

Geology Matters

The Newsletter of the Geological Survey of Ireland
Nuachtlitrí Suirbhéireacht Gheolaíochta Éireann



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Introduction

Welcome to Issue No. 10 of **Geology Matters**, the Newsletter of the Geological Survey of Ireland.

In this issue the SEABED 10 conference that celebrated ten years of Ireland's marine mapping programme, takes centre stage. GSI's Director, Peadar McArdle, succinctly captures the essence of the programme in his Discourse, whilst Enda Gallagher provides some additional detail about the programme and information about the event itself. Geoparks are fast becoming an outstanding success story in the world of tourism, here Sophie Preteseille explains why. In the last issue we provided some food for thought around the concept of Carbon Capture and Storage, here John Morris provides even more thought-provoking subject matter on the issue. Several staff members combine to provide an overview of Dublin's first-ever baseline study of soil quality. Mary Carter dissects one of the most ambitious global projects ever undertaken in the field of geology – OneGeology, and Eibhlín Doyle provides a comprehensive overview of the Griffith's Geoscience Research Awards. And that's not all, please read on for information about even more GSI activities. We hope you enjoy this end-of-year edition of **Geology Matters**.

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Seabed 10 Conference In Dublin,
October 2009 **page 3**

Geoparks - A tool for geological heritage conservation, education, economic activity and sustainable development **page 6**



Photo courtesy RTE



Director's Discourse

A DECADE OF MAPPING IRELAND'S SEABED

Peadar McArdle

Ireland is a small island which lies on the continental shelf of the northeast Atlantic Ocean and which occupies a strategic European position. We are endowed with a huge seabed resource - almost ten times our land area - and stretching from our coastline to the deepest parts of the Atlantic Ocean. We are a nation with a proud seafaring tradition, one that stretches back to its earliest settlers some 8,000-9,000 years ago. Our maritime history is reflected in our literature and music, in our explorers and scientists, their names are as diverse as St. Brendan and Robert Shackleton.

Yet consider this quotation: "We probably have more information per square metre about the surface of the moon than we have about the seabed, which occupies three quarters of the earth's surface. This is especially true in regard to our own (Ireland's) area of sea floor." Surely this is a nineteenth century assertion? Wrong! It is taken from an article published in 1996. Its author was none other than Ray Keary, our late distinguished colleague whose memory we celebrated in early October at the Seabed 10 conference in Liberty Hall.

This reminds me of the link, however tenuous, between Liberty Hall and seabed mapping. That link comprises the ships *Helga*. *Helga* the second was stationed close to Liberty Hall at Easter 1916 in order to shell the buildings of central Dublin. But *Helga* the first was employed a few years earlier in the earliest exploration of Ireland's Atlantic seafloor. It would be many decades before the strength of opinion on the potential of our Marine would drive several key developments - a specific Government Minister and Department, the establishment of the Marine Institute and the first seabed surveys by PAD in 1995 to support our claim for seabed delineation under UNCLOS. As far as seabed mapping is concerned we, as a community of stakeholders, developed a shared vision of considerable challenge and sold it persistently and, eventually, successfully. In all this, I want to emphasise the driving determination of our partners, the Marine Institute, and the visionary leadership of its Chief Executive, Dr. Peter Heffernan.

As a result of the combined efforts of many, Government invested €32 million in the period from 1999 to 2005 in order to complete the Irish National Seabed Survey (INSS), a comprehensive mapping programme of all our waters deeper than 200m. Long-term investment in a truly valuable resource had started. In 2006, Government announced a new follow-up programme, called INFOMAR, which was intended to invest €4 million per annum in order to complete the nearshore seabed areas. Following a review of its initial progress which showed INFOMAR benefits running at four times its costs, Government at the end of 2008 confirmed its intention to continue support for INFOMAR although - given the current financial climate - at the understandably lower annual investment level of €3.4 million. The special conference, Seabed 10, was held to mark the tenth anniversary of the start of INSS and to launch the new GSI vessel, R.V. Keary.

The seabed surveys are designed to produce comprehensive information on all aspects of our seabed, providing a sound basis for its sustainable management, supporting policy and regulation at national and European levels, and underpinning research and services for a wide spectrum of maritime activities. The speakers at Seabed 10 documented the breadth and depth of benefits arising from INFOMAR (see www.infomar.ie for the conference programme). While this has required significant financial investment it has also built an effective cooperation between a range of national and international partners. The partnership between the Geological Survey of Ireland and the Marine Institute has been particularly crucial to the success of the programme. Indeed the availability since 2003 of the R.V. Celtic Explorer, with berths for 19 scientists, has been a key milestone in the history of Irish marine science and geoscience.

Of course a mapping programme focused only in data acquisition would quickly fail. GSI has built what is a major digital data store by national standards, with a capacity of 16 terabytes, and there are backup copies in the Marine Institute and elsewhere. Earlier this year the INFOMAR team shared in an eGovernment Award for

its cross-agency metadata infrastructure. INFOMAR databases have supported about 50 postgraduate studies - a level adequate to sustain a considerable skillsbase in geoscience and marine science in Ireland. At the same time media attention has enhanced public awareness of the value of our work and of the enterprise and career opportunities that arise from it. INFOMAR also supports key government policies such as developing the smart economy, increased pupil participation in S&T, and deepening scientific cooperation both between Ireland and Northern Ireland, and Ireland and UK.

