IN THIS ISSUE:
Iceland
Book reviews
Primary schools
Kerry journey
Yates collection
Rock Star
And more ....
EDITORIAL

It has been quite a summer and autumn. All sorts of natural disasters around the world, some being attributed to climate change, and the hunt for minerals of all sorts stepping up as the demand steadily increases. Yet mining companies shares drop and prices at the petrol pumps plummet. Maybe it has ever been thus with more instant reporting these days giving things a different complexion than in the past and the economic cycle of ups and downs….continuing up and down!

We have definitely hit a ‘down’, as warned in my last editorial. The funding from the Northern Ireland Environment Agency has been withdrawn, we would like to think temporarily but…. As we scramble to keep the magazine and other initiatives going I must first pay tribute to the Environment Agency. It, in the then guise of the Environment and Heritage Service, started sponsoring the ES2k Magazine in 2002 with Issue 6 that featured Seamus Heaney on the front cover (a 12 page issue). That major sponsorship has gone on until now. I like to think we have given good value for money as we all operate on an entirely voluntary basis but mostly that we have helped spread the word about the fine work that agency has been carrying out.

A big thank you to the Northern Ireland Environment Agency.

On the ‘up’ side we are keeping going albeit, because of the debate about the future, with an unusually late issue and of reduced size. This means some articles that I chased authors for have been held over until the next issue. Sorry to those authors but their efforts are greatly appreciated and the articles will be included next time.

This issue reports on an especially important initiative for the Northern Ireland Primary schools. It also highlights the great teaching at the only two secondary schools now entering geology exams. I opened by mentioning natural disasters and the hunt for resources. It still surprises me that a country which has such unusually varied rocks that reflect those disasters and resources has so little teaching of geology at secondary level and virtually none at tertiary, university, level. That is why this magazine will try to keep going and is looking for another one or two major sponsors.

Acknowledgements


The views expressed in the magazine are those of the authors. All rights reserved. Permission to reproduce, copy or transmit all or part of the publication must be obtained from the Editor.

Tony Bazley, Editor, Earth Science Ireland, 19 Inishanier, Killinchy, Newtownards, Co Down BT23 6SU Email: rbazley@btinternet.com
Bob Dickey reports

The Primary School initiative was previewed in Issue 15 of this magazine and in Issue 17 (p.18) we promised a fuller article. It is matter of great joy to report that it is now virtually complete.

This project is about the use of Earth Science topics as the basis for the development of lessons and materials which can be used in the ‘World Around Us’ theme within the Northern Ireland Curriculum. This theme encapsulates Geography, History and Science but there is a strong perception among many practicing teachers and principals that Science has become marginalised.

Over the last eighteen months a working group of three teachers has worked on the design and content of materials which put Earth Science topics at the very centre of the delivery of some of the statutory requirements of the ‘World Around Us’ theme. As expressed in the documentation the intentions are less than fulsome. Somewhat vaguely, they refer to such things as ‘Changes over time in places’, ‘the causes and effects of energy, forces and movement’ and ‘Ways which change occur over both the short and long periods in the natural world.’

It goes without saying that such aspirations resonate with every Earth Scientist but teachers in many cases lack the background and the detail to comfortably fulfil and deliver these intentions. The materials have therefore been designed not only to provide lesson content for children but also sufficient background to inform, facilitate and engender confidence in teachers who may themselves be less than familiar with the concepts and content.

So what has been done to address this situation? With help and guidance from professional geologists in Geological Survey of Northern Ireland (GSNI) a comprehensive suite of materials has emerged. It is probably best encapsulated in tabular and item format rather than in text.

Table: Overall Structure of the Package

<table>
<thead>
<tr>
<th>Planet Earth</th>
<th>Dynamic Earth</th>
<th>Violent Earth</th>
<th>Future Earth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rock observation</td>
<td>Rock breakers</td>
<td>Plate tectonics</td>
<td>Rocks in our lives</td>
</tr>
<tr>
<td>Rock properties</td>
<td>Rocks on the move</td>
<td>Volcanoes</td>
<td>Fossil fuels</td>
</tr>
<tr>
<td>Rock Types</td>
<td>Environmental impacts</td>
<td>Earthquakes</td>
<td>Renewables</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Environmental impacts</td>
<td>Water</td>
</tr>
</tbody>
</table>

- The fourteen lessons have been set out to reflect the generally accepted structure and teaching methods which are now regarded as best practice in curriculum delivery.
- Lessons have sufficient background material to inform teachers and a full glossary of all the scientific words and terms is appended.
- Nearly all the lessons have resources for teachers’ and children’s use - worksheets etc.
- A wallet is being provided and contains all the printed lessons and an enclosed CD has the entire package of lessons and resources in digital format.
- All the Education Regions - formerly called Boards - have agreed to distribute these wallets to the 830 Primary School Principals.
- Rock kits containing 9 main rock types are being provided to 16 host centres - mainly primary schools - and the kits will be available for borrowing and return to the host.
- All the lessons and resources are available on the Northern Ireland schools computer network, C2K, and this gives teachers direct access for use and illustration in the classroom.
- C2K also hosts 4 Fronter Rooms which were designed by the teachers in the working group and these contain interactive materials which children can access in the classroom and at home.

C2K is a vital provision as it complements
the growing use of e-learning and Esther Woodhouse from the C2K Curriculum Team explains the background:

‘As part of the Education Network Northern Ireland (ENNI) contract, C2k has enhanced the eLearning provision for all DE-funded schools. This includes new tools such as a virtual learning environment known as ‘Fronter’ and a digital resource known as ‘Equella’ which hosts the lessons and resources, a Collaborate web conferencing facility and a redesigned Newsdesk. These eLearning Services are available 24/7 to teachers, support staff and students across Northern Ireland.

C2K is delighted to make the Earth Science Primary Lessons and Resources available to teachers in digital format via the Equella digital library and enhanced by the interactive options in Fronter. We believe that the 14 lessons, background material and accompanying worksheets will prove invaluable to teachers wanting to develop their World Around Us provision.’

Jody Marshall, one of the teachers who worked on the materials emphasises the valuable role of Fronter:

‘Children can use Fronter to collaborate using online discussions and they can take part in quizzes to test their knowledge. Pupils can also upload work on a topic for teachers and others to see and comment on. Fronter is available in all schools which use the C2k system and it can also be accessed at home via the My-School portal by pupils using their C2k username. This allows teachers to set homework tasks based on classroom topics and the children can upload their work to Fronter.’

