practical classroom activities using earthquakes and seismology as a unifying theme to teach basic science concepts, to be published in collaboration with the Science Enhancement Programme as part of the Innovations in Practical Work series.

Project background and summary

For more information email: schoolseismology@bgs.ac.uk

http://www.bgs.ac.uk/magazine/magazines/download.html
This website provides a link to Earthwise focussing on a range of Geoscience themes such as Geohazards, Sustainability, Geology for the Community and Geoscience challenges of coasts, seas and oceans. The articles are very good for A Level students and provide opportunities for extended reading.
More for teachers (& others)
from Karen Parks...

THE DIAMOND TRADE

“Now who gives a damn
About the ice on your hand
If it’s not too complex
Tell me how many Africans died
For the baguettes on your Rolex”

Ms Dynamite ‘It Takes More’
(Lyrics: N Mclain-Daley)

The film Blood Diamond and famous pop stars such as Ms Dynamite and Kanye West have questioned the ‘bling’ thing with diamonds and tell the story of another side of the diamond chain built on greed and violence:

Teachers can use the resources listed below to allow students to research and investigate the Diamond industry. These are very useful resources that can be used to stimulate discussion and awareness of the industry and the film could be shown to A Level pupils in both Geology and Geography classes.

http://www.globaleye.org.uk/

Global Eye has an exercise based on Diamonds, how and where they are formed. This is an excellent interactive site and allows pupils to examine and investigate the problems associated with conflict diamonds in Africa. There is a focus on Angola, the Democratic Republic of Congo and Sierra Leone.

Some the world’s poorest countries have paid the price for their diamond supplies, especially in West Africa. Here, about 3.7 million people have died in diamond-fuelled wars. Millions of others have lost their homes and livelihoods.

A diamond ranking exercise is used to identify methods that can be used to spread the word about ‘conflict diamonds.’ This can be transferred into other activities related to resource extraction.

http://www.diamondfacts.org/

Most people are unaware of the role diamonds play in bringing real benefits to people in the countries around the world where diamonds are sourced. Nowhere is this more evident than in Africa. It is also in Africa that this same resource has been used to fund conflict. In 2000, a coalition of governments, non-governmental organizations and the diamond industry worked together to address this issue. In 2002, they established the Kimberley Process Certification System, an UN-backed process that has virtually eliminated the trade in conflict diamonds. Today, over 99% of the world’s supply of diamonds is from sources free of conflict. Diamondfacts.org is dedicated to presenting the facts about conflict diamonds, along with how diamonds are driving economic growth and prosperity in countries around the world.

Juicy Geography

The aim of this website is to share ideas and resources. There is a section on diamonds.

http://www.juicygeography.co.uk/diamonds.htm

Other parts of this website are excellent for Geology and Geography teachers.

http://www.juicygeography.co.uk/interactives.htm this takes you into a range of games that are suitable for Key Stage 3 and 4 students and looks at topics such as earthquakes and weathering.

http://www.juicygeography.co.uk/shaker.htm

This site helps you to make an earthquake shaker

The Teaching and Learning section of Juicy Geography includes a number of decision making exercises which encourage independent research and thinking skills. These allow students to work in groups to identify key problems and solutions and both these activities are supported by a series of downloadable documents that will help them to understand the use of hazard maps.

http://www.juicygeography.co.uk/teachingandlearning.htm

San Francisco - a Decision Making Exercise – this is a complete lesson with custom-made Google Earth overlays

Montserrat Role Play – Crisis management with Google Earth – pupils will often use Montserrat as a case study and the pupils can assess the risk based on the reports and need to use the websites, maps and Google Earth to produce a simple Power Point
The UK Quarry Products Association has been working with quarry owners for many years to open up their sites, under strict supervision of course, for educational purposes. The Northern Ireland branch is no different and Laverne Bell is the local contact (lbell@qpani.org). It is guessed that many quarries all over Ireland would similarly want to help local communities in this way.

I was speaking to Laverne when she led a Belfast Geologists’ Society trip to the very well run Croaghan Quarry in County Londonderry. She made the point that many schoolteachers, at primary as well as secondary levels, do not appreciate the potential teaching resource within quarries. Not all quarry owners will be able to help, but others have already gone a long way to reach out to their local communities. So ask them, or contact Laverne for advice.

Croaghan Quarry is operated by Northstone and happens to have one of the most modern asphalt plants in Ireland. They quarry basalt to make road aggregate. Company geologist Angus Kennedy and ‘supervisor’ Gavin Ramsey led us around. Later in the day we visited their quarry at Carmean where limestone is taken to produce a variety of products for the building and animal feed industries. The company has an excellent education section on its website www.northstone-ni.com/about-us/education. First-class graphics and in-depth accounts of the rock types, rock blasting and rock quality assessment.

If you want animations and games then go to www.virtualquarry.co.uk. This is the Quarry Products Association site, which claims that few industries have more to offer teachers. The site has 20 curriculum-focussed lesson plans, developed and vetted by teachers.

Pictured is a card that opens to show a spinning wheel and can be used when children visit a quarry – this is just one teaching item sometimes available from Laverne. Quarries certainly can offer something different. An opportunity not to be missed?
When the Russian scientist Dmitri Mendeleev developed the idea of the Periodic Table of the elements over a two-week period early in 1869 it is unlikely that he would have predicted the nationalistic fervour that marked the discovery and naming of elements in the late 1800s. Gallium (for France) in 1875, Germanium in 1886 and Polonium in 1898 were so named. In 1922 John Joly of Trinity College, Dublin named Hibernium, a new radioactive element he had discovered in granite. Unfortunately for both Joly and Ireland it was later discovered that the new element was in fact Samarium that had been isolated over sixty years earlier.

Joly was born on 1st November 1857 in Hollywood House (the Rectory), Bracknagh, County Offaly, the third and youngest son of John Plunket Joly and Julia AnnaMaria Georgina née Comtesse de Lusi, and this year we are celebrating the sesquicentenary of his birth. He was a distinctive man who sported a bushy moustache and wore pince-nez perched on his nose. By all accounts he was highly popular with his students, and very generous to colleagues with his time and expertise.

Educated at the Rathmines School in Dublin, and later at Trinity where he studied classics and modern literature and later engineering. He was to remain there for the rest of his life, holding assistantships in engineering and then in physics before obtaining the Chair of Geology and Mineralogy. In his early career he can be regarded as being an inventor and physicist. His steam calorimeter allowed for the measurement of the specific heat of minerals and this piece of equipment later played an important role in the development of the kinetic theory of gases.

Joly had the ability to focus his mind on a wide variety of subjects outside his immediate academic discipline, and together with his life-long friend the botanist Henry Horatio Dixon, he explained the mechanism of the ‘ascent of sap’ or transportation of water in plants. They showed that this was driven by a pressure gradient set up in plant vessels through the loss of water from the surface of leaves by transpiration. In the late 1890s he invented a system of colour photography called the ‘Dublin method’ or ‘Joly Method’ in which he produced colour images by lining up a glass plate marked with thin lines of the primary colours with a negative. Many of his images are still-life compositions of plants but also include a stuffed parrot. He established a business on Brunswick Street (now Pearse Street), Dublin to exploit his invention but it failed, as it proved difficult to produce colour prints from his glass slides. Until the advent of digital methods Joly’s invention was essentially the scheme used for colour photography.

After his professorial appointment in 1897 he shifted his focus to matters more geological, and together with his life-long friend the botanist Henry Horatio Dixon, he explained the mechanism of the ‘ascent of sap’ or transportation of water in plants. They showed that this was driven by a pressure gradient set up in plant vessels through the loss of water from the surface of leaves by transpiration. In the late 1890s he invented a system of colour photography called the ‘Dublin method’ or ‘Joly Method’ in which he produced colour images by lining up a glass plate marked with thin lines of the primary colours with a negative. Many of his images are still-life compositions of plants but also include a stuffed parrot. He established a business on Brunswick Street (now Pearse Street), Dublin to exploit his invention but it failed, as it proved difficult to produce colour prints from his glass slides. Until the advent of digital methods Joly’s invention was essentially the scheme used for colour photography.

After his professorial appointment in 1897 he shifted his focus to matters more geological, but he cannot be regarded as a field geologist. To my knowledge he never drew a geological map, nor did he accumulate large collections through his own collecting. However he is now remembered in geological circles for his considerable and important research into geochronology and in the fledgling subject of geodynamics and tectonics.

Towards the end of the nineteenth century William Thomson (later Lord Kelvin) argued that the Earth was between 24 and 40 million years old. However in 1899, Joly published an influential paper in the Scientific Transactions of the Royal Dublin Society in which he calculated the Earth to be 100 million years old, and soon the earlier estimate evaporated away. Joly derived his global time-span from an estimate of the volume of sodium in the oceans that he divided by the rate at which it was carried into the oceans by rivers. It is not surprising that he turned to the sea for his inspiration as he was a notable yachtsman, who was also a Commissioner for Irish Lights for whom he undertook an annual inspection of lighthouses. He was a pioneer in the field of radioactivity and its connections to geology. In 1907 he demonstrated that pleochroic halos found in biotite in some granites were formed as a result of the decay of radioactive zircon crystals. He established the Irish Radium Institute in 1914 that exploited the medical advantages of radium.

Joly was probably the most brilliant Irish scientist of his generation. He was elected a Fellow of the Royal Society before being admitted to the Irish equivalent, and received medals from the Royal Society, the Royal Dublin Society and the Geological Society.

He died in Dublin on 8th December 1933 and is buried in Mount Jerome Cemetery. Forty years later he had a crater on Mars named for him, which was appropriate given his research on the nature and origin of Martian Canals.
Philip Doughty puts the case:

It was a Monday morning early in April 1990 when the phone rang. It was a Mr Patterson of Holywood, Co Down enquiring whether anyone in the Ulster Museum could identify something his sons had found over the weekend. He then described, in detail, what could only be an elephant tooth. It sounded to be fresh, perhaps a trophy of Empire, but I mentioned the possibility of mammoth – we had just finished excavating at Aghnadarragh in Co Antrim where we had turned up dozens of mammoth teeth. “Could he drop it in when he was next passing the museum?” He could do better than that. Curiosity was killing them he said and 30 minutes later he was unwrapping his trophy in my office.

Goose bump moment

In a curatorial career there are hundreds of goose bump moments but this was something exceptional. There, lying on the bench was the most spectacular elephant tooth I had ever seen and although I had never seen an actual specimen of this species before, I knew immediately what it was. I lifted the Leith Adams monograph describing fossilized elephant remains off the shelf and turned immediately to the plate that might almost have been the very tooth we were looking at. It was a perfectly preserved lower molar of *Palaeoloxodon antiquus*, the straight-tusked elephant, extinct for over 100 thousand years. A complete skeleton of *Palaeoloxodon* has never been found but from fragmentary remains we know it was enormous; 4 metres high at the shoulder, with long legs and in old bulls the almost straight tusks protruded like a pair of javelins from a head that was relatively small compared with the body-size.

Down to Croft Burn

Part of the thrill of recognition was the cascade of implications it carried with it, so the first thing to do was to validate the tooth’s geological setting. Late that afternoon I was standing in the almost dry bed of a stream at the bottom of Mr Patterson’s garden where the owners had consoliated the banks in a variety of ways – with poured concrete, breeze blocking, staking corrugated iron against them, indeed covering them so thoroughly that the deposits only appeared in tiny disjointed “windows”. Nowhere could bedrock be seen because it was covered by superficial deposits.

The tooth hadn’t travelled far. The only blemish was one slight abrasion. Even the delicate root ridges were intact and they wouldn’t have survived rolling. So what was in the walls? Here was the next disappointment. All the back gardens in the road ended at the stream and it was obvious that stream erosion was eating into them. The owners had countered this by consolidating the banks in a variety of ways – with poured concrete, breeze blocking, staking corrugated iron against them, indeed covering them so thoroughly that the deposits only appeared in tiny disjointed “windows”. Nowhere could bedrock be seen because it was covered by superficial deposits.
This valley, occupied by Croft Burn, drains north into Belfast Lough and had clearly existed before the last glaciation. It had been filled with something in late Pleistocene times and the burn was now re-excavating it but it was impossible to get a clear view of exactly what.