Ireland's seabed mapping is a story of people - of scientists, crews, support staff, customers and stakeholders. I want to pay particular tribute to the INFOMAR team drawn from the Marine Institute and the Geological Survey of Ireland. Its membership is too extensive to allow for individual acknowledgement but I know that Peter Heffernan will join with me in saluting the excellent leaders over the years - Yvonne Shields, Mick Gillooly, John Evans and Tommy Furey of the Marine Institute, and Deepak Inamdar, Mick Geoghegan, Eibhín Doyle and Koen Verbruggen from GSI. However none of these will mind if I conclude the list with a mention of the late Ray Keary, a highly motivated and dedicated scientist, who constantly pointed to the value of our offshore resources, who provided encouragement to all marine scientists, and who was the inspiration for INSS. We were delighted that Barbara, his widow, and members of his family joined us for the launch of R.V. Keary.

We have achieved much, but there is much left to do. Remaining areas, if investment is sustained at current levels, will not be fully surveyed before 2030. And given the uncertain financial climate we cannot assume that any specific level of support will be provided indefinitely. We must continue with great determination to produce excellent science and to ensure that our stakeholders are fully aware of its implications and potential benefits. If we continue to strive for these goals then the extent of our success will be constrained only by the level of our ambition.

SEABED 10 Conference, Dublin, October 2009

Enda Gallagher and Koen Verbruggen

What lies beneath....

The oceans of the world are probably the last great unknown frontier. Geologists have explored and mapped almost all lands, even the most remote areas of the Arctic and Antarctica. However, the majority of the Earth's surface is covered by water and comparatively little is known about it. Ireland's marine mapping programme, now 10 years in operation and many more in the making, is setting new standards globally in understanding the offshore territory. A whole new detailed picture of the sea floor is emerging from a combination of state-of-the-art data collection techniques including, multi-beam and side scan sonar measurements, underwater video footage and a variety of sampling operations. The discovery of cold water corals in deep Irish waters and the precise recording of hundreds of shipwrecks are just two fascinating aspects, but the seabed survey geological data are only just beginning to open a whole new world....

Seabed 10

The tenth anniversary of Ireland's seabed mapping programme was marked in spectacular style by a two day conference in Dublin in October. The partners in the programme – GSI and the Marine Institute – organised a comprehensive conference programme covering a review of activities to date (including both the INSS and INFOMAR programmes), research based on survey data, noteworthy achievements and plans for the future.

The conference, which was held in Liberty Hall theatre, incorporated the annual "seabed seminar" which usually provides a detailed review of that particular year's activity. As well as hosting a poster exhibition it also saw the formal launch and naming of GSI's new inshore mapping vessel, the RV *Keary* at a ministerial ceremony at Poolbeg Marina, Ringsend, Dublin. The 192 delegates across the two-day conference certainly came away with a comprehensive understanding of what is one of the world's largest seabed mapping projects.

Scientific Programme

Highlights

In his speech at the naming ceremony for the RV *Keary*, Conor Lenihan, T.D., Minister of State at the Department of Communications, Energy & Natural Resources, commented that he was "struck by the broad range of topics and areas being discussed." He went on to say that this "compellingly reflected how the results of the seabed mapping campaign over the last ten years have fed into so many different sectors; from safety at sea, to new territorial claims, from shipwrecks to environmental protection and from energy to research." This was an apt and succinct overview of an outstanding scientific programme.

A particular highlight of the programme, and one that was very appropriate in these economically pessimistic times, was the economic overview of INFOMAR, provided by Gareth Hetherington, PriceWaterhouseCoopers (PWC). PWC have carried out an independent value-for-money study which has valued the benefits of the state's marine mapping programme at €275 million. This is more than four times what will be spent completing the "INFOMAR" programme. He outlined in great detail that the benefits accrue across a range of sectors from fishing, tourism and energy, to compliance with international legislation and the research sector.





Another project presented provocatively by Dr. Colin Brown of NUI Galway was one about the investigation and protection of Irish Coral Reefs. As well as giving a broad overview of corals in Irish waters Dr. Brown was able to display a range of imagery that was literally hot-off-the press. The imagery was taken from a cruise that employed seabed survey data to locate and film for the very first time deepwater coral reefs on parts of the Rockall Bank. The survey partners - GSI, MI and the National Parks and Wildlife Service - employed the Marine Institute vessel, the Celtic Explorer and her new remotely operated vehicle, the ROV Holland. This study will assist the process of designation of new offshore Special Areas of Conservation.

The scientific programme included outstanding presentations across a wide range of additional Irish marine survey activity including a focus on the research being carried out in various Irish universities; an evaluation of where Ireland's mapping programme fits in a European context, and how the survey data assist the fishing industry, petroleum research, in expanding Ireland's sovereign territory, in identifying shipwrecks and in the production of official navigation charts. Staff from the INFOMAR programme also presented movie "fly-throughs" of the data and demonstrated how to access the data online. The event was wrapped up in riveting style by the Marine Institute's CEO,

Dr. Peter Heffernan. The title of his talk "Conversations on Maritime Ireland in 2020 (at SEABED 20)" provides a clue as to the strategic thrust of his musings!