Space precludes the inclusion of a series of pdf files which copy specimen pages from the actual lessons and it is hoped to include these in a future issue of the magazine. We do show some ‘samples’.

In the meantime we are looking forward to seeing the package bedding into schools and enhancing the delivery of a broad range of Earth Science topics.

Bob Dickey is Chair of Earth Science Outreach and a committee member of Earth Science Ireland which is proud to have played a prominent part in this initiative.
ENQUIRY FILES 7

In this series in the magazine in each issue we can highlight some of the oddities of the geological world, brought to light by ordinary people in their lives and travels, and brought into museum curators for identification.

A trilobite - but which one?

A more obvious type of identification was brought into the Natural History Museum recently by Mr Bernard O’Keeffe, of Brownstown, The Curragh in Co. Kildare. He found it while walking through an old sand pit and it appeared to have been disturbed to the surface by rabbits burrowing. Whilst it was clearly a fossil trilobite, and a very nicely preserved one at that, I did not immediately recognise it. It was largely complete and represents a dead animal, rather than being a moulted part of the exoskeleton, as many trilobite finds are. It is 32mm long. The lithology of the rock was not that of the Ordovician Kildare Limestone, which has a good documented trilobite fauna, but rather a decalcified mudstone with a scent of Carboniferous about it.

So I contacted a real trilobite expert, Dr Bob Owens in the National Museum of Wales, for advice.

Bob came back with good news: ‘A very nice specimen of the Carboniferous trilobite Phillibole, and it resembles closely P. polleni from the late Holkerian Pendleside Limestone Formation of the Clitheroe district. Phillibole is characteristic of deeper water facies, and the lithology seems from the photos to be similar to the calcareous mudstone in which specimens of P. polleni are preserved. I do not know the Irish Carboniferous well enough to be aware if a similar facies is present in the area from which the specimen originates, but it is the first Phillibole I have seen from anywhere in Ireland.’

So Mr O’Keeffe has found a first for Ireland and so too could anyone reading this – that is the fascination of geology – it is all around us and open to all.

ENQUIRY FILE 6 – RESPONSES

Several different people responded on the identity of the knobbly object featured in Issue 16. Thank you to all of them. Thanks very much to Andrew Taylor of the RPS group in the UK for the answer to the enquiry: it is an unusual example of a nodule forming around two Thalassinoides burrows. These are three way branching crustacean burrows which have at the junction of the split a swelling (turning circle) which is often cemented later. These burrows occur in marine sediments.

Matthew Parkes (mparkes@museum.ie)

AWARD – SARAH CAVEN

It is a delight to record the success of one of our, Earth Science Ireland, committee members. Sarah Caven has been awarded the 2015 Early Career Geologist Award of the Geological Society. She entered through the Northern Ireland Regional Group of the Geological Society. The final was held last April at Burlington House and was hosted by Paul Maliphant, Development Director, Mott MacDonald Ltd. The finalists each made a presentation describing their careers to date with Sarah’s talk being titled ‘Exploring Ethiopia – gold, copper and camels’. A memento of the achievement was presented to Sarah by Edmund Nickless, Executive Secretary of the Society.

Sarah comes from County Down and graduated with a Master’s degree from Leicester University in 2009. She has spent the last 4 years working for a mineral exploration company in Europe and Africa. Previously she worked for short periods with the Geological Survey of Northern Ireland and the Geological Survey of Canada. We know that Sarah is interested in the education of young people and look forward to her being able to contribute to the aims of Earth Science Ireland. Maybe she will find time to write for the magazine. In the meantime we offer our sincere congratulations.

Photos: by Liz Pedley, courtesy Geol. Soc. London
ICELAND – my experience

By Matthew Parkes

I was lucky enough to attend the 8th International ProGEO Symposium held in Reykjavik last September. ProGEO is the short (if obtuse – Editor) name for the European Association for the Conservation of Geological Heritage and the topic was ‘Geoconservation Strategies in a Changing World’. I presented two papers (both jointly authored with Sarah Gatley of the Geological Survey of Ireland’s Geological Heritage and Planning Programme) on the Irish take on two of the symposium themes. In the first thematic session ‘How to secure the integrity of geosites under threat?’ we presented on ‘The selection of and characters of a geosite – examples from Ireland’. This summarised our current county based approach in Ireland. The second talk was in a final thematic session on ‘Is mining and quarrying compatible with geoconservation?’ Here we presented on ‘Quarrying and geoconservation in Ireland – the value of Guidelines for operators’, based on some recent evaluations.

The status of the symposium in Iceland was such that the opening address was by the elected President of Iceland, Ólafur Ragnar Grímsson, now in his fifth term since 1996. In a thoughtful and inspiring talk he considered how the Judaeo-Christian view of Genesis in the Bible has influenced western European thinking on geological heritage. He discussed how, in Iceland, until recently, storytelling and poetry was the foundation of which places mattered, e.g. mountains and waterfalls, and which didn’t. However, landscape without a name is worth something.

A striking anecdote to precede the volcanic geology we would see on the fieldtrip afterwards, was his response to an offer of help from the American top military chief in 1996, when Grimsvötn erupted under the Vatnajökull ice sheet, that all the might of the US military couldn’t do anything against a major volcanic eruption.

His main point to conclude was that the big cultural deficit in how people see the planet Earth is an obstacle as big as any other bureaucratic ones to progress in geological conservation. Iceland, with tourism becoming its prime economic activity, is now a test case for this – how to preserve the wilderness in the face of a global tourism expansion.

Following the symposium, I was fortunate to see some of the geology of the volcanic zone of Southern Iceland – led by Icelandic experts, and in a four wheel drive bus that could negotiate the rough tracks that are Iceland’s roads in the interior. When you are in a wilderness area with no services or even habitations for hundreds of kilometres, it is not something to treat lightly.

Nearly every visitor to Iceland visits Pingvellir, where the Mid-Atlantic Rift is expressed at the land surface in a fault graben and you can almost stand with one foot on the American Plate and one on the European. Of course it is not quite as simple as that when the geology is looked at in detail, but for almost anyone the evidence of crustal spreading is right in front of your eyes. Indeed, this is the overwhelming characteristic of Iceland, with tourism becoming its prime economic activity, is now a test case for this – how to preserve the wilderness in the face of a global tourism expansion.