**A first for Ireland**

Why was all this so exciting? For a number of reasons. First because remains of *P. antiquus* had never been found in Ireland before so it was a new addition to the Irish list; second because it was the furthest north it had ever been discovered in the British Isles but most of all because it would profoundly alter our understanding of Irish Pleistocene history. Let me elaborate. In Britain there are two sustained interglacial periods, times of temperate or warm temperate climate, separating the last three glaciations. The Anglian glaciation that started 350,000 years ago was followed by the Hoxnian interglacial 280,000 years ago, in turn succeeded by the Wolstonian glaciation 250,000 years ago, then the Ipswichian, the last interglacial 150,000 years ago leading to the last glaciation, the Devensian, around 110,000 years ago.

**No evidence of the last warm period (Ipswichian) in Ireland**

In Ireland, despite the profusion of glacial deposits, things are less clear and further fogged by the use of different names. There is convincing evidence for the last two glaciations, the first called the Munsterian, equivalent to the British Wolstonian, and the second called the Midlandian, equivalent to the Devensian. The problem arises with the interglacials. In Ireland there are 14 or so sites equivalent to the British Hoxnian, here called the Gortian, but to date nothing that can be attributed with certainty to the Ipswichian thus creating the mystery of the missing interglacial. There is one site to the far southwest in Co Kerry that looks like a promising first candidate. It is on the north shore of Tralee Bay between Spa and Fenit and it carries a radiometric date of 118,000 years. It consists of 3 peaty muds containing pollens suggesting cool temperate thinly wooded landscapes with a hint of rising temperatures towards the end.

**Straight-tusked elephant changes it all?**

The over-riding problem in Ireland is the absence of vertebrate remains from all interglacial sites. In the Hoxnian of Britain skeletal parts of 14 species of medium-sized to large mammals have been unearthed and in the later Ipswichian there are 13 equivalent species. Why none in Ireland? The late Professor Frank Mitchell was of the opinion that although Irish conditions were suitable for substantial mammal populations, Ireland was isolated from Britain and Europe at the close of the Munsterian glaciation so none was able to cross. In the absence of evidence he was supported in this conclusion by the late Antony Sutcliffe of the Natural History Museum in South Kensington, the leading authority of the day. The *discovery of the Holywood straight-tusked elephant tooth had the potential to change all that at a stroke*.

In Britain *P. antiquus* occurs in both the Hoxnian and the Ipswichian so it is at least possible that the Ipswichian is present here. But just as one swallow does not make a summer, a single spectacular molar of *Palaeoloxodon* does not make a Gortian or Ipswichian mammalian fauna an Irish reality particularly since this tooth was not found in its geological context. More mammalian evidence is needed. The typical large mammals of the Ipswichian commonly include the narrow-nosed rhinoceros, hippopotamus and hyena, in addition to the straight-tusked elephant. Remains of any one of these three would fortify the case.

**Back at the Museum**

Colleagues in the museum began to call to examine the tooth and chatter about it. One of them, Helena Chesney, asked where it was found and instantly raised another possibility.

“*Holywood.*”

“*Where in Holywood?*”

“*In Croft Burn.*”

“Exactly where?”

So I told her.

“*Are you aware that Robert Lloyd Patterson had lived in Croft House only a hundred yards away?*”

**I wasn’t but that simple fact was immediately unsettling.**

**The Patterson Dynasty**

Robert Lloyd Patterson was the second in the Patterson dynasty, a family which had strong cultural and, sometimes, scientific interests. The founder of the fortune was Robert Patterson the first, who was a mill furnisher in Belfast at exactly the boom time in the linen industry in the 1820s and 30s. His cultural activities were Shakespearean (he published a book on the insects of Shakespeare’s plays) and science in education. He lived in Belfast, was not a collector and Croft House was not built at the time.

His son, Robert Lloyd Patterson, the occupant of Croft House, was also a wealthy businessman. His passions were the bird and marine life of Belfast Lough and he read no less than 12 papers on these subjects before the Belfast Natural History and Philosophical Society between 1868 and 1895. He had no geological interests and was not a collector.

It was the third in the dynasty, the second Robert Patterson, also a successful businessman, who was likely to complicate the picture. He had wide natural history interests and in one phase of his life was an avid collector. He took great pride in his trophies that became the founding collection of *Belfast’s People’s Palace Museum* in 1904, alternatively known as the Patterson Museum. When the museum eventually closed, the entire contents with detailed specimen display plans and a complete catalogue of the collection were passed to the Belfast Municipal Museum. Robert
Welch, the celebrated photographer, also made a good photographic record of the museum before it was dismantled. Nowhere is an elephant tooth mentioned in the catalogue or the display plans nor is it seen in any of the photographs. If he had owned it, he would certainly have displayed it. It was also consoling to learn that he resided in Belfast in the Malone area and had no associations with Holywood or Croft House and no reason to be in that area.

It is inconceivable that any member of the family could have possessed the tooth and failed to recognise or publicise its significance, particularly not the second Robert, so vitally involved in natural history and a close friend and confidante of Robert Lloyd Praeger, destined to be one of Ireland’s great natural scientists. (The Patterson’s who recently found the tooth are not part of this ‘Dynasty’)

**Tooth too ‘clean’**

There are other reasons, purely curatorial, for believing that the tooth was never a valued prize. Much-handled material usually has a polish. In this case only the occlusal, biting, surface of the tooth is shiny, a feature of all elephant teeth. Even careful handling of such heavy objects can lead to breakages along the root surface where individual laminations thin into soft tissue. In this case the root surfaces are intact. Finally, valued specimens, and this one would be a treasure in anyone’s collection, would carry some kind of identification written directly onto the surface, or on a sticker, in the 19th century applied with glue. Either would normally leave an obvious mark or deposit. The Holywood tooth is entirely clean. All the evidence tends to support the conclusion that its occurrence in Croft Burn was the result of natural processes eroding the deposits in the wall of the valley.

**Chance meeting in Dublin**

Serendipity then took a hand. Over a pint in a Dublin pub following a professional meeting, I happened to mention the Holywood find to Nigel Monaghan, then the geologist in the National Museum in Dublin. Conversation turned briefly to the problem of the Ipswichian in Ireland before moving on. A week or two later I received a letter from him containing a photocopied page from a 1986 auction catalogue showing two competent drawings, unmistakably of a mastodon tooth and a hippopotamus lower canine. Both were signed and annotated by the artist, A M McHenry, who made it clear that they were copied from original drawings made by Victor Du Noyer in 1838. Du Noyer was a talented and prolific draughtsman employed first by the Archaeological branch of the Ordnance Survey of Ireland, then as Temporary Geologist in the Survey before finally becoming a District Surveyor in 1867.

**Hippopotamus tooth from Woodburn Glen**

Research revealed that a hippo tooth had been discovered “near Carrickfergus” in 1837. It had been reported by Leith Adams in the Scientific Proceedings of the Royal Dublin Society in 1878, over 40 years after the event. This was the same Leith Adams who authored the fossil elephants monograph mentioned earlier and a leading authority on Pleistocene mammals. A Dr Moore provided him with details of the circumstances of the find. This was David Moore who in 1837 was employed as a botanist working on one of the memoirs that the Ordnance Survey planned to publish for each of its sheets. Du Noyer made the drawing of the hippo tooth for the memoir but the entire scheme foundered for want of finance and it was never published. It was this drawing that A M McHenry copied later and it was fortunate that accurate images were made because by the time Adams presented his report to the Royal Dublin...
to see the place afterwards, and, unless the locality be greatly altered since, would easily find it again. I gave the specimen (as was my duty) to General Portlock, who was then the commanding officer of the Geological and Natural History Departments.

Faithfully yours, D. Moore.

The site could only be in Woodburn Glen, giving it added significance.

The hippo in question is the same species as that commonly seen in Africa today, *Hippopotamus amphibius*. In Britain and Europe, where its remains are common, they only occur in the Ipswichian and are confined to two of the four pollen zones identified in the interglacial, the top of zone 2 and the base of zone 3. In the Ipswichian straight-tusked elephant remains are restricted to the top of zone 2 and the whole of zone 3. Is this merely coincidence or is a scenario beginning to emerge?

**The facts**

We have a *Palaeoloxodon antiquus* canine tooth found embedded in a modern stream channel in Holywood, probably washed out of deposits in its walls. Only 9 or 10 kilometres away on the other, northern, side of Belfast Lough a tooth of *Hippopotamus amphibius* is collected from eroding gravels in a similar geological setting. The two species were known to be contemporaries for only a brief period in the Ipswichian, i.e. from the top of zone 2 and the base of zone 3.

**Painting the picture**

A hypothesis starts to build of a landscape **around 130,000 years ago** with a climate similar to todays. Visualise a steep-sided, northeast trending river valley, the nascent River Lagan, cut into a lightly wooded tableland with a general height of around 400 metres with well-watered tributaries feeding into it on both sides. A mature straight-tusked elephant died or was killed in one of these side valleys and although the corpse would undoubtedly have been scavenged, the brick-like teeth proved completely resistant to predation and eventually washed into the local stream deposits where they were buried.

On the other side of the valley, in this same period, a herd of hippos did what the same species commonly does today; they followed the main valley and migrated up the tributaries in search of a suitable habitat with pools, wallows and a food supply. One place meeting these requirements was the valley now called Woodburn Glen. Here, as members of the herd died, their bodies bloated and decayed and their remains eventually sank onto the pool bottoms where they became incorporated into the sands and gravels.

The tributary valleys progressively silted up, incorporating many more remains, before the intermittent onset of glacial conditions that eventually ended the Ipswichian and locked the British Isles into one of the most severe of its glaciations. Two major ice centres influenced the lower Lagan Valley during the last glaciation, the early dominant force being the southern flow of Scottish ice that overran the Irish coast somewhere north of Larne before pressing south west across the whole of the area south of Lough Neagh. Following a melt, a second glacial phase affected the area, this time with an ice dome centred on Lough Neagh with an east-west axis more or less along the line of Belfast Lough. Neither of these ice sheets could fully re-excavate the deeply incised side valleys of their Ipswichian deposits and so patches of them survived that are now being actively eroded by the Croft Burn and the Woodburn River.

If this interpretation of events is correct then not only was there an Ipswichian interglacial in Ireland, very similar to that in Britain, but the larger mammals were a part of it.

**Keep your eyes open around Belfast Lough**

Science progresses by disproving hypotheses and this one is supported by evidence that is far from conclusive. Ideally I might have wished that the *Palaeoloxodon* tooth had been embedded in datable Ipswichian deposits and that the *Hippopotamus* canine had survived in substance rather than image alone but we have to work with such evidence as presents itself and here it points to the conclusion I have offered as the simplest, although not the only, explanation. All I would ask is that the residents around the Croft Burn and in Woodburn Glen keep their eyes open because one day -- who knows? -- pieces of spotted hyenas and narrow nosed rhinos may emerge to join the party - **and they really would be clinchers**.
Give an Inch, lose a mile
Loss of Type section at Inch Strand, Co Kerry

Bettie Higgs reports:

A geo-heritage disaster has occurred on Inch Strand in Co. Kerry. In early May of this year, while carrying out a reconnaissance for an international field trip, the author was devastated to see the classic Inch Conglomerate locality, at Inch Strand, being broken up and covered over as part of a coastal defence scheme.

The relatively soft Quaternary cliffs are prone to erosion and Kerry County Council commissioned engineering consultants to come up with a coastal defence scheme to protect the road above. Large boulders, some 2 meters in diameter, have been brought from quarries at Minard and Ardfert, and used as rock armour to shore up the cliff. The rock armour defence is almost 50 metres wide at the base and, at the time of writing, is 20 metres high. This has damaged and completely covered over the type section of the Inch Conglomerate.

### Why is it important

Why is the Inch Conglomerate important and unique? It is only found on the southern side of the Dingle Peninsula and is characterised by large clasts (pebbles and boulders) of high-grade metamorphic rocks, held in a red sandstone matrix. The provenance is enigmatic, as there appears to be no local source area for these metamorphic clasts. This adds to the interest of the site. The conglomerate, formed as a series of alluvial fans, records evidence of an ancient Precambrian mountain ridge, just to the south of the present Inch strand, where high-grade metamorphic rocks were exposed and being rapidly eroded during the Middle Devonian. This ridge is no longer present today. In addition, the classic Inch site also showed the unconformable contact with the overlying Upper Devonian Lough Slat Conglomerate. The locality is used by geological researchers and is an important teaching site, with numerous groups of students visiting each year.