Further information on the INFOMAR programme is available at www.infomar.ie. If you're interested in a brief overview of Ireland's marine survey story you can download a guide with this name from the news section of www.gsi.ie.



The RV *Keary*

The vessel is named after the celebrated geologist, Ray Keary, RIP. The RV *Keary* is a purpose built, aluminium catamaran designed for the survey of shallow waters, made possible by her shallow 1.7 metre draft. The 15 metre fully-equipped hydrographic/geophysical launch will also deliver survey data that will meet the required international surveying specifications. The minimum crew is 3 (Skipper, Surveyor and Data Processor) but survey operations are usually undertaken by a crew of 4, operating during daylight hours, weather dependant (Sea state 4 or less).

Survey operations throughout 2009 have been (and continue to be) concentrated on the remaining unsurveyed areas of Dublin Bay and completion of these will allow the UKHO to update the Dublin Chart in 2010. The first chart of Dublin Bay was undertaken in 1800 by Captain William Bligh, famous for the "Mutiny on the Bounty" incident and later went on to be the Governor of Australia. He completed the chart in 1803 and it was considered the most accurate map of the bay well into the 20th century!

The RV *Keary* was commissioned to complement the survey capabilities of the Marine Institute vessels, the Celtic Explorer and the Celtic Voyager. The Explorer carries out deep sea mapping and research, the Voyager carries out mapping in median waters and there was a need for a state vessel to map our shallowest waters.

Keary Specification

Registered Dublin.
Call Sign EIGO9.
MSO P5 Licence for 12 Passengers.
Vessel contract awarded to IMAR Tionscail with the assistance of Maritime Services Ltd
Design by Nic De Waal of Teknikraft New Zealand
Manufactured by Veecraft Marine of Capetown, South Africa

Leading Particulars

Length (OA)	15.5 m
Length (Hull)	14.6 m
Beam (moulded)	5.6 m
Draft	1.7 m
Engines	Cummins QSC 8.3-500 INT
Rating	368 kW/2600 rpm
Speed (90% power)	22 kn
Fuel	2000 lt
Hull Type	Asymmetrical catamaran
Construction	Marine Grade Aluminium
Equipment	Simrad 3002D Multibeam, USBL, GPS systems, Applanix POS-MV, CHIRP, Single Beam, Quincy Navigation software, AIS, SOLAS, Radar, AutoPilot

Ray Keary RIP

Ray Keary was a respected and important employee of the GSI for over two decades, where he founded the Marine Geology programme, having worked with NUIG for fifteen years prior to that. His influence in his chosen field of Marine Science was huge and his outstanding legacy is Ireland's seabed mapping programme that he tirelessly lobbied for.



GEOPARKS

A tool for geological heritage conservation, education, economic activity and sustainable development.

Sophie Preteseille

The Geopark Concept

The origins of the Geopark concept date back to the late 1990s. At that time UNESCO (the United Nations for Education, Science and Culture Organisation) Division of Earth Sciences was looking at ways of using geological heritage to promote sustainable development among communities otherwise bypassed by economic growth, but also how to provide an international framework for the conservation of geological heritage, or geo-conservation, to enhance the value of the heritage of the Earth.

Meanwhile, four European territories (Reserve Géologique de Haute Provence-France, Vulkaneifel-Germany, Petrified Forest Lesvos-Greece, Maestrazgo Cultural Park-Spain) were interested in the same sustainable tourism for local communities issues. The concept of geological tourism or geotourism was born. Together, they founded the

European Geoparks Network (EGN) in 2000 and sought to spread the concept across Europe.

In 2001, an agreement was signed between UNESCO's Division of Earth Sciences and the EGN to join efforts as the network began to rapidly expand. The EGN would then operate under the auspices of UNESCO.

As territories outside Europe - especially in China first - interested in the Geopark concept, wanted to join but no suitable structure was in place at the time, the Global Network of National Geoparks (also known as the Global Geoparks Network - GGN) was created, assisted by UNESCO in 2004. The GGN operates with regional/continental networks. For a European territory to become a member of the Global Network, it must first become a member of the EGN.



At present (December 2009), there are 35 Geoparks in 13 countries across Europe and 29 other in the rest of the world (China, Malaysia, Iran, Brazil, Australia, Japan), all of which are members of the GGN.

What is a Geopark?

Bedrock is the foundation of all landscapes on which biodiversity has developed over millions of years and humans have settled in more recent times. With no geological diversity (geodiversity), the rest wouldn't exist as it is. This is the reason why geological heritage has to be protected and people have to be educated about it so they can benefit from it even more.