Pingvellir, site of the earliest Icelandic Althing (open air assembly parliaments), is part of the Atlantic Rift valley, and this fault scarp in basalt flows is a visible sign of crustal spreading.
Icelandic geology – it is so ‘in your face’. Without any significant vegetation over large areas the interplay of subglacial and subaerial volcanic eruptions with subsequent river and glacier erosion is so easily seen and read in the landscape. Many times in Ireland I have thought how much easier it would be to interpret the geology without all the biodiversity and glacial debris in the way. Iceland allows you to do that.

The other big contrast that was quickly explained to us was the big difference in landforms produced by volcanic activity under ice sheets compared to sub-aerial eruptions. Each situation produces its own suite of classic volcanic landforms, which we quickly got to recognise. Linear fissure eruptions under ice produce a narrow ridge of hyaloclastite (broken up volcanic debris formed by interaction of eruption into ice or water) called a tindar. An eruption from a single point under ice produces a landform of the same material called a tuya. These deposits gave rise to large areas of volcanic desert with no vegetation. There are extensive areas of these palagonite deposits, where the basalt eruption into water or ice has created volcanic glass which then alters into palagonite.

Subaerial eruptions can produce massive lava flows and as we drove around you could see transitions from one to another, with most dated to specific historic or dated eruptions. The surfaces of most lava flows I saw were generally the highly broken-up aa-lava type, with fissures and rubbly tops. Pahoehoe or ropy lava was much less common. In many parts of Iceland, moss grows well on the lava flows and they can become an intense green colour in the landscape.

Befitting a geological conservation conference, the impact of humans on this often pristine landscape was the topic of many conversations. Despite a ban on off-road driving, the need for 4-wheel drive vehicles in the interior means that any Top Gear-loving-Turkey can leave tracks where they shouldn’t go, and many were evident. There is no active process that removes them and they scar the landscape. The major conflict between those wanting to exploit the hydro-electric power potential (solely to power aluminium processing plants) by damming large parts of the National Parks and volcanic interior, and
those aiming to protect the wilderness was also a critical concern. At least in Iceland there is some strategic national approach from politicians, to assess and decide on the merits of each site, within a framework, rather than the adhockery that might apply in Ireland based on narrow local interests.

Abundant geothermal energy is an obvious feature in Iceland and visible symptoms of this are sites such as Geysir, where dozens of fumaroles bubble and steam away in a powerful reminder of the volcanic heat below the surface. Water, heated and superheated, spouts up in geysirs that attract hundreds of thousands of visitors. Elsewhere many swimming pools use geothermally heated water, but for me one highlight was bathing in a wild pool, as hot as you could stand, at the base of large lava flow at Landmannalaugar. I can only strongly recommend a visit to Iceland if you have an opportunity to go. It is a magical place.

Letters to the Editor

As always, it was a pleasure to receive the latest copy of Earth Science Ireland – I always find something to give me a few ideas of how to continue with my own interests in geology.

I haven’t had much reason to be writing articles lately, but I have been busy with various Blogs, including the Language of Stone, which describes various geological projects and related interests. As my time with the GSI was both one of the most enjoyable experiences I have had, both professionally and personally, I decided to write a series of posts about my experiences (27 in total!). Here is the link to the introductory post: http://thelanguageofstone.blogspot.co.uk/2015/03/the-geological-survey-of-ireland.html

Scott Engering

[Readers will find this link interesting so it is worth a look. Scott is a brilliant photographer as his articles for ESI have shown. Editor]

A cousin of mine picked the ESI magazine up in her local library for me, not knowing that I already get them. She is not a geologist, but has been in Greenland, so the cover attracted her notice.

My mentors include JKC (that dates me!), Bernard A, Ian M, Jack P - and Joyce for what grows on rocks, Philip D, Peter M and very many other inspirational people, so I love to read about them and remember their lectures and field trips.

Elisabeth Henry

[I print this letter partly to give an apology to many members in Northern Ireland who have recently been getting their copies late or, for a couple of earlier issues, never. Elisabeth very politely wrote wondering why she hadn’t had her copy and then it arrived! Editor]

I’ve completed reading the Barry Long article on climate change. It was refreshing to hear an argument from the other side.

From all that I have heard and read there does seem to be climate warming. I have seen evidence of this when visiting the Chamonix valley a few years ago. A glacier that flows into the main valley is very much reduced; the surface now is many tens of metres (perhaps a lot more) below from where it was in the early 1900s. There are plaques marking where the surface was over the years, the reduction is quite frightening.

No one likes change and climate change threatens us all. For this reason I hope I’m not clutching at straws when agreeing with Barry’s assertion that man’s activities are not affecting the climate. However, the measures that are being taken to reduce CO2 and other gas emissions should be rigorously pursued. Obama’s recent announcement on emission reduction is long overdue. This should lead to the developing counties to follow suit. Our carbon resources are much too valuable to just burn.

Efficient renewable energy sources must be developed asap. Barry’s assertion that scientific evidence suggests that we are entering a new glacial and life in the temperate zones (Ireland) will be brutal is more scary than the warming scenario. The loss of so much agricultural land to cold conditions would mean food production would have to be within protected areas warmed perhaps with the conserved fossil fuels.

More research is needed for the reverse of the popular opinion on climate change. Let’s not go forward with a blinkered view.

Dennis Hawke
In the last two decades a novel method of studying fossils without destroying them has been available through the technology of CT scanning. From the resultant images a 3D rendering of the entombed fossil can be produced. Similarly, such images and thus reconstructions can be obtained through serial grinding of the specimen through tiny increments at a time and photographing the flattened image at each stage. In the early 1900s an advocate of such ‘cutting edge’ technology was William Johnson Sollas (Figure 1) who with his daughter Igerna illustrated the skull of Palaeospondylus a Devonian larval lungfish.

Sollas was born in Birmingham in 1849 and studied at the Royal School of Mines London and then in Cambridge where he graduated with a first class degree in 1873. His abilities were recognised early on by his appointment to the chair of Geology and Zoology at Bristol only six years after graduation. There he specialised in the study of fossil sponges and became the leading expert in palaeoporifery. He also described a new plesiosaur species that is now the type of Attenborosaurus.