### Included in Heritage Plans

The type section at Inch Strand was included in Kerry’s county heritage and development plans and was being proposed by the Irish Geological Heritage Programme to NPWS for designation as a geological Natural Heritage Area (NHA). The site is on a list drawn up by the Geological Survey of Ireland in consultation with experts around the country. The list was circulated to all the county councils in the country. The county councils are obliged to inform the Geology Survey of any proposed developments that may affect any of these sites. Unfortunately Kerry County Council did not consult with the GSI on this cliff defence project, and engineering work went ahead without the knowledge of the geological community.

### All not lost

However, all is not lost. The Geological Survey of Ireland was alerted and rapid action was taken. Dr. Sarah Gatley, Head of the Irish Geological Heritage Programme of the GSI, communicated the problem to Kerry County Council. In discussion with Prof. Ken Higgs of University College Cork, Kerry County Council have provisionally agreed to two developments. In the first of these developments, large blocks of Inch Conglomerate have been rescued from the site. These will be placed near the café/restaurant on the strand and will have interpretive boards to inform the public of the importance of the Inch Conglomerate. Secondly, Ken was asked to survey the steep coastline with the aim of finding a site that could be studied by geologists. Two new sites, showing some of the features of the classic site have been identified. It is hoped that Kerry County Council will put access paths in place in the near future. Readers will be kept informed of the progress of these developments.

### Lessons to be learnt

A number of lessons should be learnt from this situation. The most important is that we cannot be complaisant about our geo-heritage. Fortunately there have been some promising recent developments. A useful history of geoconservation in Ireland has been written by Matthew Parkes (in press), and the Geological Survey of Ireland has consolidated the Geological Heritage section by appointing a Head of Section, Dr. Sarah Gatley. With the ‘International Year of Planet Earth’ fast approaching, Ireland’s attitude to geo-heritage and geo-diversity will be on display. Members of the geological community in Ireland, and members of the public, will have to be ever vigilant if we do not want to lose some of the nation’s most important geological sites.
You may have heard of Kerry Blue terriers, Kerry Hill sheep, Kerry cattle and even Kerry Blue cheese but have you come across the Kerry ‘Geopark’ yet? Probably not, because it is currently working towards official accreditation by the European Geopark Network and UNESCO as a Global Geopark with planned formal accreditation in 2010.

Work in progress

It might be asked why a geopark has to be ‘worked for? Surely the landscape and rocks are either there or not. They certainly can’t be changed but a geopark is much more than just the geology. It is a special region where partnerships are formed between the local and wider communities to take advantage of all that nature has provided.

Working with, for example, Fáilte Ireland (The Tourist Board), providers of accommodation, the local council, businesses and schools; making explanatory boards and leaflets for sites of interest; setting up walking trails and scenic routes; providing colourful books, postcards and the like for sale in local shops and interpretive centres; establishing teaching packs and sites for schools and colleges researching the ecologically sustainable economy of the area and its geology, geography and archaeology. Current research activity includes investigating the ecological economies of a sustainable hill farming industry, a river catchment restoration project and investigations into some of the many archaeological features of the area.

It is also a district where new scientific research will be encouraged because the rocks still hold undiscovered clues to our past. Maybe some eagle-eyed person will find actual skeletons of the lizard-like animals whose tracks are mentioned below.

A geopark, to be accredited, certainly needs exceptional rocks and scenery but these must be presented in a way that will help the economy of a region. Any development must be sustainable and conserve the landscape for future generations.

New DVD

Earth Science Ireland’s attention was drawn to Kerry Geopark through a new DVD - see www.sccird.com/geopark. As anyone who has travelled to this southwestern part of Ireland knows, the rocks and landscape are spectacular but the DVD shows how all other aspects of nature, the wildlife and plants, archaeology and the community fit into the project.

First geological surveyors worked here

As this is an Earth science magazine lets briefly look at the landscape and rocks of the Kerry ‘Geopark’. The Geological Survey first mapped the rocks in the early 1850’s – this means the region was one of the first in the world to be formally surveyed by geologists. Some of the surveyors of the time, Willson, Du Noyer, Foot, Kinahan, O’Kelly and Wynne went on to lead geological survey work not only in Ireland but also in India.

Read that fine book ‘North from the Hook’ (1995) by Gordon Herries Davies (ISBN 1 899702 00 8) and you will find the survey work slowed down when it reached Kerry due to the difficult terrain and poor accommodation. That was 1854 and in the words of Herries Davies:

“The Officers were into that magnificent region where Europe’s frayed extremities finally yield to the fury of the Atlantic. They were surrounded by peninsulas where rugged Old Red Sandstone mountains look down upon island-flecked inlets. On a summer’s day…..the region presents a succession of visions that by any standards are breathtaking in their splendour”.

Ireland’s highest mountain

It is one of Ireland’s most mountainous regions, including our highest mountain (Corrán Tuathail 1039m), part of that range schoolchildren pick out from the atlas because of the name,
Macgillycuddy’s Reeks. On a clear day a World Heritage Site, the Skelligs Islands with their hoards of gannets and the remarkable 6th Century monastery, appears dramatically on the western horizon amongst the foam of the Atlantic Ocean.

First land animals

The mountains are made up of a huge thickness of sandstone, called the Old Red Sandstone by earlier surveyors. A good name because the rocks are mostly sandstone, reddish brown in colour and they are old, between 350 –400 million years old. They are now termed Devonian sandstones. They were formed when Ireland lay just south of the equator where the climate was sweltering hot. Conditions were not good for preserving life (fossils) but on Valentia Island tracks of a 1 metre-long newt or lizard-like animal have been found. This, the Valentia Tetrapod Trackway, is now a national geological monument and represents a time, 385 million years ago, when animals first hauled themselves from water onto land.

Walking, climbing - teaching

The rounded but in places jagged mountains are popular for walking and climbing – see www.climbing.ie for photographs in all seasons. They have been modified by the cold times of the Ice Age, only 10-20,000 years ago. Corries, U-shaped valleys, rias, moraines are all present in classical form near what was the edge of the Irish ice sheet; wonderful examples for teaching purposes. In addition for those interested in history, Daniel O’Connell (The Liberator) lived at Derrynane House near Caherdaniel – now classified as a National Park.

Bronze Age copper mines

It is a region where, as the ice retreated, humans first started to migrate in from Europe. They formed communities and used such resources as were available, including the copper from small mines like that on Coad Mountain, near Caherdaniel, where it was worked in the Bronze Age about 4,000 years ago.

All this is in a region well served by a road that goes right around the peninsula, the famous ‘Ring of Kerry’. As Cole and Hallissy wrote in their 1924 ‘Handbook of the Geology of Ireland’, it has “the grandest rock-scenery in Ireland”.

These are exciting times for Earth science in Kerry.

More information can be downloaded from the Kerry Geopark website (www.sccird.com/geopark) and a visit to the Kerry Geopark Visitor Information Centre on the Killarney Road in Sneem is well worthwhile. Current opening hours are Monday – Friday 10.00 to 17.00 hours.

Contact details from Nigel Fitzmaurice Hawker or Georgina White, Kerry Geopark, The Old Ring Ballroom, Killarney Road, SNEEM, Co. Kerry. Tel: 064 75824

Email: kerrygeopark@eircom.net
Chris King, Peter Kennett and Elizabeth Devon ask teachers to help:

Send us email addresses to circulate Earthlearning idea around the globe

Earthlearningidea plans to put up a new idea for learning about the Earth every week during 2008 – the International Year of Planet Earth. The ideas are aimed at teacher trainers in science and geography who will be training teachers in the teaching of Earth science - but we hope they will also be widely used by classroom teachers who have access to the internet. A blog runs alongside them aiming to build up a worldwide discussion network of Earth science educators.

Each of the ideas involves simple practical activities or ‘thought experiments’ that require minimal resources so that they can be used in almost any classroom. They are designed to educate pupils about the Earth, in ways that will engage and interest them, whilst teaching important scientific or geographical principles and developing thinking skills – and they should be fun as well!

You have another crucial role in this initiative. The global nature of the enterprise will only work if we can obtain the email addresses of teacher educators across the globe so that we can alert them to the ideas that are available to them. So we hope that you will be able to help us, by using any international connections you have, to discover these addresses and send them to us. If you want to include the email addresses of ordinary classroom teachers who might be interested at the same time – that will be fine.

For each contact, please find the:

*Country  *Name  *Email address

of the individual and email them to us at info@earthlearningidea.com

If you want to track our progress and receive the ideas yourself – then just email us your name and details as well. If you subscribe to the blog, you will be informed automatically every time a new activity is published.

We also hope to set up a support group of scientists/geographers/educationalists who will respond to technical queries raised through the blog and so enhance the discussions that will develop.

Our timeline is:

• **Ongoing**: publicise the initiative; collect email addresses of teacher trainers and teachers across the globe; prepare earthlearningideas for web publication;

• **September – December 2007**: publish one activity per month in a run up to the International Year of Planet Earth in 2008; encourage discussion around each activity using the blog; continue to develop earthlearningideas;

• **January 2008 – December 2008**: publish one activity per week, continuing to encourage discussion around each activity;

• **January 2009 onwards**: receive earthlearningideas from members of the global discussion network, edit them and publish them as they appear.

So – do please send us email addresses and do please contribute by testing the activities with children and feeding back your experiences through the blog. In this way we can bring earthlearningideas to parts of the world that other ideas find difficult to reach!


Quake shake – will my home collapse?

When an earthquake strikes – investigate why some buildings survive and others do not
Set up the demonstration out of sight of the class. Place a flat piece of wood in one end of a tray and then fill the whole tray evenly with sand, so that the wood is hidden. Soak the sand thoroughly with water, then pour off the surplus water. Place two heavy objects, of identical shape and mass, representing buildings, gently on the sand at each end of the tray.

Explain that when earthquakes occur, the ground shakes violently. The model represents two buildings standing on wet sandy ground. Ask the pupils to say what they think they will see when the tray is shaken from side to side. Then shake the tray repeatedly whilst the tray is resting on a table.

After a few shakes, the sand can be seen to liquefy, and water rises to the surface. One “building” either topples over, or sinks into the sand, while the other one stays upright and does not sink. Ask the pupils to explain why they think this might be. They usually offer many ideas for what they have seen, but they seldom think that the teacher has done anything so underhand as to hide a solid object under the sand! The shaking reduces the load bearing strength of the sand, as the water forces the grains apart so that the ‘building’ without a solid support underneath falls over or sinks. This happened when Mexico City, which is built on an old lake bed, was hit by an earthquake and many buildings with poor foundations collapsed. An earthquake of the same magnitude will cause far less damage to a building built on rock.

The back up

Title: Quake shake
Subtitle: Will my home collapse?
Topic: When an earthquake strikes – investigate why some buildings survive and others do not. How buildings with different foundations respond to earthquakes.

Age range of pupils: 7 – 18 years
Time needed to complete activity: 5 minutes
Pupil learning outcomes: Pupils can:
- demonstrate how the shaking of damp sand, as if by an earthquake, reduces its strength
- explain how providing a foundation increases the strength of shaken sand, allowing it to bear loads. The foundation does not increase the strength of the shaken sand. The piece of wood provides a raft-type foundation which allows the building to ‘float’.
Context: The activity could form part of a lesson about earthquakes and their effects. It could also form part of the preparation for the best way people should respond to an earthquake in earthquake-prone areas.

Following up the activity: Try a websearch for real data.

Underlying principles:
- the slow movement of the Earth’s plates causes stress to build up in the rocks underground.
- eventually the rocks break (brittle failure) at a fault, and the rocks spring back (elastically) causing shock waves.
- two forms of shock waves are produced, longitudinal (primary, P-) waves and transverse (secondary, S-) waves.
- these waves reach the surface and cause surface waves – undulations of the Earth’s surface.
- the waves cause solid rocks to move, but when they hit waterlogged sand, the sand can lose cohesion and ‘liquefy’ causing heavy masses (eg, buildings) to sink, fall over or collapse.
- people are hurt or killed by the collapsing buildings, falling broken glass or subsequent fires.
- the safest place during an earthquake is usually out in the open, away from buildings that might collapse.