The official UNESCO definition of a Geopark is: "A Geopark is a nationally protected area containing a number of geological heritage sites of particular importance, rarity or aesthetic appeal. These Earth heritage sites are part of an integrated concept of protection, education and sustainable development. A Geopark achieves its goals through a three-pronged approach:

CONSERVATION

A Geopark seeks to conserve significant geological features, and explore and demonstrate methods for excellence in conservation. The management authority of each Geopark ensures adequate protection measures in consultation with collaborating universities, geological surveys or relevant statutory bodies in accordance with local traditions and legislative obligations.

EDUCATION

A Geopark organizes activities and provides logistic support to communicate geoscientific knowledge and environmental concepts to the public. This is accomplished through protected and interpreted geosites, museums, information centres, trails, guided tours, school class excursions, popular literature, maps, educational materials and displays, seminars and so on. A Geopark also fosters scientific research and cooperation with universities and research institutes, stimulating the dialogue between the geosciences and local populations.

GEOTOURISM

A Geopark stimulates economic activity and sustainable development through geotourism. By attracting increasing numbers of visitors, a Geopark stimulates local socio-economic development through the promotion of a quality label linked with the local natural heritage. It encourages the creation of local enterprises and cottage industries involved in geotourism and geoproducts."



Beigua Global Geopark, Italy

What a Geopark is not:

A Geopark is not an area of outstanding geological heritage alone; other facets of heritage (natural, cultural, historical, archaeological) must also be integrated as they're all interlinked.

A Geopark is not a single site either (Geoparks are territories large enough so development strategy can be emplaced). A Geopark is not an area fenced off just for scientists and it is not a theme park either.

A Geopark is not a formal, legislative designation. And, as such, it carries no legal obligations or restrictions. However because of the nature of conservation activities taking place in Geoparks, these territories and/or their collaborating partners are likely to be involved with policy making.

Why is the concept becoming popular?

Geoparks aim to protect geological heritage and geodiversity within national frameworks. Geoparks aim at promoting understanding of Earth history and legacy through education. Geoparks aim at supporting economic growth and sustainable development through geotourism. Geoparks aim at reconnecting people with Planet Earth.

As Geoparks operate within a network, whether at a European level or a Global level, they are provided with a platform for exchange of knowledge and best practice. All territories have different geological heritage and communities but they are all driven by the same will to make it work: conserve geological heritage for the future generations, educate and develop in a sustainable and responsible way for the benefit of all.

Access to the Network is achieved through a very selective process where applicants are asked to demonstrate that they are operating as a "de-facto" Geopark, i.e. a Geopark in everything but name, which also insures the quality of the applicants.

*Marble Arch Caves Global Geopark,
Co. Fermanagh and Co. Cavan*



Are there any Geoparks in Ireland?

In 2000, Marble Arch Caves, in Co. Fermanagh and the Copper Coast, in Co. Waterford applied to join the EGN and were successfully accepted. To date they remain the only official members of the EGN on the island of Ireland.

Through successful applications to EU funding programmes, Marble Arch Caves

and Copper Coast raised a considerable amount of funds to further develop themselves as territories, along with infrastructure, signage, staff, educational services and products, promotional resources, tourism products and raise awareness of the Geopark concept. Both territories became Global Geoparks in 2004. Marble Arch Caves Global Geopark has since successfully extended to Co. Cavan in 2008, thus becoming the first international Geopark in the world.

*Copper Coast
Global Geopark,
Ballydwane,
Co. Waterford*



Other community groups in Ireland are becoming interested in the concept, believing in the outstanding value of their geological heritage and its potential for tourism, education and sustainable development. Among them Kerry (Sneem-Caherciveen), Mourne Mountains/Cooley/Ring of Gullion and The Burren/Cliffs of Moher, to name a few.

The Geoparks Ireland Forum

To answer the demand for information and insure the quality of the geological heritage put in the application to the EGN, the Geological Survey of Ireland and the Geological Survey of Northern Ireland, both having experience and having been involved with the Geoparks listed above established the Geoparks Ireland Committee in 2007 as an all-island committee which would apply the highest standards of geoscience in assisting stakeholders to build the Geoparks brand throughout the island of Ireland. For terms of reference, see link at the end of the article.

One of the Committee actions was to set up a Geoparks Ireland Forum to inform and guide stakeholders and provide networking opportunities. Membership is open to any body or group, including both community based and local authority organisations, seeking to develop a Geopark or already operating a Geopark. Stakeholders include existing and prospective Geoparks, local authorities, the Heritage Council, the Environment and Heritage Service, Tourism Ireland Ltd., universities and regional and local tourism bodies.

Meetings have been taking place once a year since the set up. They usually consist of presentations updating the forum about development in each territory along with a visit of the area when possible and suitable.

The Burren meeting, 20th - 21st October 2009

The Geoparks Ireland Forum held its most recent meeting in the Burren aspiring Geopark. Delegates from the existing Geoparks and aspiring ones met in Ennistymon for presentations from each territory and exchange on the 20th October. The discussion revolved mainly around aspects of the application process to the Network, management issues, education, site access, site degradation, and local support. For presentations and notes of the discussion, see link at the end of the article.

The following day was dedicated to discovering part of the geological heritage of the Burren led by Dr Ronán Hennessy, geologist with the Burren Connect Project, and visiting the Atlantic Edge at the Cliffs of Moher Visitor Centre where Geraldine Enright, Marketing Manager was on hand to answer numerous questions about the largest tourist attraction in Ireland.