Although Sollas lived much of his long life in England, he spent a period of fifteen years between 1883 and 1897 in Ireland. As Professor of Geology and Mineralogy at Trinity College, Dublin he was at the height of his intellectual and creative powers, and during this period he was elected a Fellow of the Royal Society. He largely abandoned his sponge work, but diversified, and was later described by an obituarist as being “distinguished for his versatility and brilliance”.

He mapped out the distribution of eskers in the midlands, described trace fossils from the Bray Group, erecting a new ichnogenus Pucksia from Howth, wrote on glacial deposits of the east coast with Robert Lloyd Praeger, and provided detailed petrological analyses of the Leinster granites. He presented the College with a plaster case of his marine reptile and recently this has been restored and is now on display (Figure 2). This cast along with similar casts in Oxford and London are significant in that the original became a victim of the blitz in the Second World War. For a period he was also employed in a part-time capacity as a petrologist for the Geological Survey of Ireland.

While we don’t have a record of his teaching ability, clearly one student was not impressed and scratched a derogatory remark on a display case in the Geological Museum!

In 1896 he led a Royal Society expedition to the Pacific atoll Funafuti in order to determine its geological foundations. The goal was to drill through the coral reef into underlying successions to test Charles Darwin’s contention that atolls encircled former volcanic islands. Unfortunately the two borings only reached 72 and 105 feet respectively before being abandoned and bedrock reached, and so Sollas failed to reach any conclusion.

On leaving Trinity in 1897 he took up the Chair of Geology at Oxford and remained in post until his death in 1936. There he launched into anthropology, but subsequently was falsely accused of perpetrating the Piltdown Hoax. In 1913 a skull was discovered in a gravel pit in Sussex, and the scientific community was enthralled: up until the 1940s the general public were fed literature and books with titles such as The Earliest Englishman! Later in the 1950s it was demonstrated that Piltdown Man was simply stained human cranium fragments, a canine tooth, and a modified orang-utan jaw. Sollas had no part in this deception. Between 1908 and 1924 he oversaw the translation, by his elder daughter Hertha, into English of Seuss’ monumental work Das Antlitz der Erde [The Face of the Earth].

Sollas had a keen intellect, a capacity for debate, and an impatience to get meaningful research completed; he made an indelible mark on Irish geology during his brief sojourn of a decade and a half.

A geological journey through North Kerry on the Wild Atlantic Way

by Gosia Shaikh-Horajska

To date there seems to be little published about the north part of County Kerry. This journey takes us on the Wild Atlantic Way; from the cliffs of Ballybunion, through the Old Red Sandstone (Devonian age) rocks of Kerry Head to Waulsortian limestone in Fenit. During ten stops, including some geological heritage sites, you can explore an amazing world of minerals and rocks set in beautiful scenery. Why not follow in my footsteps?

Site No. 1. Bromore Cliffs – “Wavellite”

The cliffs were a subject of William Ainsworth’s study in 1834 when he wrote a book “An Account of the Caves of Ballybunion”, describing the cliffs in great detail. Unfortunately, nowadays most of the cliffs are inaccessible from the land. At Doon Point (“Fossil Point”), in the black shale beds, specimens of goniatites were discovered during field work. North of that point is a bay called “Copper-mine Bay”, visible from Bromore Cliffs, with a syncline of black shale exposed where copper mineralization can be seen. Just next to it (according to Ainsworth’s book) a small cave is located where in 1979 Richard W. Barstow found a rare copper selenite mineral called “chalcomenite”. In the surroundings of Bromore Cliffs (Doon Bay), a local lady, who unfortunately passed away a few years ago, found a specimen of green wavellite, a phosphate mineral.

Site No. 2. Ballybunion Beach – “Limestone/Shale Contact”

Ballybunion Beach is a very safe and accessible place located on the contact between Carboniferous shale and limestone. There is an example of ripple marks on one layer of black shale below the castle. On the south side of the beach Waulsortian limestone bedrock is exposed and is rich in fossils such as gastropods, corals, brachiopods, goniatites and bryozoans. The term Waulsortian is used for rocks formed from carbonate mudbanks and reefs in the ancient ocean.

For a unique experience at locations 1 and 2 you can get Danny Houlihan (EcoTreck Ballybunion), silver awarded ecotourism company to guide you through the geological, historical and archaeological sites.

Site No. 3. Ballyduff – “North Kerry Museum”

North Kerry Museum is located north-west of Ballyduff town, just 10 minutes’ drive from Ballybunion. It is one of the “hidden...
treasures” of North Kerry and was opened in 1995 by the Rattoo Heritage Society. In 2014 the museum was awarded grant funding by North, East and West Kerry Development (NEWKD) and underwent major renovation. During spring/summer 2015 the museum undertook a pilot project (Eco-Tourism Geological Survey of North Kerry) and a small section with local geology was created. The museum keeps records of “ancient forest” discovered a few years ago at Ballyheigue Beach. Photographs and pieces of tree trunks are kept in one of the rooms. Thanks to the Geological Survey of Ireland, detailed maps and booklets of local geology can be accessed for viewing.

Site No. 4. Kilmore Beach – “Galena”

Another beautiful and a very safe beach located on the Wild Atlantic Way. Good spot to explore Old Red Sandstone formations (easily noticeable sandstone in different colours; from deep red, through yellow, to greenish-grey). Cross bedding features, quartz veins and “mud cracks” can also be seen. A pebble of galena, lead ore, (about 3.5 cm in length) was found on the beach which could be possibly linked to the Ballinglanna Mine, near Causeway. This mine was mentioned by Sir Richard Griffith (1861) and is located just a few miles away. Old Red Sandstone rocks in the cliffs near Kilmore Beach contain plants and fish fossils.

Site No. 5. Kerry Head – “Kerry Diamonds”

Kerry Head stretches from Kilmore Beach (Site No. 4) to Ballyheigue Beach (Sites No. 5 and 6). Both places are perfect locations to explore the different Old Red Sandstone formations. Ballyheigue is very well-known for what locally are called “Kerry diamonds” (quartz crystals). They are very commonly of a good quality. Quartz veins cross-cut the rock at the nearest beach but it is now hard to find a good specimen due to local collectors. A piece of crystal of very clean quartz, about the size of a 2€ coin, was obtained from Kerry Head and was sent to Galway, where Mr Simon Zaletel, Gemstone Faceter, transformed it to perfectly resemble a “diamond” shaped gem.