Thinking skill development:

- the contrast between one ‘building’ sinking and the other not causes cognitive conflict (mental challenge)
- further discussion about what we should do when an earthquake hits causes bridging (application) of the ideas seen into potentially real contexts

Resource list:
Shallow tray, e.g. about 20 x 15 x 5 cm.
Sand, to fill the tray
Water
Two small heavy objects, e.g. large metal nuts, 3cm lengths of lead pipe, etc.
Flat piece of wood, or similar material, to bury under the sand at one end of the tray

Useful links:
Guide to selected sites for earthquake education - http://mceer.buffalo.edu/infoservice/Reference_Services/earthquakeEducation.asp

Source: This activity was developed by Peter Kennett of the Earthlearningidea team.
Imagine a time long before the dinosaurs colonised the Earth, when the only four-legged creatures were the early amphibians. These were animals related to modern day frogs and newts and were equally at home on land and in water. The earliest amphibians evolved during the Devonian Period about 360 million years ago and they diversified into many different forms when suitable conditions developed in the subsequent Carboniferous Period.

During the Carboniferous Period, life in Ireland was situated almost directly over the equator. The early Carboniferous saw rises in sea levels, which covered Ireland with shallow tropical seas. As sea levels dropped again in the late Carboniferous a variety of plants colonised the land, giving rise eventually to enormous swamp forests. The Lycopsods were among the more common plants. They grew up to 35m tall and their distinctive diamond patterned trunks are frequently preserved as fossils. Calamites spp. plants were related to modern day horsetails but grew up to 20m tall.

Giant millipedes, dragonflies and a Bigheaded Thickhead

This swamp vegetation provided a home for an abundance of invertebrate life including the giant millipede Arthropleuris and dragonflies with wingspans of up to 75cm. It also provided a home for a wide variety of amphibians. Megalocephalus pachycephalus was a large predator with sharp backward facing teeth for holding on to struggling prey. Its name translates from the Latin as ‘Bigheaded Thickhead’. Dendrerpeton rugosum was another predator with a short stocky body and short legs that grew up to a metre long. Ophiderpeton brownrigii was unusual for an amphibian in that it had lost its legs and resembled modern day snakes in appearance. Keraterpeton galvani was a much smaller creature with a flattened tail and side projections on its skull that may have been used for swimming and the related Urocorystus wandesfordii was a small skinny creature that may have been preyed upon by the larger amphibians or even the larger invertebrates.

Coal mining and ‘Darwin’s Bulldog’

Over time the huge swamp forests turned to coal deposits and the amphibians became fossilised and were preserved within the coal for 300 million years. In 1864 the fossils were brought to light by coal miners working the coal seams of the Castlecomer Plateau in County Kilkenny. Because conditions in the coal swamps were not ideal for the preservation of fossils, there are only a few locations around the world where Carboniferous amphibians have been preserved. The finding of the Castlecomer fossils was a hugely important scientific discovery and attracted many scientists including Thomas Henry Huxley.

Huxley was an important scientific figure at the time and an expert on vertebrate fossils. He had been given the nickname ‘Darwin’s Bulldog’ because of his enthusiastic defence of the theory of evolution by natural selection. On his first visit to Castlecomer he discovered five genera of amphibians which were previously un-described.

Castlecomer Discovery Park ‘Footprints in Coal’ Exhibition

The Castlecomer amphibians form part of the newly opened interactive multimedia ‘Footprints in Coal’ exhibition at Castlecomer Discovery Park. The exhibition uses models, reconstructions, audiovisual and fossils to tell the story of the Castlecomer Coal from the formation of the coal swamps 300 million years ago to 300 years of coal mining history. The park also includes woodland walks, angling lakes, Jarrow Café, gift shop, design craft yard and car and coach parking. Facilities are open seven days a week, all year round. Castlecomer Discovery Park is accredited under the Discover Primary Science Programme and runs a special science programme for primary schools. For further details see our website at www.discoverypark.ie or phone 056 4440707.
RUSSIA! WHY SHOULD WE BE INTERESTED?


So two ladies ‘d’un age certain’ travel to one of the world’s lonely places. Why should readers of an Irish Earth Science magazine be interested?

For starters they are Irish ladies and then it all becomes clear when the author comments that ‘one could go on for pages listing the fabulous volcanic features to be seen, but this would be wearisome…’ In fact, throughout the text, the author couldn’t resist coming back to the remarkable landscape – and far from being wearisome that is what your reviewer liked!

The Kamchatka Peninsula is getting nearly as far east as you can go in Russia. To the south is Japan and if you swim east (don’t try it) you will eventually land in the USA (Alaska). It lies on part of the Pacific Ring of Fire and includes the “Volcanoes of Kamchatka” World Heritage Site. The Peninsula seems to have everything, boiling mud pools, geysers, hot springs, curious lava rock formations, in fact just continuous volcanic activity. How people, animals and plants co-exist in this remarkable ecosystem of ice and fire will make you appreciate all the more the comforts of an Irish homestead.

The book takes the form of a journal with well researched sections on the indigenous peoples, early explorers, the wildlife, including bears and salmon, and much more. It tells you about life there in the past, the present and ends with a section entitled ‘A sustainable future?’

It is wonderfully illustrated throughout. The author has cleverly involved experts to write small sections on aspects where she felt she didn’t have enough background to do them justice. An example is near the start where, for the Earth scientist, it opens with an authoritative chapter by none other than Chris Stillman, Professor and Fellow Emeritus of Trinity College Dublin. After that, the author writes, “Give me your hand and I will take you to touch on an extraordinary country, a place where bears and reindeer roam, where indigenous people live in harmony with nature, a wild and fiery land…”

She takes you on their adventure, so enticingly that after it you might just want to go yourself. If you did wish to follow in their footsteps there is plenty of advice for travellers and the book is of a handy size (about 21 x 15 cm) for the rucksack you will surely need.

It is a travel book with a difference. It goes to an exotic and wild place that is only now opening up after the long years of communism. It will appeal to a geologist for its fire and brimstone but it is written for a general readership. Available at Waterstones, Belfast and Dublin, and other outlets. The author will also supply copies directly (post free) email: dgleadhill01@tiscali.co.uk.

W.B.Davies

The cover is “One of Kamchatka’s Infamous Big Brown Bears in Kronotsky Reserve” by Daisy Gilardini. And the other is “A Fissure Belches Poisonous Fumes in Avachinsky Crater while Kronotsky looms behind” by Sergei Polushin.

Ocean Drilling Workshop in Coleraine

One of the benefits of the changed political climate in Northern Ireland over the last few years has been a dramatic increase in the numbers of Earth scientists of all types and nationalities who are visiting the north of Ireland to view the remarkable variety of geological phenomena that is available in a relatively small area. Most recently the University of Ulster at Coleraine hosted a workshop on ‘Large Igneous Provinces’ held by the Integrated Ocean Drilling Program (IODP), an international marine research program that brings together hundreds of scientists from numerous countries and scientific disciplines to conduct drilling expeditions below the seafloor. This meeting comprised around 80 scientists from 15 countries, ranging from eminent scientists working in the field of geophysics and basalt petrology to graduate students just started on their doctoral studies. The meeting consisted of three days intensive discussion of topics such as mantle processes and the environmental consequences of large-scale volcanic eruptions. All this was preceded by visits to the Causeway, Carrickarede and, you guessed it, the Bushmills distillery. Many of the delegates were in Northern Ireland for the first time and it was clear from conversations throughout the week that many of them were either staying on afterwards to explore the area further, or were intending coming back some time in the future. Meetings such as this, and there are a number of others arranged over the course of the coming year, provide an opportunity to promote this part of Ireland as a venue for field excursions and geology-based tourism - after a prolonged period when many geologists perhaps felt reluctant to visit.

Paul Lyle
WHAT’S ON

Belfast Geologist’s Society

The earth gods certainly smiled on the members of Belfast Geologist’s Society this summer, giving them bright sunshine for most of the events during their series of what were exceptionally interesting field trips.

Three were especially outstanding weatherwise and in terms of numbers – Garth Earls’ Presidential trip to see the diversity of rock types that create the scenery of south Donegal, Bernard Anderson’s wide-ranging exploration of the metamorphic rocks of North West Donegal (both week-end expeditions) and Paul Lyle’s long-anticipated trip to see the metamorphic rocks of North West Donegal (both week-end expeditions) and Paul Lyle’s long-anticipated trip to see the metamorphic rocks of North West Donegal.

In May Laverne Bell of the NI Quarry Products Association took members for an eye-opening look at the modern quarrying industry and its importance to society. In July Andy Jeram led a trip to study the Carboniferous formations around Ballycastle and Murloch and it was back to the north coast in August to hear Bernie Smith describing the problems of managing an actively eroding World Heritage site.

An evening trip in June saw Peter Millar leading a joint BGS-Belfast Naturalists Field Club trip to Islandmagee to see the complexity of limestones, lavas and fossils found there – as well as the fine example of a tombolo at Muck Island.

The programme ended with a trip led by Kirstin Lemon to learn about the features of the karst landscape of Fermanagh and Cavan and their earliest settlers.

The forthcoming programme of winter meetings and talks, to which as always anyone interested will be welcome, again promises to be a stimulating one, although as we go to press it has not been finalised.

The series kicks off in October with Richard Warner revealing the latest findings of his team’s investigations into the source rocks of Irish archaeological gold. On 10th December the Harold Wilson Memorial Lecture will be given by Gordon Herries Davies on Ireland and the Geological Society of London (if you read his ‘North from the Hook’ and newer book on the Geological Society of London you will not miss this). Then the Mournes will be in the spotlight in two successive lectures. Under the title ‘Born in Fire, Shaped by Ice’ David Kirk’s Presidential Address in January will take members on a virtual field trip to see the drama of the mountains, which will also serve as an appropriate scene-setter for February’s talk, when Dr Carl Stevenson will describe the exciting new ideas on how the Mourne granites actually came to be where they are. In March Dr John Nudds from the University of Manchester travels further afield to ‘expose’ the fabulous fossils of the world famous Green River Formation of Wyoming.

These monthly meetings will again be held in the Minor Hall at St Bartholomew’s Church on the Stranmillis Road in Belfast starting at 7.30 pm (with refreshments from 7 pm). Usually they are on the third Monday of the month, but not always.

You can check with Society Secretary Peter Millar – 90642886 or peter.millar@nireland.com. He will be happy to send you a copy of the programme when it is finalised.

David Kirk

TOMBOLO = bar of sand or shingle joining an island to the mainland

A GEODIVERSITY TRAIL

Geodiversity Trail: Walking Through the Past on the University’s Chester Campus
ISBN 978-1-905929-32-0

A work-based learning project led to an important publication documenting the geological heritage of the University of Chester, Chester campus. This 29-page booklet guides the reader around the campus, pointing out both the landscape and the geology. It documents the building materials on the campus, highlighting building styles, and will act as an archive in the event of future development. The very act of documenting geoheritage may prevent ill-considered development in the future. The publication also shows how the campus geodiversity “...the rich variety of rocks, fossils, minerals and natural processes forming our landscapes and soils” influences or underpins the local biodiversity.

From the limestone chippings in the car park to the 20-metre high red sandstone bell turret of the campus Chapel, from the kerbstones to the slate roof tiles, and from the marble pillars to the concrete paving stones, the campus is an example of urban geodiversity. Old and new materials are compared. It is clear how the choice of material varied according to purpose and, depending on the rock properties, was purchased for durability, functionality and/or decorative value.

This production is a joint venture between Chester University, Cheshire RIGS (Regionally Important Geodiversity Sites) and Cheshire region LGAP (Local Geodiversity Action Plan). The collaborative element could serve as a model for documenting our own Higher Education campuses. The text was written by Professor Cynthia Burek, chair of the University Environmental Task Force, together with an undergraduate student from the Geography Department. Cynthia has accepted invitations by the Cork Geological Association and the Irish Geological Association to give guest lectures on Geodiversity in Cork and Dublin respectively, in October of this year. It is hoped that an increasing awareness of Ireland’s geodiversity will be an outcome of the forthcoming International Year of Planet Earth.