The next meeting in 2010 is likely to be hosted by the new kid on the block: the Joyce Country aspiring Geopark in Co. Mayo-Galway. Date will be announced next spring.

If you wish to be added to the circulation list to be kept posted of any development in the Forum, contact Sophie Préteseille at sophie.preteseille@gsi.ie

More information:

- UNESCO Division of Earth Sciences: www.unesco.org/science/earth and http://portal.unesco.org/science/en/ev.php-URL_ID=6400&URL_DO=DO_TOPIC&URL_SECTION=201.html
- European Geoparks Network: www.europeangeoparks.org
- Global Network of National Geoparks: www.globalgeopark.org and <http://unesdoc.unesco.org/images/0015/001500/150007e.pdf>
- Marble Arch Caves Global Geopark: www.marblearchcaves.net
- Copper Coast Global Geopark: www.coppercoastgeopark.com
- Geoparks Ireland Forum: www.gsi.ie/Programmes/Heritage/Projects/Geoparks.htm



The Burren, Co. Clare

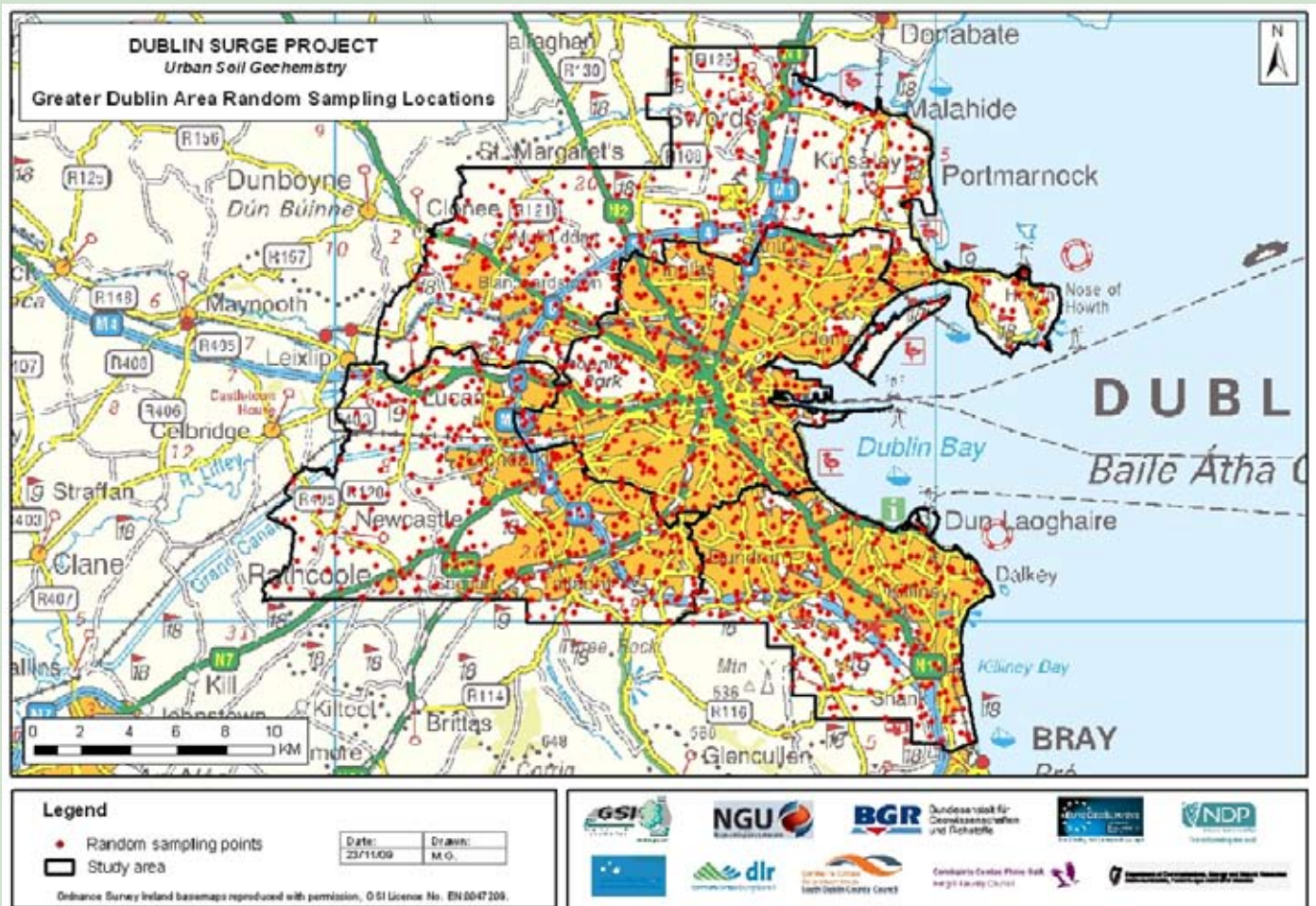


Survey of Dublin Soils Dublin SURGE Project - Soil Urban Geochemistry

Mairead Glennon, Ray Scanlon, Michael Sheehy, Pat O'Connor, Enda Gallagher

October saw the fieldwork phase of a first-ever baseline study of soil quality in Dublin. The Dublin SURGE Project sets out to establish geochemical baselines of metals and organic chemicals in Dublin soils. The project will provide information on soil chemistry in the urban environment relevant to human health, land-use planning and urban regeneration. It will also allow us to identify and quantify human impact on soils in urban areas through comparison with adjacent rural soil baseline geochemistry.