Site No. 6. Ballyheigue Beach – “Ancient Forest”

Ballyheigue Beach is a renowned blue flag beach. Unfortunately the remains of an “ancient forest” can only be seen at a very low, spring tide. Luckily, it was revealed and recorded a few years ago so photographs and pieces of tree trunk can be studied at North Kerry Museum in Ballyduff.

Site No. 7. Caharrane Strand – “Ancient Karstic Tower”

This feature is located at the beautiful Carrahane Strand at Barrow. It is a natural wonder which is made up from Waulsortian limestone and probably eroded into this form during the Tertiary Period. It is assigned as a county geological site whose rocky outcrop is locally known as “Crosty”.

(Left) Kilmore Beach – sandstone with visible quartz vein, (Upper right) “mud cracks” in sandstone, (Lower right) Galena (about 3.5 cm in length).

Ballyheigue Beach with (inset) part of the trunk of an ancient tree.

Sandstone exposure on Ballyheigue Beach, (Upper inset) Quartz Crystal, (Lower inset) Same specimen as a brilliant cut gemstone.

Relict Karst Tower at Caharrane Strand (Barrow) near Fenit. Inset is view from below showing solution weathering of the limestone.
Site No. 8. Barrow – “Lithistid demosponges”

Waulsortian limestone build-ups (reefs) are exposed along low coastal cliff exposures close to Tralee Golf Course. Here the section displays a number of juxtaposed mound-cores. These mounds are particularly interesting as they contain fossils of rare sponges (lithistid demosponges). This is another county geological heritage site.

Site No. 9. Fenit Harbour – “Colonial Corals”

A statue of St. Brendan the Navigator stands on a top of the Great Samphire Rock which is made up entirely from Waulsortian limestone rock. Walking down below the hill on the west side is a very good example of a colonial coral fossil. Other fossils in the limestone, like crinoids, can also be spotted and made up or lived in the reef complex.

Again this site is assigned as a county geological site.

Site No. 10. Knockmichael Mountains -“Amethyst Mine”

Knockmichael Mountains are part of the Sliieve Mish Mountain Range. Built up from Old Red Sandstone rocks where amethysts were discovered many years ago near “Scotia’s Grave”; reputed to be the grave of an Egyptian Pharaoh, known as Friel. A thick layer of peaty turf covers this area and it’s believed that the amethysts are lying under this organic material. A recent discovery shows that amethysts can still be found.

Acknowledgments: I would like to thank the North Kerry Museum (Sean Quinlan), Danny Houlihan (EcoTrek Ballybunion), Mike Flahive (Bromore Cliffs), Simon Zaletel (Gemstone Faceter, Galway) and many others who helped me to access the above localities and with the acquisition of specimens.

FROM ROCKS TO RIDGES

The Formation of the Mountain Landscapes of the North of Ireland

We will properly review this map produced by Mountaineering Ireland in another issue. Suffice here to say it has been produced with the input of professional geologists and those interested in the environment. It is colourful and is aimed at anyone walking, climbing or just enjoying the outdoors.

It is a free publication that can be obtained from: Mountaineering Ireland, Irish Sport HQ, National Sport Campus, BLANCHARDSTOWN, Dublin 15

Thanks to Peter Wilson, School of Environmental Sciences, Coleraine for bringing it to our attention.
FOCUS ON ROCKY HERITAGE IN KERRY

Gosia Shaikh-Horajska explains this initiative

During spring/summer 2015, under the auspices of the Rattoo Heritage Society, a pilot project called the “Eco-Tourism Geological Survey” of North Kerry was carried out. The main focus was on marine wildlife preserved as fossils in the rocks from the Carboniferous Period, so around 340 million years old. During the project a significant collection of local rocks and minerals was obtained. These have been put together with descriptive material to make an exhibition that will help people to identify fossils and rocks they can find for themselves. Copper mining in Killarney that started around 2,000BC, the oldest in Ireland, and finally ended just over 100 years ago is also featured.

The launch of the exhibition took place on 24th September 2015 at Kerry County Library in Tralee. It was officially opened by Ms Siobhan King, Client Services Officer - Failte Ireland. In October it was moved to a permanent place at North Kerry Museum in Ballyduff. Well worth a visit if you are in the area.

FRIEND TO EARTH SCIENCE

Ian Enlander

Taking early retirement last summer was a geologist who for many years held a key position within the Northern Ireland Environment Agency. Ian Enlander was its senior, and for long periods only, scientist with an expertise in geology. He showed how important it is for Earth Science to be represented within the government offices because that is where so much of the funding and support is derived.

Ian’s success in initiating the Northern Ireland Geological Conservation Review and seeing that it was carried through to completion was critical because it formed the basis for so many Earth Science conservation sites and areas being established. That review also owed much to Philip Doughty but it is Ian who ensured the funding and when sites were proposed for protection made the cases so expertly before the Council for Nature Conservation and the Countryside. Expertly but also with heart because he understands the value of this aspect of our heritage.

It is Ian who had much to do with the CEdAR database now operated through the National Museum and he established the geological garden at Crawfordsburn Country Park that this magazine has featured and tells the dramatic story of the Earth’s history and our diverse rocky foundation.

Latterly Ian had his job split into two, geology and ornithology, because he is also a very expert ‘birder’. Even so he continued to lead field trips where he is always at his most comfortable, being a great lover of nature and understanding that outdoors is where it all happens.

Ian is happily still in the Province and we hope he will continue to inspire people in the years to come. He has been and is a great friend to our science in particular and conservation in general. The unhappy side for Earth Science is that he has not been replaced, so Earth Science loses someone from a key position in government. It is no coincidence that this magazine has this year lost its funding from that source. Earth Science Ireland owes Ian a considerable amount for both getting us a substantial part of our funding and keeping it going for so long. We believe the Agency had good value and hope maybe funding will be resumed when its finances become healthier.

Editor
BOOK REVIEW – CAUSEWAY COAST


Derek Mahon writes in his poem ‘North Wind’.

What did they think of us During their brief sojourn? A string of lights on the Prom Dancing mad in the storm- Who lives in such a place? And will they ever return?

Paul Lyle’s A Geological Excursion Guide to The Causeway Coast answers the closing question with a resounding yes. With its cogent, accessible vernacular and its weaving of local industry and heritage sites into geological locality, it goes beyond the realm of science. Lyle unfurls an evolving narrative that will snare both practicing and amateur geologists alike.