Can we learn from this?

The booklet, containing over 50 colour photographs and costing a mere £2, can be purchased from The Environmental Task Force at the University of Chester, or at the forthcoming lectures in October.

Bettie Higgs, University College, Cork
The Irish Geological Association

From its inception about 40 years ago, the IGA has had a membership that is drawn from many backgrounds. Earth History students, complete amateurs and qualified geologists all happily join together in the enthusiastic pursuit of geological knowledge, both Irish and global. Over the years, the Universities and The Geological Survey have been very supportive in providing venues for lectures, while several companies have been most generous in providing core funding.

**Talks and Field trips**

IGA activities include about a dozen lectures a year, on topics as various as “Mineral water vs. tap water”, “Darwin and Robinson Crusoe” (work that one out!), “Will it get hot or cold – and how fast?” and “Mass extinctions – what we can learn from fossil plants”, to name only a very few. Apart from the lectures, about three or four, one- or two-day, weekend field trips per annum are organised to interesting geological locations around Ireland and previous trips have been to places like “The Copper Coast of Waterford”, “The Carboniferous deltaic deposits of S. Clare”, “The margins of the Wicklow Granite” and “Gold Panning in the Dublin Hills, again”, to name but a few. The lectures are given and the field trips are lead by qualified geologists, BUT they are pitched to be understood by amateurs. There is no blinding with science! Up-coming Irish field trips include one in the autumn to the Beara Peninsula on the Cork and Kerry border, while another is planned to see the glacial deposits in the Sperrin Mountains.

**Foreign ventures**

In the last couple of years, field trips have been organised to interesting geological sites outside Ireland. Last year a group went all around Iceland in six days, checking out the amazing volcanics of that ‘hot spot’ ocean floor spreading zone, above water. This year a group went to “The Jurassic Coast” of Devon and Dorset, to see the wonderful array of Triassic, Jurassic and Cretaceous rocks and fossils that are abundant there. Next year’s foreign field trip looks likely to be to Poland.

Once a year, there is a very relaxed ‘Members’ Night’, when all are encouraged to bring in anything geological that’s of interest to them, be it precious specimens or ordinary stones for identification. There are refreshments, a short talk or two on a geological topic and general chit-chat.

New members are very welcome at any time, see advert in this issue.

**Letters to the Editor**

Many communications have been sent, all saying much the same thing. “It is good to have our own magazine back”. Each was greatly appreciated. Thank you for your support. Printed are just two of the longest distance comments:

‘I received the Earth Science Ireland magazine a few days ago….it looks great and an interesting read. It is nice to know what is going on across the way’. Robert B. Rieser, Oklahoma City, USA

‘Congratulations on ES2k’s newly named magazine, which I have just finished reading cover to cover (a unique experience among magazines generally). We found lots to relish…..and the end article “Ancient Monuments & Landscapes” was particularly enjoyable and enlightening. Tom McCullough, Mt. Martha, Victoria, Australia

Tom continued:

Our visit to Beltany Stone Circle on June 2004 posed many questions that Paul Lyle has either answered or intensified in our minds, especially the awareness of there being a distinct ‘sense of place’ at most of the ancient sites in Ireland or, indeed, the UK…. There is also a related impression of ‘significant landscape’ surrounding many ancient Australian prehistoric sites. Contemporary aborigines may claim this placement of sacred sites as being unique to their culture, but only very insensitive people (or mining corporations) would dismiss the almost tangible aura emitted by the selected geological and/or geographical contexts of such locations.

We picture Roma & Tom McCullagh beside the gravesite on Maeve’s Tomb mount.

Earth Science Ireland Magazine

24
Mike Young explains:

Following three years of intensive survey and data processing, the Geological Survey of Northern Ireland (GSNI) has announced a general release of geochemical and geophysical data from the Tellus Project. This is an excellent opportunity for research teams to acquire coherent and complementary datasets for research in the Earth and environmental sciences. Datasets have already been licensed to universities in the UK, Republic of Ireland, USA and Canada.

Natural magnetism and radioactivity

The geophysical results provide new insights into Northern Ireland’s geology, particularly where glacial cover and peat obscure bedrock. This low-level airborne survey operation acquired detailed data on the Earth’s magnetic field, shallow electrical conductivity and radioactivity. The magnetic results refine existing structural mapping, notably by extending the mapping of dyke swarms and delineating regional and local faults. Prominent isolated magnetic anomalies define the Antrim basalts and the igneous complexes. The electromagnetic method mapped shallow variations of electrical conductivity, of both geological and man-made origins. Gamma-ray maps show gross differences in the radioactivity of different lithologies and soils and are being used to improve the mapping of radon potential.

Mineral prospectors activated

These data are a major resource for industry, regulatory authorities and researchers. The results have already prompted renewed interest in mineral prospecting and several companies are already investigating anomalies in gold, platinum group elements and base metals. Consequently, new prospecting permits or applications now cover more than half of Northern Ireland.

Popular presenter at October conference

GSNI will display these results at a conference in Belfast on 17/18 October 2007. The conference, at the W5 science and discovery centre, will discuss preliminary analyses of the data in areas such as mineral and energy exploration, environmental monitoring and management, and animal and human health. Guest speaker at the conference will be Dr Iain Stewart, the presenter of popular TV series ‘Journeys from the centre of the Earth’, who will set the Tellus Project and its results in the wider context of sustainability and management of resources.

For further information about licensing the data or the Tellus Conference, please visit www.tellus.detini.gov.uk or contact Mike Young, Tellus Project, GSNI, Colby House, Stranmillis, Belfast BT9 5BF; Tel 028 9038 8462; E-mail: mike.young@detini.gov.uk.

Environmental and commercial value

In 2006 GSNI completed rural and urban geochemical surveys which covered all of Northern Ireland. Rural areas were covered by three geochemical surveys, of soils, stream sediments and stream waters. Under this massive field programme nearly 30,000 samples were collected and analysed for 55 elements and inorganic compounds. Environmental applications of these geochemical results include baseline mapping of trace-element concentrations in soils and detecting contamination of soils and streams. The data will contribute to compliance with the requirements of EU Framework Directives on soils and water. Trace element distributions broadly correlate with lithologies and reveal anomalies significant for mineral exploration.

Summer jobs for students

As college fees soar so it is essential to do something. Just occasionally you can be lucky enough to get a job that relates in some way to your course. So you get money and useful experience that peps up the CV. The Geological Surveys (GSNI, BGS, GSI) occasionally take on students or other part time workers. These photographs show sampling work being undertaken for the GSNI, who have employed over 50 students in the past few years. Can be mucky, can be fun but must be carefully done and is usually quite hard work.
The Geological Survey of Ireland recently published a guide to the varied granites and related rocks exposed along the northern shores of Galway Bay to west of the city, along with selected inland localities. These are clearly shown on a neat summary map of the whole area on the back cover including the outline geology and main roads. Through the extensive use of black and white maps and grid references it is possible to construct an itinerary from selected points of interest depending on the state of the tide and weather as much as your own priorities and time available. Throughout, the descriptions are illustrated with carefully scaled colour photographs. There is useful information on car parking, access, points of cultural interest and local hazards - a few sites are only accessible around low water and others are exposed, requiring special care during bad weather.

Before details of the localities, which take up two thirds of this 62-page A4 format book, there is a technical introduction. This puts the Galway Batholith in the context of the Appalachian (North America) - Caledonian orogenic belt of mountains that developed during the Palaeozoic as the Iapetus Ocean closed. These granites were intruded, between about 411 and 380 million years ago during the Devonian period, into already highly metamorphosed gabbros and gneisses on their northern margin and greenschists exposed along a small portion of the coast. The distribution of granite types and the nature of their contacts with each other is explained with reference to their mineralogy and composition. In addition to a map showing the main lithologies and structures, there is a schematic block diagram in colour that is quite hard to follow, as some of the unlabelled tones are quite similar to each other. After a map showing the contribution of various geologists to the mapping of the Galway Batholith, there is a series of technical boxes detailing the geochronology, chemistry of the mineral veins, geochemical modelling at one locality, mineralogy and chemistry and, finally, fabrics developed at another site. As this is a Gaeltacht, an Irish-speaking region, there is a useful three-page gazetteer listing the Gaelic place names used in the text followed by their English equivalents and a translation.

While the different localities are clearly illustrated with some fine photographs, including one showing the clear contrast between the darker country rock of Iorras Beag and the Errisbeg Townland granite on the hillside below, the addition of some thin sections would have been an extremely useful aid to understanding granite textures. Apart from the description of Flannery Bridge (Locality 7) which states the last glaciation was ~10,000 years ago, when the present Holocene interglacial started at around 11,600 years ago, there are few other niggles with this well produced guide, which at 20 Euros is good value for money.


David A. G. Nowell, New Barnet, Herts.

Note new closing date for entries

This year prize money is increased to €800. There are two categories, Irish (3 awards) and foreign (1 award).

Details now available at www.gsi.ie

Closing date 12th October 2007

If you are particularly proud of a photograph you took this summer why not enter? At least it is likely to be displayed for others to appreciate and at best it might win.
WESLEY SEMPLE

With the death earlier this year of Wesley Semple, the geological and natural history community of Northern Ireland lost one of its most gifted and perceptive members. Wesley has long been an active participant in the Belfast Naturalists’ Field Club where he was renowned for his botanical expertise. In more recent times, however, he had extended his considerable enthusiasm to the Earth sciences and had become a regular at lectures and fieldtrips organised by the Belfast Geologists’ Society and the Geology Department of the Ulster Museum. It soon became clear that Wesley was now approaching matters geological with the same keen intellect and sharp observation that he had previously brought to bear on natural history in general and botany in particular. Indeed when I noticed that he was in the audience for a lecture I was about to give, or if he was in the car park preparing for a field excursion I was about to lead, I had a mixture of feelings. Pleasure in the anticipation of his company but a wariness to keep on my toes. I knew that at some stage in the course of the event there would be a perceptive comment or a searching question. Since Wesley was not a geologist by training, he was not constrained by the orthodoxies of the subject. So his questions and observations were often from an entirely different perspective from that of professional geologists, leaving us wondering why we hadn’t thought of it that way for ourselves.

However, I was fortunate also to experience Wesley’s talents from the opposite direction. When he wasn’t indulging his natural history interests he was head of Classics at Campbell College in Belfast, and also a tutor to generations of Open University students studying Greek, Latin and the history of ancient civilizations. It was in this role that I had the pleasure and privilege of meeting Wesley on what was in effect his home ground. As he guided our tutorial group through the intricacies of Homer and Plato we saw the formidable scholarship of someone totally on top of his subject, perfectly at ease whatever the topic, with a breadth and depth of knowledge that was quite awe-inspiring. This scholarship was allied to a teaching style that was apparently low-key and under-stated. Yet it left us after a two-hour tutorial wondering where the time had gone and wanting more, surely the mark of all truly inspirational teachers. Wesley’s Presidential Address to the Belfast Naturalists Field Club was particularly memorable. A magnificent exploration of geological aspects of the classical architecture and statuary he was so passionate about studying. It serves as a fitting memorial to the all-encompassing talents and abilities of this remarkable man whose social and academic contribution will be greatly missed by the whole natural sciences community.

Paul Lyle, Chairman, ES2k

MAP REVIEW - DUNGIVEN

The Geological Survey of Northern Ireland has just published a pair of fully coloured maps for the Dungiven district (Sheet 18), County Londonderry. Price £5 or €8 each (Tel GSNI: +44(0) 28 90388462).

Bedrock Map - The bedrock geology shows mostly Dalradian (Neoproterozoic) metamorphic rocks with, to the east around Dungiven and Moneymeaney, a sequence of Lower Carboniferous sediments overlain by Triassic sandstone and Cretaceous chalk exposed at the edge of the Tertiary basalt lavas of the Antrim Plateau. The Dalradian rocks were mainly deposited as turbidite sedimentary flows on the edge of a deep ocean 650 to 550 million years ago and include metamorphosed pillow lavas, limestones and conglomerates. The map (using cross-sections) shows how these ancient rocks have been folded and faulted. The Landscape from Stone section sets out a few clearly written paragraphs on the geological history of the district illustrated with fine photographs.