GSI and the Norwegian Geological Survey (NGU) are co-ordinating the survey and the fieldwork phase is now complete. 1065 soil samples have been collected and prepared for laboratory analysis. All four local authorities in the greater Dublin area supported the project and the vast majority of samples were taken from areas that are publicly accessible (e.g. public parks and school grounds). The results of the survey will be publicly available by early 2011.



Sampling points

European Partnership

Eighty per cent of the European population lives in cities. Most cities have well-established monitoring systems for air and water, while soils have received comparatively little attention. To remedy this, a consortium of European Geological Surveys has initiated an Urban Geochemistry Project to investigate the chemical make-up of urban soil in European cities. GSI has lobbied successfully to have Dublin included in the first phase of the project. This is a very significant outcome for Ireland since no baseline geochemical information of any significance exists for Irish urban environments, whilst many European cities have been developing such databases in the past decade.

The first phase of this Euro-wide project will involve mapping soils in 10 selected cities across Europe for a wide range of potentially harmful chemicals (e.g. heavy metals such as lead, arsenic, cadmium, chromium, and organic compounds such as polychlorinated biphenyls – PCBs) which may pose risks to human health. The study is part-funded under the NDP, and by NGU, as part of what is an overall “EuroGeoSurveys” study.

Fieldwork Programme

1065 soil samples were collected to characterise the spatial variation in soil quality over an area of some 600 sq. km in the greater Dublin area. The sampling was carried out by teams of trained personnel from the Geological Surveys of Ireland and Norway (Norway has already carried out very successful soil sampling surveys of its cities). Survey teams worked off carefully planned and mapped

schedules and in accordance with agreed procedures. At each sample site, GPS coordinates and field observations were recorded and two digital photographs were taken (a general landscape shot of the surrounding environment and a site photograph showing details of soil texture).

Interpretation & Results

The surface soil samples will be analysed at the geochemical laboratories of NGU. It is critical that the samples from all cities in the study are analysed at these particular labs as one of the primary aims of the project is to provide environmental geochemical data that are harmonised and interoperable. In this way the soil quality from city to city can be compared objectively. A Geographic Information System map database will be used to gather, display and interpret data from the Dublin SURGE project. Analytical data will be statistically processed and digital geochemical maps of all elements will be produced. The data will be freely available to municipal authorities and other stakeholders.

Benefits of SURGE

It is hoped that the study will have benefits in the following areas:

- Establishing baselines for environmental monitoring;
- Identifying city areas possibly in need of environmental remediation;
- Assisting authorities in setting soil environmental standards for Irish cities;
- Contributing to more informed urban planning for both brownfield redevelopment of inner city areas and suburban development.
- Assisting in compliance with EU Directives (Soil and Water) and national legislation protecting groundwater, soils, habitats etc.
- Contributing to a better scientific understanding of pollutant accumulation and transport in urban soil environments.

Further information is available at www.gsi.ie/surge



Worldwide Acclaim for Staff Member, Caoimhe Hickey!

Monica Lee, Brian McMahon &
Enda Gallagher

At a conference held in Croatia in September, a staff member of GSI, Caoimhe Hickey, won a prestigious international prize that recognised her specific scientific expertise. The conference was organised by the International Association of Hydrogeologists (IAH) on Karst*, entitled "Sustainability of the Karst Environment". Caoimhe was joint recipient of the "Young Karst Researcher Prize 2009" prize for her presentation of the excellent research that she has been carrying out in the karstic landscapes of county Roscommon. The IAH is the Worldwide Groundwater Organisation and this award is not only an outstanding personal achievement for Caoimhe, but also promotes her as an expert on Irish Karst in the international hydrogeological community. 2009 has been quite a year for Caoimhe – she was also awarded a PhD by Trinity College Dublin, for her research thesis entitled "Landforms and Hydrology of the Lowland Karst of County Roscommon, Ireland". Well done, on both counts, Dr. Hickey!

* Karst

Karst is the name given to the landforms that develop when rocks are dissolved by water. Half of Ireland is underlain by limestones and their solution by water over millions of years has resulted in many of our most distinctive landscapes, including the Burren ("Burren" meaning stony place) and the north-western plateau areas encompassing Benbulbin and the Bricklieve Mountains in Sligo and Cuilcagh and the Marble Arch cave complex and Global Geopark in Fermanagh. (See Geopark item elsewhere in this newsletter).