One can find little fault with the structure of the guide. It opens with a historic overview of the Causeway Coast, demonstrating the enduring appetite of geologists and wider society for the area. A tourist or aspiring geologist is invited to understand why and anybody with an informed knowledge may find something new: the Neptunist-Vulcanist polemic was revealed to me upon reading, as an example.

The ensuing geological history is exceptionally thorough. Text is interspersed with clear maps, cross-sections and stratigraphic columns. Key terms are highlighted in the glossary. As a geophysicist approaching the text from a cognate background, the thought did occur to me that the density might deter a tourist or beginner. This notion is dashed, for a reader is rewarded with a set of summary diagrams at the end of the section: the effort, with hindsight, is worth it. In addition to this it is refreshing to unearth a publically available scientific text governed by rigorous intellectual capital in an era when all information is expected to be delivered at the touch of a smartphone. One presumes that anybody acquiring a copy of Paul Lyle’s guide is of a similar mindset.

While tempted to skip the section on plate tectonic theory (having coming into contact with it repeatedly as a seismologist over the past three years), I was drawn in by the continental distribution time plots that clearly delineate the position of the Causeway Coast as a function of latitude, climatic conditions and differential plate motions throughout geologic time. Kilian McDaid’s diagrams mutually reinforce Lyle’s writing.

A reader is then referred to the ‘Excursion Guide’ section. It addresses a rich list of localities along the Causeway Coast. Its chief strength is its recurrent referencing back to the preceding geological history, keeping the reader alert. Lyle, in addition to relating outcrops and successions to the overarching Antrim Lava Group stratigraphy, flags the phenomena unique to a given locality. Outstanding examples in my memory are the horizontal cooling joints of Seagull Isle juxtaposed with the Runkerry dykes with orthogonal orientation. It is evidence of the chief strength of Lyle’s approach to A Geological Excursion Guide to The Causeway Coast: thorough referencing encourages a reader to engage in the interpretative mode particular to geology in the field, by cross-referencing signatures across localities. I was able to do so without leaving my own garden. This is not the point: this guide should in the field. Its kinesthetic dimension, from the tone of the text through to the sensual veneration of the figures, encourages the reader to revisit localities time and time again. By doing so they honour a tradition that has been passed down from geologists like Hutton and Lyell to our local, Robert Bell (who was, let us not forget, an amateur, albeit a fine one). A Geological Excursion Guide to The Causeway Coast administers to the thrill of discovery. Lyle’s presentation of paramoudra at Larry Bane elevates them to a level of spectacle commensurate with that of stalagmites. He forces the reader to pause, to contemplate the significance and uniqueness of this area of outstanding natural beauty.

This is reinforced by Lyle’s celebration of human activity along the Causeway Coast. No rock is left unturned, to excuse the pun. The Neolithic monument at Magheraboy is acknowledged, as is the resilience of past local industry. The latter is emphasised by photographs of mining adits through the laterites, minute with respect to the macroscopic stratigraphic succession. Lyle implicitly links Kinbane Castle to the land by selective placing of figures. It is pictured atop the shattered chalk yet shadowed by the vast tuff cliffs, an apt substitute for words.

As a seismologist my interests lie in continental scale solid earth phenomena. Paul Lyle’s guide reminded me that there is more to scientific process than matching synthetic travel-time curves with observed data. With over 7,000 copies sold to date, A Geological Excursion Guide to The Causeway Coast is a revision worthy of the name. It dually pays homage and develops our shared geological inheritance on both a global and regional scale.

Eoghan Joseph Totten
MSCi student in Geophysics at Imperial College London
QUEEN’S UNIVERSITY BELFAST - GEOLOGY CLASS OF ’74 REUNION

Don Cameron reports

It had been 41 years since the ’74 QUB geology honours class had dispersed to find fame, fortune or a job that might help to pay the mortgage. Would we still recognise each other? Would we have anything to say to each other?

On July 15th, Elaine Shallcross née Baxter, Ray Burr, Don Cameron, Andrew Pearson, Dave Ruddock, Mike Tuer and Dave Williamson, 7 out of the graduate class of 19, assembled for a 4-day reunion. The agenda included a conducted tour of the QUB’s Lanyon building, a celebratory reunion dinner at Molly’s Yard, a day of sightseeing on the Antrim coast and a geology field trip to north Donegal. From the outset our initial apprehensions proved to be completely unfounded. Some of us might have put on weight, most of us still having it had have hair now in various shades of grey, but otherwise we got on famously, so much so that plans have been mooted for another reunion in 4 years’ time.

The reunion also provided an unscheduled opportunity to visit the former premises of the QUB’s Geology Department that had been closed down in controversial circumstances during 2001. We had anticipated to find that Geography had expanded from next-door to occupy the building, but instead it is currently home to Computer Sciences. The building’s doors were open and, with no security presence, in we went. On the ground floor, we found the main lecture theatre to be much as we remembered it, with its tiers of wooden seats facing a small central podium and an overhead projector still apparently available for presentations. Most of the remainder of the ground floor has been transformed to an attractive lounge and study area for postgraduate students. The first and second floors have been completely refurbished. Our former lecturers’ offices, the library and teaching laboratories have been replaced by four large suites occupied by rows of semi-enclosed computer booths. Despite all this change, it was gratifying to notice that a geological relief map of Ireland still occupies the building’s central stairwell.

Day 1 concluded with an excellent, well lubricated and often hilarious dinner at Molly’s Yard in Botanic Avenue where Bernard Anderson was our Guest of Honour. The ‘crack’ was fast and furious as memories improved, the best stories of 41 years ago were retold as the years slipped away.

After 41 years there was considerable curiosity about the life experiences and careers of our erstwhile fellow students. Tim Parsons spent his career in the oil industry, but is sadly deceased. Of those who attended the reunion or have information available on social media, the inevitable diaspora following graduation led many to emigrate to North America. All but one of the remainder are now based in England or Scotland, with possibly only Dave Williamson still resident in Ireland. Most are retired or semi-retired.