Superficial Deposits Map - The ‘Drift’ map has a similar introductory text (with plenty of grid references for key localities) that concentrates on the Quaternary history of the area. Interestingly, it shows the extent of artificially modified ground, mainly due to quarrying, and extensive landslides along the edge of the Antrim Plateau. Glacial features such as meltwater channels and kettle holes are also present. A schematic section shows the relationships of the superficial deposits and, notably, there is an innovative visualisation of the Munree Hills meltwater deltas with a superimposed image of the lower glacial lake level in front of them.

David Nowell, New Barnet, Hertfordshire.

SYBIL WATSON

We also said goodbye in April to Sybil, a staunch member of the Belfast Geologists’ Society. She was one half of a husband and wife team, both from Northern Ireland who spent their working lives at the University College of Wales, Aberystwyth. They first discovered pingos in Wales and brought them to international attention. Pingos, our past readers will know, are structures that had formed at the edge of an ice sheet and were described in an article in ES2k, Issue 12, 2006.

Sybil, in her 80th year when she died, spent her later years living outside Belfast near her daughter Barbara. She believed fieldwork lay at the heart of good Earth science and admired the leaders of the past generation who tramped the hills to collect their data. Indeed, no speaker at a BGS meeting could get away with denigrating the work of such as JK Charlesworth if she was in the audience.

Editor
‘Not guilty’ say the Geological Survey, hands raised in horror

‘Certainly not us’ says the Environment and Heritage Service’s top geologist.

This summer hill walkers on Slieve Binnian in the Mournes have been faced with the desecration, pictured here, of one of its most dramatic features, the sculpted grandeur of the North Tor.

Who? Why?

It was inconceivable that it would have been but the guardians of Northern Ireland’s geological heritage have confirmed that it wasn’t their doing.

And following the article in our last issue condemning the action of so-called professionals drilling sampling holes in the Black Head basalt cliffs, it is worrying to have to report on another instance of geo-vandalism.

Now there’s nothing amateur geologists like doing more than whipping out their little hammers and knocking chips off old blocks but this is an altogether more serious piece of work.

To explain. The dark hole in the centre of the picture has been there for maybe 10,000 years. It reveals a magnificent example of a Drusy Cavity (of which more later) which erosion has opened, like the top of a boiled egg being sliced off.

In an attempt to pillage the ‘treasures’ it could contain about 10 half-inch diameter holes were drilled in a circle round it and the rock blown away, either by explosives or compressed air. Either way heavy equipment was involved, pointing to the work of professional gem-dealers seeking the beautiful quartz crystals they expected it to contain. Thankfully they weren’t very successful, blowing off only a few inches depth of granite from around the entrance – but they certainly made a mess.

Is nothing sacred when avarice takes to the hills?

Drusy cavities are ‘fossil’ bubbles formed when the pressure on liquid magma rising from deep in the earth is reduced as it expands into an opening void, which is how the Mourne granites came to be. Gases in the liquid froth out, as happens when you open a tin of beer. As each surge of granite magma comes into contact with cold rock above it starts to solidify, ‘freezing’ the bubbles forever – but creating within each one a space in which the quartz can solidify in the form of hexagonal crystals, sometimes of great size and beauty, either clear or amethyst purple.

The main bulk of Slieve Binnian is formed of what is known as G3 granite. The tors however are the sculpted remnants of a mass of earlier granite, long cooled (called G2) and where they met Drusy Cavities formed. Similarly, the famous Diamond Rocks, near the Hare’s Gap, for generations a mecca for collectors and also recently the subject of the use of explosives, is located where the G2 granite itself intruded against the even earlier G1 which caps Donard and Commedagh.

Those responsible for this unsightly scarring of the Binnion Tors cannot be forgiven but as some consolation their activities have drawn attention to a magnificent example of a rarely seen phenomenon. The cavity is egg-shaped and more than a metre deep and although dulled by thousands of years of weathering and use as a refuge by small animals and birds, its lining of big crystals can be seen. For those interested it is on the west face of the North Tor – GPS co-ordinates J31920/24587 (take a torch).

David Kirk

Footnote – The great are not always good. He wasn’t in it for the money but a century ago the father of Irish natural history, Robert Lloyd Praeger, reputedly made a practice, when leading Field Club members and others on trips to look for crystals at the Diamond Rocks, of arranging for a quarryman to go up a few days beforehand with some charges of dynamite to ‘loosen up the rock’ and ensure no one returned empty-handed and disappointed!
Matthew Parkes, Natural History Museum, Dublin explains:
The widespread and intensive range of road developments across the country frequently generates concern and media publicity about new archaeological discoveries. These are usually made once monitoring of the excavations begins, or may be identified in the preliminary route consultations. It makes a rare exception when a geological site stirs things up for a National Roads Authority (NRA) project. This article is a brief report on just one such site where geology and mine heritage precipitated a detailed study and a proper evaluation before a route selection was made.

Derrylea gets a brief mention in Cole’s Memoir of Mineral Localities and Metalliferous Mines of Economic Importance in Ireland, from 1922, but even then there was uncertainty about what, when and if it had worked. There was talk of lead, copper and even gold, but a search of the historic mine records and the modern exploration data in the Geological Survey of Ireland failed to make things clear. It was with this background that the NRA Archaeologist Jerry O’Sullivan asked the Mining Heritage Trust of Ireland to examine the site.

Mine that never was

Although there is undoubted mineralisation in the area and some lead may have been produced, what emerged is a fascinating picture of a mine that never was. There are two very short adits, each only a few metres long, and a stretch of surface excavations. No sign of a rumoured shaft (perhaps confused with a nearby mine called Derrynea!). These workings have by now been buried under the N59 Galway to Clifden road. The road has been straightened and regraded, and at Derrylea it was in a pinch between the lake and steep hillside, so there were few engineering options. The mine workings themselves were insubstantial and a minor example of a style of 19th century mine that is better represented elsewhere in Galway, including the tourist show mine at Glengowla near Oughterard. Some 60 historic mine sites are known in the county.

Causeway never finished

However, it turned out that aside from the minor excavations on a small zone of stratabound minerals, there was a whole complex of industrial heritage associated with the mine, much of which was not even on the map! A track was shown on the six-inch to the mile map linking the site to the now disused Galway to Clifden railway line. On attempting to follow this it became apparent that it was a causeway across the bog that was never finished – with the middle section being merely a boggy depression. At the railway end, it was the track that predated the railway and continued past the interruption to a processing works based around a waterwheel for power. Even more astonishing was the fact that an adjacent lake had been dammed at its normal outlet and a new channel dug to carry flow to the waterwheel. Although clear footprints and sections of the building, trackway and dam all remain on the ground none appear on the 1839 first edition six inch map, although some lead mining is marked at Derrylea. By the 1898 second edition only the trackway is marked, and not beyond the recently built railway.

Marble Saw Works? Heartbreak!

It was our conclusion that this complex of processing works was probably built in the 1850s, probably to accompany investment in the mine at Derrylea. It would seem that the investors genuinely believed in the value of the mineral resource as serious effort had gone into the construction before it was abandoned. Today the lack of spoil and the unfinished causeway show it was
never used. Its disappearance from common knowledge and cartographic record in the mid 1900s provide mystery and the excitement of rediscovery. One uncertainty remains – the presence of some long linear excavations close to the start of the causeway suggest an alternative explanation that the works may have been intended to be a sawing works for Connemara marble rather than for processing lead ore. In this case it was still an ill-fortuned venture, abandoned before it was completed. Many 19th century mines were speculative gloss designed not to yield rich minerals but rich profits from foolhardy investors in so-called bubble companies. Derrylea was not one of these but may have caused as much heartbreak for the sincere promoter.

A full colour extensive report is available in Conference Proceedings published by the Mining Heritage Trust of Ireland. Contact mparkes@museum.ie or see www.mhti.com for details.

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Of stones and men

Walls;
stitching the patchwork of the human landscape,
their stones resting in crafted beds,
print-outs
that recount the sagas of a world’s long story.

Walls,
defining limits
defining lives,
their stones
coaxed from the living rock
across which they stride
(and on the mountains, soar)
or salvaged from the glacial jetsam.

Walls
to follow - or to stop
and lean upon;
to touch, to feel
and wonder at the past
their stones tell of.
Stories of deep fires
of tectonic jostling,
of ‘dark primordial ocean depths
where life’s remains rained down
to build the stuff of mountains,
of the endless silent sands
of lands without a shore

Walls,
the heritage
of men,
their stones
the heritage of earth.

David Kirk

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Mourne ‘National Park’

The last ESI issue included a short article entitled ‘Keeping a geological eye on the proposed Mourne National Park’. So where is that proposal a few months on?

The draft consultation report has shown that 2298 responses were made to the Mourne National Park Working Party consultation leaflet and a further 79 written submissions had been received. It is stated there had been good attendance at public consultation events. Sidestepping the requested methods of making views known were 3 petitions from a number of farmers from the area.

The Working Party has made it clear that its job is not to recommend whether or not a Mourne National Park should be designated. It will recommend the possible boundary for a National Park, comment on possible management structures and report on the outcome of the public consultation. This will be presented in its final report to the Minister for the Environment this autumn. The decision on how to proceed will then be a matter for the Minister and the Northern Ireland Assembly.

The Mourne Heritage Trust produced, in May, an excellent ‘Position Statement on the Proposed National Park for Mourne’. It is worth going into www.mournelive.com to see it. The Trust believes that a National Park is the most effective and beneficial way forward for everyone, including those involved with agriculture – its view is of an active and ever changing area, not of an open-air museum. ES2k urges the Minister to fully back a National Park and not go for any lesser designation.
In Brief

Two articles recently published by the Journal of the Geological Society, London:

David Chew and John Graham of Trinity College, Dublin with Martin Whitehouse of the Laboratory for Isotope Geology, Sweden have been working on the age of the start of the Grampian orogeny. Using granites from the Lough Nafooey arc in South County Mayo they have used Uranium-Lead (U-Pb) zircon geochronology techniques that provide an absolute constraint on a previously poorly constrained event. It has demonstrated that the arc had encountered subducting Laurentian margin sediments by 490 million years ago. (See Vol 164, Part 4, July 2007, pp 747-750)

Marshall McCabe and Paul Dunlop of the University of Ulster, Coleraine with P. Clark of Oregon State University and D. Smith of Oxford University have revised the model for the last deglaciation of eastern Scotland. Using Carbon 14 dating of marine shells from raised muds they record initial deglaciation before 21,000 years ago. Two younger readvances are described that are similar in age to ice-margin fluctuations from the Irish Sea Basin and northwestern Ireland, suggesting a common response to regional climate changes. The youngest, Perth Re-advance, is correlated with the Killard Point Stadial in Ireland and thus the Armoy Moraine of north Antrim. (See Vol 164, Part 2, March 2007, pp 313-316)

Letter to the Editor

Dune damage

Picked up a copy of this lovely production while in 7 Ely Place. I think it is an important initiative. Do Geologists concern themselves with soft coastline and the terrible condition now of Brittas Bay dune systems? Should there be a sea surge at Brittas Bay then the road to Arklow will be torn away. The little Burnet rose is still surviving but of the Green helleborine there is now no trace.

Quad bikes are an increasing horror on Dollymount and Sandymount Strand; one hears that NPWS would like it if people pushed for legislation about the damage these are doing both on strands and mountainsides.

How do we reach the general public? Do you think the UK might lend us Bill Oddie or someone like him?

Catherine Cavendish

(Editor – We do worry about dune systems as the article on sand dunes in Donegal suggested. It would be good to find an Irish clone of Bill Oddie)
CRUSHED ROCK
Aggregate Potential Mapping

Gerry Stanley (Geological Survey of Ireland) writes:

Over the past ten years the Republic of Ireland’s economy has been transformed. One of the many reasons for this success has been the performance of the construction sector. Its value in 2005 is estimated at some €31 billion representing approximately 17% of the country’s Gross Domestic Product (GDP). Employment in the sector is about 220,000 or 12% of the workforce. Underpinning this huge sector are its raw materials and principal among these are aggregates – the stone needed to construct foundations for our roads and concrete for our buildings and houses.