Young Karst Researcher Prize 2009

Donated by the IAH Karst Commission
For an excellent study presented during the Conference
"Sustainability of the Karst Environment"
Plitvice, Croatia, September 2009

To: Caoimhe Hickey

Plitvice, 25 September 2009

Goldscheider
For the IAH Karst Commission
Nico Goldscheider, Chairman



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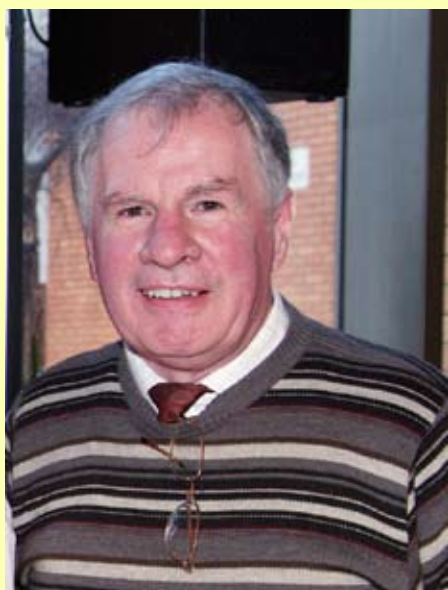
Retirements in 2009

John O'Donoghue

A number of staff across different GSI programmes retired over the past few months.



Andy Sleeman (pictured above), Senior Geologist, retired earlier this year. Andy had been involved for many years with the publication of the 1:100, 000 Bedrock County map series and more recently the new 1: 50, 000 Bedrock series starting with County Wexford. His work has greatly advanced our knowledge and understanding of the bedrock geology of Ireland. Andy is very well thought of by his colleagues and his work in GSI over many years is greatly appreciated by his peers.



Chris McDonnell (pictured left) was a Senior Laboratory Technician, who also retired at the end of September, 2009. He also worked for many years in GSI. His area of speciality was petrology – the study of the origin, structure and mineralogical and chemical composition of rocks. His knowledge of this subject was considerable. Sadly in today's financial climate his considerable skills are unlikely to be replaced and this will be a big loss to GSI corporate knowledge.

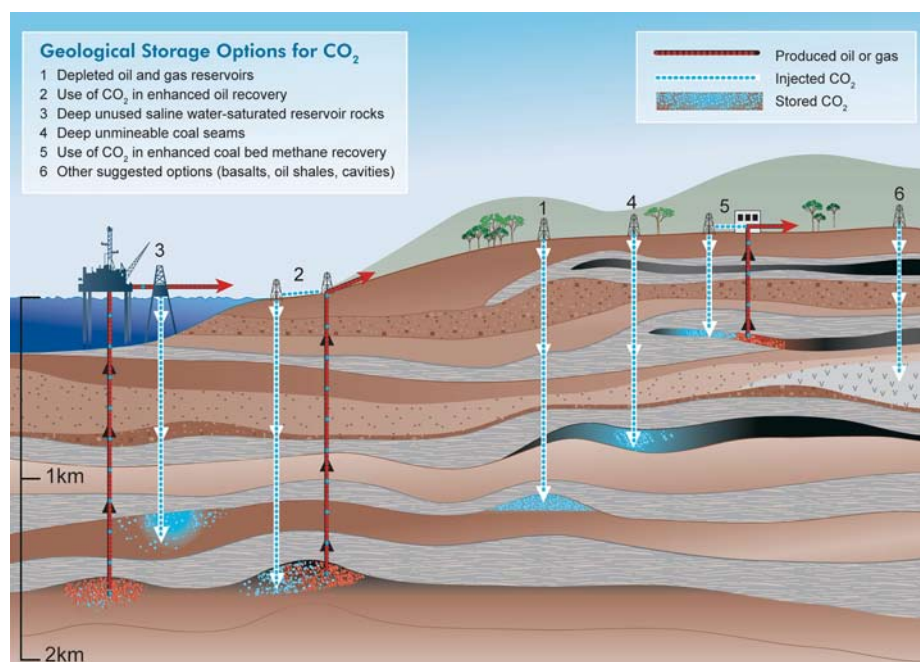
Staff Transfer

Dr. Eibhlín Doyle transferred to Exploration and Mining Division in October, 2009. Eibhlín was a member of the Senior Management Team in GSI and had responsibility for the Groundwater and Minerals Programmes as well as strategic surveys. In recent years she has been actively involved in two major studies, the Historic Mines Sites project and Avoca Mines Remediation Study. She took a leading role in many strategic issues in GSI, including its research function, North-South cooperation, and staff training and development. GSI would like to thank Eibhlín for her significant contribution to GSI over many years and to wish her every success and happiness in her new post.

All of these staff worked successfully in GSI and they can be proud of their individual contributions. They enjoyed the respect of their colleagues and will be sorely missed.

Carbon Capture and Storage (CCS)

John H. Morris



CCS has emerged in recent years as a technology which has the potential to contribute very significantly to climate change mitigation actions by storing CO₂ emissions in underground geological storage reservoirs, while at the same time facilitating a global transition towards lower dependency on consumption of all forms of fossil fuels.