Andy Pearson, Ray Burr, Dave Williamson, and we believe also George Hillis, made careers in the oil industry. Steve Wilson apparently became an environmental geologist in Washington State (USA). Martin Lockley is based at the University of Colorado and is a world authority on dinosaur footprints. Rather surprisingly, he has also published on the evolution of consciousness in humanity. Jerry Delaney is a research scientist at Rutgers University, New Jersey. Donny Hutton pursued an academic career, lecturing on structural geology and tectonics at Trinity College Dublin and four English universities – he is currently an honorary professor at the University of Birmingham. After obtaining a PhD at the University of Manchester, Dave Ruddock forged a career in the chemicals industry with Blue Circle Cement and BASF. Ken Carruthers and Elaine Shallcross (née Baxter) were initially mining geologists in Africa. Ken retrained as a primary school teacher, progressing to headmaster at schools in Bristol and Bath. Elaine is currently an information consultant at the University of Aberdeen. Mike Tuer and Pete Bryan used their geology degrees as passports to careers in local government administration. Your correspondent spent his career with the British Geological Survey, mainly as a petroleum geologist providing advice to government on undrilled petroleum resources in the North Sea and west of Shetland. We could obtain no information on the whereabouts of our remaining four fellow honours students.
Antrim Coast

Day 2 was just sightseeing but convivial. We motored along the Antrim coast road at the request of our Canadian & English residents as far as the Carrick-a-Rede rope bridge, and then met up with Ken Carruthers in a Bushmills pub for a rather long lunch (he was doing a clearance of his parents’ house nearby). We had intended to continue to the Portrush sill, but it had turned to rain while we’d been indoors, so we made a dishonourable retreat back to Belfast.

North Donegal

On day three, 5 of the reunion group departed Belfast bound for Donegal with the best of intentions to visit in a day and a half as many as possible of the localities described by Bernard Anderson and Donny Hutton in the “Field Guide to a traverse in the North-Western Irish Caledonides”, published by the Geological Survey of Ireland (GSI) in 1978. Many of these localities are in the Rosapenna Peninsula, used by QUB for many years as a training ground in geological field mapping for its Level 1 (second-year for most) students.

The weather was initially against us. Incessant torrential rain greeted our arrival in Arnold’s Hotel, Dunfanaghy, where we had stayed for 10 days as second-year students in 1972, thus curtailing our activities to a single day. As recommended in Donny Hutton’s guide to localities in the Cresseough area, we began the following day by viewing structural geology in the field for several decades, so not surprisingly we initially had 5 entirely different opinions on what we were looking at – just like the old days. Despite this, we were all in agreement that this locality provides a superb mountainscape in its own right, and it also gives an extensive panorama across the lowlands between Muckish and the north Donegal coast.

Now we drove to the Rosapenna Peninsula south of Downings, to locality 5.1 as described by Bernard Anderson in the GSI Field Guide. Along with an attractive stretch of coastline, this gave us an opportunity to view the overturned limb of the Errigal Syncline at close quarters. We strolled northwards through steeply-dipping exposures of the Ards Pelite and its upward transition into the Ards Quartzite, cutting short our transect as rain clouds gathered once more in the west. Nevertheless, we had lingered for long enough to observe the change in structural style along the transect as described in the Field Guide from isolated fold pairs with southerly vergence to more numerous folds with essentially neutral vergence at the core of a recumbent syncline (as in the photograph).

The rain held off as we continued on a clockwise circuit of the Atlantic Drive north of Downings and during a third stop viewed the Rosguill Granodiorite at Dooey, a locality that is not included in the GSI Field Guide. At Dooey the xenoliths are mostly of interbedded pelite and semipelite and are from a few centimetres to tens of metres in length. Elsewhere in different areas of the granodiorite outcrop, Knill and Knill (1961) noted that xenoliths of ‘banded lithologies’ or quartzite prevail, hence preserving a ‘ghost stratigraphy’ within the granodiorite pluton. Of the dozens of xenoliths that we observed, all but one had sharp contacts with the granodiorite, implying that partial melting of the country rock made little or no contribution to the granodiorite melt.

We rounded off the day’s itinerary at an exposure recommended to us by Bernard Anderson of mullions in a road cutting between Carrigart and Creeslough. None of us could provide a convincing explanation of their significance, and again they are not described in the GSI Field Guide. However, Google came to the rescue and reminded us that these rod-like or semi-cylindrical features simply represent structural lineations on bedding surfaces, and that they are generally formed at the interface between a competent lithology (in this case quartzite) and a less competent lithology in which bedding is at a high angle to a pervasive cleavage.

Over the course of a day we had visited only 2 of the 15 north Donegal localities recommended by Bernard Anderson and Donny Hutton in the GSI Field Guide. This may have been deliberate, for it gives us plenty of scope to return to the area for a second QUB Class of 74 reunion field trip in the coming years.

References


Join the Earth Science Ireland group.

If you would like to be a member of ESI, currently no charge, and receive copies of the magazine twice a year, again free of cost, please tear off this section and return to ‘Editor, ESI, 19 Inishaner, Killinchy, Newtownards Co. Down BT23 6SU’ or email: rbazley@btinternet.com

ESI is a voluntary initiative to raise the profile of Earth Science in Ireland.

Name and Address (including Post Code): ...............................................................................................................................................................................

..................................................................................................................................................................................................................

E-mail (Essential if you want us to contact you regularly): .................................................................................................................................................................
BOOK REVIEW – LOOK AGAIN AT IRELAND’S LANDSCAPES


There is no doubt that it feels good to be able to look at the varied landscapes our lives lead us through, whether (seemingly) unremarkable or exhilarating, and to understand how they came to be and the forces and processes that created them. But is knowledge of just the geophysical forces enough? The sciences we study can give us this information - but do they give us understanding of all there is in a landscape? How are we shaped and influenced by it - and by it our practices and attitudes? And how have we influenced it?

Every so often - and not too often - a book is published that to those who have learned the facts of their science or their interest by conventional approaches is more than an eye-opener - it is a mind-opener. Peadar McArdle’s book is one such.

This volume by Dr McArdle - Peadar is a past Director of the Geological Survey of Ireland - is a masterful work bringing together the worlds of science and literature - literature, especially in poetic form, being essentially the human imagination writ down. I cannot believe there is not a geologist, whether professional or amateur, whose knowledge and appreciation will not be enriched by the new perspectives opened up in this work. Geology is more than earth science - its manifestations shape human thought and behaviour. In Peadar’s words: “The scientist may have mastery of the physical mountain but to really appreciate landscape we need a more inclusive approach and poets have a strong role in this; it is they who guide our mental response . . . “

He envisages the role of the poet as giving us greater understanding of the importance of landscape in our development and very lives - and demonstrates it through the works of those who have been able to express it in verse and prose. And through his examples of their work help us realise there that maybe we have not been getting the ‘big picture’ of our subject - because our perceptions and appreciation of landscapes are shaped by our mental and emotional experiences of each one as much as by any knowledge of the processes that formed them - seismic, geophysical or climatic.