Uses and users of aggregate

Aggregate material is mostly used in housing, road building and maintenance, industrial/commercial development and other major public capital programmes.

It is estimated, for 2005, that 81,000 housing units were completed which, with an average cost of €280,000, represents a €22bn industry. €1.4bn was spent on national roads, €5.1bn on the public capital programme (schools, hospitals, power plants, sewage treatment plants etc.) and €2.5bn on the retail, leisure, industrial and office sector.

Sources of aggregate

Aggregate comes from stone quarries and gravel pits. Worldwide the principal sources are (proportion of Irish production is given in brackets):
- Crushed rock aggregate (70%);
- Granular aggregates – sand & gravel (30%);
- Marine aggregates (<1%);
- Recycled aggregates (<1%).

Aggregate supply and demand

The Irish Concrete Federation estimates that 134 million tonnes of aggregate were produced in 2005. This level of production is leading to a rapid reduction in reserves among existing suppliers. The vast bulk of the 134m tonnes is used to supply the domestic demand, there only being a small export market.

Using a methodology developed by John Barnett and Associates a forecast of demand for aggregate up to 2021 is shown graphically, using 2005 as the starting point, the latest year for which there are production figures. Future demand is estimated making the assumptions that construction output will fall 0.5% to 10% of GDP in 2018; construction output for 2019 to 2021 will remain at 10% of GDP; GDP growth for 2006 of 5%, 2007 – 4%, 2008 – 3%, 2009 and 2010 – 2.5%, 2011 to 2021 – 2% per annum.

It is estimated that aggregate demand for the next few years will grow to just over 140mt per annum, will then decline, as the proportion of construction output as a percentage of GDP falls to EU levels, until about 2018 when 110mt per annum will be required and then demand will slowly grow again.

Can industry meet this demand?

During the 16-year period 2006 to 2021 just over 2bn tonnes of aggregate material will be required to service the construction needs of the country. What this means in terms of the number of pits and quarries is shown in Table 1.

It is estimated that there are approximately 400 quarries / pits operating in the country with a combined annual output of 134m. There is no accurate picture of the current overall reserves of the operating quarries and pits in the country so it is difficult to be accurate about how many will close and hence need to be replaced with new operations over the time frame being considered. Based on the assumption that 5% of quarries will close every two years the following Table 2 provides an estimate of the number of quarries and production lost every two years. Under this scenario 20 quarries will be lost with a consequent loss of production of approximately 7,000,000 tonnes of aggregate. Therefore new operations with a combined production of this amount of material will need to come on stream every two years. An Bord Pleanala estimate that they have granted planning permission to...
developers for 5m tonnes for each of the past 5 years.

Therefore to meet this increase in number of pits and quarries Local Authorities need to have information available to them to enable informed planning decisions to be made. There will be serious challenges to meeting this demand, such as, adequate reserves, available land, necessary skills, planning permissions, investment and acceptance by local communities. Not all of these issues are geological in nature. However, the Geological Survey of Ireland aims to provide relevant information through its proposed Aggregate Potential Mapping (APM) programme, which is described in the next section.

Aggregate Potential Mapping Programme

It is proposed to carry out a mapping programme for aggregates for the entire country. The output will show in map form the Aggregate Potential in both paper and digital formats with explanatory texts. The APM programme will also provide Local Authorities with a management tool and decision support system, which will enable them to make informed decisions with respect to planning applications for pits and quarries.

COUNTY MEATH EXAMPLE

The end product will be similar to the illustrations of maps for crushed rock and granular (sand & gravel) aggregates for Co. Meath. This will mean producing two maps for each county.

The crushed rock map shows that there is high potential (red areas) in the northwest of the county with more scattered high potential areas to the east and northeast of the county. There is low potential (blue areas) in the south central and in the north central parts of the county.

The highest potential for sand and gravel aggregates is in the east of the county and along some of the major rivers throughout the county.

A National Programme

National development is a countrywide issue and not just for a particular part of the country. The National Development Plan, the National Spatial Strategy, Transport 21 are all national plans or strategies. The Aggregate Potential Mapping programme aims to integrate with these national strategies and plans, so no part of the country should be omitted. The plan is to work on a county-by-county basis, which, given that Counties Meath, Wicklow and Donegal have already been mapped, leaves 23 counties to be completed.

Making the maps

Information needed for the Crushed Rock Aggregate Maps is: rock type, thickness of overburden, existing and historic quarries, deleterious substances, distance from national roads, distance from population centres, and elevation.

### Table 2. Estimate of the number of pits and quarries which need to come on stream every two years in the period 2006 to 2021 to maintain production levels at 140mtn per annum.

<table>
<thead>
<tr>
<th>Annual production</th>
<th>No. of quarries closing every 2 years</th>
<th>Production lost every 2 years (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 5 mt</td>
<td>1</td>
<td>1,250,000</td>
</tr>
<tr>
<td>0.5 - 1.0 mt</td>
<td>4</td>
<td>2,800,000</td>
</tr>
<tr>
<td>0.25 – 0.5 mt</td>
<td>5</td>
<td>1,500,000</td>
</tr>
<tr>
<td>0 - 0.25 mt</td>
<td>10</td>
<td>1,500,000</td>
</tr>
<tr>
<td>Totals</td>
<td>20</td>
<td>7,050,000</td>
</tr>
</tbody>
</table>
INTERNATIONAL YEAR OF PLANET EARTH

Plans are now advanced so watch www.planetearth.ie for details. There is still plenty of time to be involved and everyone’s input is welcome. A programme of lectures, to be held around Ireland and given by international figures, is in preparation. Your support at events will be appreciated and if you haven’t been involved with Earth science events before this will be a good time to start. There is nothing quite like having geology explained by an enthusiastic expert, at a lecture or, even better, in the field. All the amateur societies will be involved and welcome ‘visitors’ without payment being necessary. Yes, they hope to draw you into the fold but they will not be pressuring.

In Ireland, the National Committee decided to particularly focus on six themes during 2008:

- Climate – towards greater understanding of variables forcing climate change
- Ocean – abyss of time
- Resources – towards sustainable use
- Groundwater – that most precious resource
- Hazards – minimizing risk, maximizing awareness
- Deep Earth – from crust to core

The Outreach Programme will be vital in delivering information and explanations to the widest public. The aims of this programme are threefold:

- To generate greater awareness among the public of the wide-ranging importance of the geosciences for human life and prosperity
- To stimulate awareness of the societal contributions of the geosciences within national education systems
- To increase understanding of the societal importance of the geosciences on the part of decision-makers

Activities will include educational materials, competitions, media programmes and Ireland will support international plans for scientists from weaker economies to be encouraged and assisted. Brochures and leaflets explaining the programme will be available digitally at www.planetearth.ie and widely circulated. Organisations and individuals can still submit project proposals or comment on those already suggested.

IN BRIEF

Climate Change Lecture – startling statistics

When you read this the lecture will be over. Even so, some of the statistics given are worth repeating. It was a Royal Dublin Society / Irish Times lecture entitled Global Warming: The Last Word on the Best Science and was given at the RDS Concert Hall on 5th September.

The lecture reported on a thorough assessment of the latest research on climate change science that was completed last February. The Intergovernmental Panel on Climate Change, an international group of experts, made the assessment. The lecturer was the Lead Author of the resulting report, Professor Richard Somerville of the Scripps Institution of Oceanography, University of California, San Diego. Their findings can be summarized by five statistics:

- 0.13C. The amount the atmosphere is warming each decade
- 1.3 times as much CO₂ is entering the atmosphere compared with just 20 years ago
- 3 kilometres. The depth to which the oceans have warmed
- 3.1 centimetres. The rise in sea level each decade
- 90% certain that we are to blame

Keep your eyes open for coastal erosion as sea levels rise!

The Author: Gerry has a BSc in geology from UCD, an MSc in geology from Acadia University in Canada and another MSc from the Camborne School of Mines in the UK - but this time in Mining Engineering. Gerry has worked in the minerals industry in both exploration and as a geophysical contractor. He joined the Geological Survey of Ireland in 1984 where he developed the Survey’s Open File system for its holding of exploration reports. In 1988, he took a career break from the Survey and worked with Arcon at its Zn-Pb Mine in Galmoy, Co. Kilkenny. He returned to the Survey and now heads up the Minerals Programme where he has been instrumental in developing the Survey’s work in aggregates.

Editor
Start of a Journey

My name is Stephen Fullerton and I started to study Earth Science at Glasgow University in September 2006. This is the story of my first year or, I should add, the serious bits!

In my very first lecture we were told the layout of the course and given our timetable for the year. Each week we had three one-hour long lectures and one three-hour laboratory session. The course was split into two modules, 1X and 1Y.

Major Earth Processes

In module 1X we learnt about the major earth processes such as the mechanism of plate tectonics, earthquakes and how they happen, and volcanic eruptions and their causes. Another big part was looking at different minerals and how they form in rocks. It was fun to start with but after spending four months looking at thin sections of rocks I was nearly ready to throw myself out of the laboratory window.

Like most young people I like the spectacular, such as things that go flash bang. So learning about plate tectonics and how it causes volcanoes and earthquakes - which was the primary reason I selected the subject - was an absolute joy. I couldn’t get enough of this side of the course.

We also had lectures on structural geology and on rock formation in this module. The structural geology was sometimes quite hard to get your head around but once I got to grips with the basics the rest seemed to fall into line. I was quite surprised to find that I really enjoyed the part of the course where we learnt about the formation of the different types of rock.

A small part of Module 1X, at the end, was on economic and applied geology. The latter was mainly about coal, oil and gas. I found the economic geology interesting for a while but grew tired of it. At this stage I would rather learn about basic geology and leave its economics until later. On the whole I found the module very enjoyable and in my opinion the best out of the two modules in this first year.

Life on Earth.

Module 1Y started after the January exams and continued until April. It kept us just as busy as the first module. There were lectures on life on Earth now, in the future and in the past. It was linked in with continental rifting, evidence from fossils, Ice Ages through geological time, deltaic and coastal processes and deposits, terrane accretion and event stratigraphy. As you can see the course was fairly packed!

My favourite lectures? Those on terrane accretion and Ice Ages but the best talk of all was on continental rifting. I also enjoyed a very interesting lecture on graptolite fossils during which the lecturer placed a pointed cone on his head and attached yogurt cartons to his arms to represent the nema and theca. Although this may sound a bit silly it was very effective and an image that has stuck with me. It certainly helped me during exams and essays.

The laboratory sessions in Module 1Y consisted of learning how to interpret and draw geological maps as well as studying fossils and the processes of fossilization. Altogether the module was demanding but I also found it enjoyable.

Field trips

There were just two field trips during the year. The first was to Arthur’s Seat and the Salisbury Crags sill, probably the most well known ancient volcanic relics in Scotland. At the same time we visited the exhibition centre called ‘Our Dynamic Earth’. The second trip was to the shore along the Firth of Forth. The rocks along the shore, into which the volcanic rocks have been injected, are sedimentary and show what the area was like when they formed. Swamps, and sluggish rivers, as well as other environments typical of tropical lowlands close to sea-level were demonstrated. Seeing rocks in the field and especially the exhibition brought to life some of the things we had learnt this year.

Examinations

The examination side of the Earth Science course consisted of two written exams, two practical exams and two essays. Not to forget the quiz based on each week’s lectures. The weekly quiz was fun as well as a great help to learning and is done on Moodle (the university’s online learning resource - a virtual learning environment). The exams were stressful and quite difficult - but I guess they needed to be. After the year was finished I was happy to find out that I had been given a B in both modules. I have really enjoyed my first year and it has made me want to go on to study Earth Science to degree level.

I now can’t wait to get back for my second year - for the fun as much as the work.

Stephen Fullerton

Thinking of going to uni? It is not all play.

By the time you read this, the author will be a second-year student at Glasgow University. He will have moved out of ‘Halls’ and into a flat, shared with friends.