This work highlights, in the most readable of styles, the potential role of the poet in giving us, perhaps often subconsciously, an appreciation of the landscapes around us and also the role of the landscapes in shaping all our minds, even though perhaps only a few reciprocate by trying to pull back the curtain. The detached artificiality of urban life, where for many landscape is a hobby or a recreation opportunity rather than the bedrock of their lives leaves many curtains unopened.

Heaney, McNeice, Longley, Durcan, Yeats, Kavanagh - the greats all have their say - as do many who have not (yet) reached the heights of fame. And not just poets. The thoughts of the great interpreters of landscape, their creation and influence, such as Estyn Evans, are here. The book is not an exploration just of our landscapes but of the minds of those who have looked at them and been inspired.

Peadar describes Seamus Heaney, whose verse extolled the secret beauties of his native boglands, as being fully conscious of ‘a fascinating relationship between poetry and geology’ and of admiring ‘the visionary perspective and detachment of each, seeing them both as distilling and communicating wisdom concerning our wonderful world.’ But it not only the philosophies and insights of Ireland’s poets that are explored. The book contains anecdotes of many of the great and good who had ‘hidden talents’.

Who knows for instance that James Craig, Northern Ireland’s founding Prime Minister (later Lord Craigavon) was the ‘prophet’ of the potential of geo-thermal energy - and got into trouble with his father for purchasing an area of hot springs in Iceland - which was later to become one of the country’s biggest tourist attractions (the family later returned the land to the Iceland nation).

With more than 350 pages this is a substantial book as befits a subject that comes as something of a surprise that a book entitled ‘The Irish Landscape’ is not illustrated - we are not short of photo-opportunities in Ireland! But on reflection pictures, especially if they had been of the familiar iconic features with which we are all so familiar, would have been a distraction from the thrust and spirit of the work, which is to encourage the use of imagination to see all landscapes, even the seemingly ‘mundane’ as more than just pretty or dramatic pictures and to appreciate the intimate inter-reaction there is between them and ourselves.

Peadar talks of Brendan Behan’s ‘love AND knowledge’ of his native place - perhaps that is what is required for a fully rewarding appreciation of our world.

This work is an invitation to ramble back through time and explore Ireland’s unmatched diversity of landscapes through new eyes. It is a journey well worth making.

David Kirk
Hidden Treasures – the Yates Collection

by Carin Stritch

Walk into any museum and you will likely be struck by a diverse range of exhibits but as a rule those on display only represent the tip of the iceberg when considering the entire collection. Many hidden treasures remain boxed away in storage awaiting their turn in the limelight or the attention of an enthusiastic researcher. The Natural History Museum (NHM) first opened its’ doors in 1857 originally housing the collection of the Royal Dublin Society (RDS). Today, the Museums’ collections comprise a diverse range of specimens acquired over the years through many means including purchase, bequests and donations from academic institutions. Serving a duel function of both education and research, the public face of the Museum can be seen on display on Merrion Street while the vast majority of the collection is currently housed in storage in the Beggars Bush facility which serves as a mecca for academic researchers both domestic and international.

Many nationally important collections remain in storage and are currently the subject of an ongoing Inventory Project attempting to catalogue the entire Museum collection thus facilitating future researchers. For example, one of the more recently catalogued collections is the Yates Collection comprising fossil specimens collected by Patricia J. Yates in preparation for a PhD at the University of London between 1956 and 1960. Unfortunately Miss Yates passed away just days before the final examination of her thesis. The results of her research were, however, viewed as being of sufficient significance to understanding Carboniferous stratigraphical palaeontology that the thesis was published posthumously in Palaeontology edited by Dr. W.H.C. Ramsbottom and Dr. Gwyn Thomas.

Following Miss Yates’ death the samples which she collected remained in repository at Imperial College London Geology Department. However, in 2004 due to rationalisation Imperial College were no longer able to house the collection and the NHM was pleased to accept it. The collection consists of over 1500 Carboniferous fossils found in shales covering the P1 to E2b marine bands, collected from Slieve Anierin, Co. Leitrim. This includes specimens of annelids, brachiopods, bryozoa, cephalopods, echinodermata, bivalves, plants, scaphopoda, trilobites and fish showing the wide range of faunas present in each band though there was a limited number of genera and species.

The collection is of both national and international importance as during her research Miss Yates identified five new species and eight new subspecies of goniatites and bivalves within the genera Caneyella, Chaenocardiola, Eumorphoceras, Obliquipecten, Caneyella rota Yates, 1961
Holotype NG:F28668. (Yates 1962)

Holotype. NG:F28828. (Yates 1962)

Map of Slieve Anierin showing the main marine bands in the upper and lower Eumorphoceras stages. (Yates 1962)
Posidonia and Posidoniella, the holotypes and paratypes of which are contained within the collection. These discoveries are detailed within the published thesis and an earlier work of Miss Yates: New Namurian Goniatites of the Genus *Eumorphoceras*.

In addition to the fossils, original thesis and the draft and corrections of Miss Yates’ earlier paper, the collection also includes Miss Yates field notebooks, the original maps drawn by Miss Yates, her photographs of the fossils with the negatives and 53 boxes of collotype plates.

This is just one of the many fascinating collections which show the richness of fossil evidence which is to be found in Ireland and one of the hidden treasures which is being preserved by the NHM. All too often in the past our heritage has been destroyed, sold off or built over. Even today we do not always appreciate the treasures which are unearthed during undergraduate, Masters and PhD research, these collections are often left to languish on a shelf or in a freezer until space requirements dictate that they are removed, all too often to the nearest skip. We should be ensuring that these collections are cherished and available to future generations of academics to study – the NHM provides just such a facility.

**References**


You are welcome to join us at:
www.geology.ie

Membership open to all:
- Student
- Family
- Amateur
- Teacher
- Professional
- Corporate

IGA members range from professional geologists to beginners of any age. See our nationwide programme of events on our website www.geology.ie

Geological Survey of Ireland
Beggars Bush, Haddington Road
Ballsbridge, Dublin 4

website: www.gsi.ie
e-mail: gsisales@gsi.ie

Phone: (01) 678 2000
Lo-call: 1890 44 99 00
Fax: (01) 668 1782