He tells of his course work in Earth science during the first year. Stephen’s home is in County Down and his school was the Royal Belfast Academical Institution. Not long ago he would have studied at Queen’s University but then the Geology Department was closed. So Queen’s loss is Glasgow’s gain. He is but one of many school leavers who now have to leave Northern Ireland to qualify with a degree in geology.
GEODIVERSITY MEETS BIODIVERSITY – DONCASTER, ENGLAND

By Scott Engering

It is the geology of the British Isles that contributes so much to the character of the landscape and vernacular building styles that attract countless visitors to these shores. The ever-diminishing presence of this science in museums, schools and universities remains a constant source of disappointment to professionals and amateurs alike. Many people are still keen to know more about the pebble or fossil that they picked up on a beach and now props open a door or takes pride of place on the mantelpiece.

Regionally Important Geological Sites (RIGS)

The county-based RIGS initiative, which started in the UK back in 1990, tapped into this latent enthusiasm for geology. It is therefore encouraging to know that many RIGS Groups still exist, especially since the initiative has largely depended on the enthusiasm of volunteers who were provided with only a very loose brief from English Nature and the Wildlife Trusts. They were asked to identify those geological sites that had not been selected as having national importance but were locally significant for one or more of the following reasons:

1. A full cross-section of geological formations in the area
2. Scientific value
3. Education value
4. Accessibility and aesthetic, recreation and amenity value.
5. Links with other biological, archaeological and architectural interests

Each RIGS Group typically comprises a variety of professionals and enthusiastic amateurs who are all keen to promote the local geology. The quality of the geology and geomorphology in each county has influenced the development of each Group, particularly the interpretation of the best sites and the production of educational material. Perhaps more significant still has been the degree of support from Local Authorities, government agencies and associated environmental organisations.

In South Yorkshire, apart from the western margins that fall within the Peak District National Park, the geology is not obviously spectacular. After the last phase of RIGS surveys were completed in 1997 a handful of the very best sites were identified for further interpretation. All the RIGS were incorporated into their respective Unitary Development Plans but subsequently Local Authority support tailed off.

As often happens with voluntary organisations, the success of the RIGS Groups is dependent on the commitment of a few core members. Once the input of one or two key committee members is withdrawn the group can fail. Locally, the production of the popular Anston Stones Wood Geological Trail in 2000 coincided with the demise of the RIGS Group.

In recent years, the further development of Geoconservation initiatives and the production of a growing number of Local Geodiversity Action Plans has largely taken place in areas with active RIGS Groups. Some have succeeded in obtaining external funds for the work (especially the Aggregates Levy Sustainability Fund). Some of these groups have evolved into thriving Geology Trusts that have received the full backing of Local Authorities, often working in partnership with neighbouring counties.

Without the real structure of good solid legislation in force, even RIGS groups in those counties that possess some of the most spectacular geology have simply floundered; this includes some that fall within the boundaries of National Parks, where wild landscapes are tourist attractions in their own right.

Having resigned myself to the fact that all the good work with RIGS in South Yorkshire had stagnated, I was extremely pleased, in the early part of 2006, to receive a wide variety of Government documents and guidance notes to inform me that Planning Policy Statement 9 now required Local Authorities to fully take...
Doncaster was particularly concerned that if challenged as part of the planning process the criteria used for the existing RIGS designation would not stand up to close scrutiny. This is not surprising, knowing that the original RIGS survey was based on information provided by enthusiastic amateurs in their spare time and not by dedicated professionals.

The Doncaster Geodiversity Audit was put out to tender with the strict proviso that the contractor should possess professional indemnity and public liability insurance cover, have field surveying skills, geological expertise and an ability to supply information in a compatible Geographical Information System format. The British Geological Survey won the contract to undertake the work.

Since 2003, the British Geological Survey has been directly involved in over half the Local Geodiversity Action Plans produced or currently in production. These include those for the Northumberland National Park, the Yorkshire Dales, Co. Durham, West Lothian and the North Pennines Area of Outstanding Natural Beauty.

The British Geological Survey, as well as bringing in its professional experts, employed the author on the contract. I had been a key figure in the development in the RIGS initiative in South Yorkshire and its principal surveyor. My local knowledge was important for meeting the strict timetable for the work laid down by Doncaster. Full details of the BGS geodiversity report are available through a “Geodiversity” search on the Doncaster Metropolitan Borough Council website but this formal document does not tell the whole story.

The main reason for the perceived deficiencies of the original RIGS designations were the lack of financial support and official direction afforded to their characterisation. The RIGS Group did the best it could under the circumstances but the fact remains that, once the time of the Local Authority officers was taken out of the equation, the entire budget for the survey and selection of RIGS in South Yorkshire equated to a sum that a professional practice would charge for just a few weeks of work.

I surveyed for RIGS in Doncaster during 1997 and selected the 26 most important sites from a total of nearly 200 potential sites. The original work, however, compared with the current study, might be described as “amateurish” by current commercial standards. Working with Hugh Barron from the British Geological Survey in Edinburgh and with the benefit of its resources, including datasets, I had the opportunity to complete my part of the project to a very professional standard.

It is to the credit of Doncaster Metropolitan Borough Council that it is fully aware that, whilst the recent Geological Audit has greatly reinforced the evidence base for its Local Development Framework document, there is still plenty of work to be done. Significantly, amongst others, the environmental and minerals planners, biodiversity officers, museum curators and archaeologists now acknowledge the importance of the geology. They are keen to be represented, alongside quarry operators and government agencies, on the steering group for their Local Geodiversity Action Plan.

Photographs by the author, copyright Doncaster MBC

The Author, Scott Engering, co-authored the BGS report on the Geodiversity of Doncaster. He produced a Teachers Information Leaflet - Building in Stone, for use at English Heritage Properties in Care. He is a building stone consultant, designing and creating the Triton Building Stone Library. He briefly worked for the Geological Survey of Ireland on the survey and designation of Natural Heritage Areas and County Geological Sites. He is an innovative freelance photographer and currently lives in South Yorkshire.
Then across to Cavan and the source of the Shannon

The next phase, already underway, is the plan to expand the Geopark across the international border with the Republic of Ireland, into West Cavan. Again, this is a logical step as much of Cavan shares the same Carboniferous-age geological heritage as West Fermanagh. In fact, one of the landmarks of the current Geopark, Cuilcagh Mountain, is cut in two by the international border! Sites such as the Shannon Pot, the reputed source of the River Shannon, and the Burren Forest, one of the richest archaeological sites in this part of Ireland, will all be included. These sites add folklore and archaeological interest to the geology, highlighting the important link between the landscape and people.

Transnational Geopark expansion will not happen overnight, but work is ongoing between both Fermanagh District Council and Cavan County Council to try and deliver a Geopark of the highest European standards in the very near future.

**The expansion is being assisted by the cross-border tourism initiative, Bréifne.**

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**Kirstin Lemon, Geopark geologist, tells us:**

Marble Arch Caves have come a long way since they opened to the public in 1985. The opening of Cuilcagh Mountain Park in 1998, receiving European Geopark status in 2001 and then Global Geopark Status in 2004 are just some of the current size, involving a multi-phase process that is anything but simple and straightforward.

**Local expansion includes oldest rocks**

The first phase of the expansion is into other parts of West Fermanagh, a logical step as much of this area shares the same Carboniferous-age geological heritage as the current Geopark. Major Fermanagh landmarks such as the Cliffs of Magho and Knockmore Cliffs, and more hidden landscape features such as Boho Caves and Coolarkan Cave will be included within the expanded Geopark. Other features, however, such as Derrin Mountain on the northern shoe of Lower Lough Erne, will be an interesting contrast. Its Precambrian-age metamorphic rocks are amongst the oldest in the north of Ireland and will add greatly to the Geopark’s geological portfolio!

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Now, 22 years later, perhaps the biggest change of all is taking place – Marble Arch Caves European Geopark is going transnational! The Geopark is planning to expand to more that 10 times its milestones that have been passed along the way.

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**Cuilcagh holds extensive upland blanket bog**

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**Lower Lough Erne**

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**The Calf House in the Burren Forest is an example of a portal tomb**

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**Earth Science Ireland Magazine**
IRELAND’S SHIPWRECK HERITAGE

Enda Gallagher reports on an unusual aspect of the Geological Survey of Ireland’s marine survey work:

Ireland’s location at the eastern edge of the mighty, often frighteningly so, Atlantic Ocean ensures that we have been exposed to marine tragedy on a scale much greater than many other countries around the world. The seabed surrounding our coastline is littered with the wreckage of several thousand ships and boats that made their final, tragic journeys in these waters over the last century and a half. Countless other journeys met similar fates in preceding centuries but the bottom of the sea is an unforgiving place and no traces remain of countless older accident-stricken vessels.

A project under the framework of the state’s marine mapping programme – INFOMAR – has been attempting to shed some light on the existence of some of these wrecks that have been identified using sophisticated acoustic technology.

INFOMAR is the current phase of Ireland’s marine mapping programme and is a joint venture between the Geological Survey of Ireland (GSI) and the Marine Institute. Planned over the course of several years the project finally came to fruition in 2006 and has delivered a comprehensive report early this year. Stuart Bennett of GSI, at a recent INFOMAR seminar in Dublin outlined the work and how he compared his findings with wrecks databases operated by NMS and the UK Hydrographic Office (UKHO).

The locations of a total of probably 233 wrecks had been detected and the project “has revealed the existence of an additional 71 wrecks previously unknown to any wrecks databases covering the project areas.”

The technology involved in the seabed mapping is acoustic in nature. “Multibeam” sonar data are collected along parallel survey lines.

Once Stuart had identified a probable wreck from analysis of the multibeam data it was matched, where possible, with wrecks from the databases mentioned above. Out of the 233 wrecks he was able to confirm the names of 64 wrecks and he said that many more wrecks are confirmed but their names are uncertain. Examples are shown of high-resolution imagery of wrecks on the seafloor.

Disappearances of vessels at sea generate huge media and public interest. Some of those that made big news at the time include the Lusitania, a Cunard steam passenger liner and also a protected wreck, which was sunk off the south coast of Ireland in 1915 by a German submarine. This cruise-liner plied the Atlantic route, ferrying up to 2000 passengers between New York and Liverpool, in a journey of about ten days. It had done over 100 such return journeys when, on 7 May that year, it was sighted and attacked by a German U-boat in the Celtic Sea, south of Cork. The damage caused by a single torpedo was compounded by a large on-board explosion immediately afterwards and the vessel sank in 20 minutes with the loss of almost 1200 lives.

The circumstances surrounding the sinking of the Athenia and Leinster are also particularly tragic. The former was a large passenger liner, mistaken for an armed merchant cruiser, and became the first civilian casualty of World War II. She lies some 380 km to the west of Ireland. The latter’s sinking in 1918 is one of Ireland’s worst maritime disasters. Built in 1896, the RMS Leinster served as the Dublin–Holyhead mailboat, as well as a passenger ferry. On 10th October 1918 she left Dun Laoghaire headed for Holyhead with 771 people on board. About 25 kms east of Dublin she was torpedoed without warning by the German submarine, U-123. Out of the 771 people on board 500 lives were lost. Her sinking, just weeks before the end of the war, was the greatest single loss of life in the Irish Sea.

Another tragic incident occurred 20 miles off the coast of Donegal in 1942 when the Curacoa was literally split in two in a collision when she cut across the path of the Queen Mary in chase of a German submarine. The Curacoa was a British light cruiser that escorted convoys across the Atlantic during WWII. Whilst escorting the Queen Mary passenger liner, NW of Bloody Foreland, carrying 15,000 American troops to England, the Curacoa’s lookout reported a submarine on the port bow. In pursuit of the U-boat, the Curacoa crossed the Queen Mary’s bows with insufficient clearance causing the two ships to collide, cutting the Curacoa in two. The Queen Mary did not slow down, fearful of U-boats. 338 men aboard the Curacoa died and just 26 survived. Today the two parts of the wreck are clearly visible lying about 500m apart on the seabed.

Both GSI and NMS are keen to stress that shipwrecks are usually protected archaeological heritage structures under Irish law. Many thousands of people have perished at sea and the shipwrecks are their graves. As such they must be respected at all times.
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