The concept is simple: CO₂ is removed pre-combustion or from exhaust gases (post-combustion) emitted by major fossil fuel-powered power stations and industrial complexes, compressed into a liquid form and then transmitted by pipeline or ship to storage sites where it is injected deep underground into suitable geological reservoirs. This technology has been used safely and successfully for many years by the oil industry, particularly in the USA, where CO₂ derived from various sources is injected into depleting oil reservoirs in order to enhance oil recovery. It has now been applied and expanded to encompass a whole new generation of CCS geological reservoirs, in particular fully depleted oil and gas fields, as well as deep saline aquifers for which the theoretical global CO₂ storage potential is enormous. However, while the capture and transmission end of the CCS spectrum are reasonable well understood

and developed, the same cannot be said for the S end – geology – which remains the least well researched and defined component, even though the whole CCS concept is ultimately totally dependent upon the safe, long term security of CO₂ injected into geological reservoirs.

Nonetheless, efforts to achieve full scale commercial CCS implementations are now developing very rapidly in many parts of the world, including the USA, Canada, Australia, China and, not least, in the EU. Very recently, the EU allocated over €1B to expedite development of a suite of “flagship” CCS pilot demonstration plants, and, in October, announced the names of the first 6 of these plants. In parallel, the EU also published its draft directives on the “Geological Storage of CO₂” [which may be the first time that geology has featured in the title of any EU directive] and its Emissions Trading Scheme [“ETS”].

Ireland has lagged far behind in its efforts to address, develop and implement this technology, despite it being one of the largest per capita emitters of CO₂ in the EU as a consequence of its major dependency on fossil fuels. That imbalance is, however, now starting to be addressed. A study of the all-island onshore and offshore CO₂ storage potential, funded by the SEI and

involving various agencies, including GSI and the Geological Survey of Northern Ireland (GSNI), was published in 2008. That report, and its recommendations, provided the framework for three follow-up actions:

- an assessment of the deep saline aquifer storage potential in proximity to Moneypoint, Co. Clare, the single largest point source CO₂ emitter in the State. This project, funded by the EPA and with technical supervision provided by GSI and PAD, DCENR, has been completed and will be published in 2009.
- Implementation of an all-island cooperative effort to assess and better define CO₂ reservoir potential in the Irish Sea. The Inter-Departmental CCS Committee chaired by DCENR mandated the GSI to implement this project in 2009 jointly with the British Geological Survey (BGS) and GSNI. Current efforts focus upon collation and integration of all pertinent data from all jurisdictions into a single digital data structure.
- On foot of an SEI initiative, preparation and submission of a research proposal to the EU FP7 programme for funding to enhance research and knowledge to advance commercialisation of the CCS potential of the Kinsale Head gas field. The Irish partner group includes PSE Kinsale Energy Ltd, operators of the Kinsale Head Field, the ESB, UCD and GSI/SEI/PAD. A preliminary decision on that application is expected in December 2009.



OneGeology

Mary Carter

Planet Earth

Our planet Earth is one of the rocky planets in our solar system. Geology is the study of the solid and liquid matter that constitutes Earth. The outer surface of the earth, the crust, is divided into rigid rafts of rock, called tectonic plates. While the solid surface rock is visible in some places, sometimes providing magnificent scenery, as in the Cliffs of Moher, in many areas rock is hidden from view under soils and plants, or covered by water. Geological maps give some indication of what type of rock is down there, showing geological features, rock units and strata.

Natural Resources

Who cares what lies beneath the Earth's surface? For one thing the earth is a source of many of our Natural Resources. Natural Resources are referred to economically as land and raw materials. Raw materials found in the earth include such things as ores of gold, copper, silver etc, as well as oils and gas. While many parts of the world are desperately short of natural resources, some economies are mainly based on their exploitation. Geological maps help us define where these resources can be found. Movements between the tectonic

plates cause tsunamis, earthquakes and other natural disasters. Added to this is the growing public interest in the environment and in particular climate change, solving the problem of excess CO₂, or where energy is going to come from in the future. You then begin to understand the importance of geology. There has never been a bigger need to understand the global environment and to solve global environmental problems.

Objectives of OneGeology

OneGeology is an international project to make web-accessible the best available geological map data worldwide at a scale of about 1 to 1 million, initiated as a Geological Survey contribution to the UN International Year of Planet Earth 2008. This project capitalises on the wealth of knowledge available in Geological Surveys in nations around the world. To end August 2009, 109 nations have committed to delivering their part of the Geological jigsaw puzzle. Digital geological map data is often of variable quality and consistency. The aim is to bring it all together, making it easily accessible and creating an important source of global geological map data available in a standard data structure. The geoscience community also needs to accelerate the development and spread of simple, essential digital geological

map standards. The project will also transfer practical know-how and the latest technology from more advanced countries to those less well advanced, reducing the length and expense of the learning curve, while at the same time producing maps and data that will attract interest and investment.

Funding

Funding has been raised to support OneGeology work and goals, €3.25 million from eContent plus programme for the 21-nation OneGeology-Europe project. Starting in September 2008, it also supports the INSPIRE Directive. INSPIRE was brought into force in May 2007, establishing an infrastructure for spatial information in Europe to support Community environmental policies, and policies or activities which may have an impact on the environment. In the USA 50 state surveys received \$700,000 for a Geoscience Information network, with similar aims.

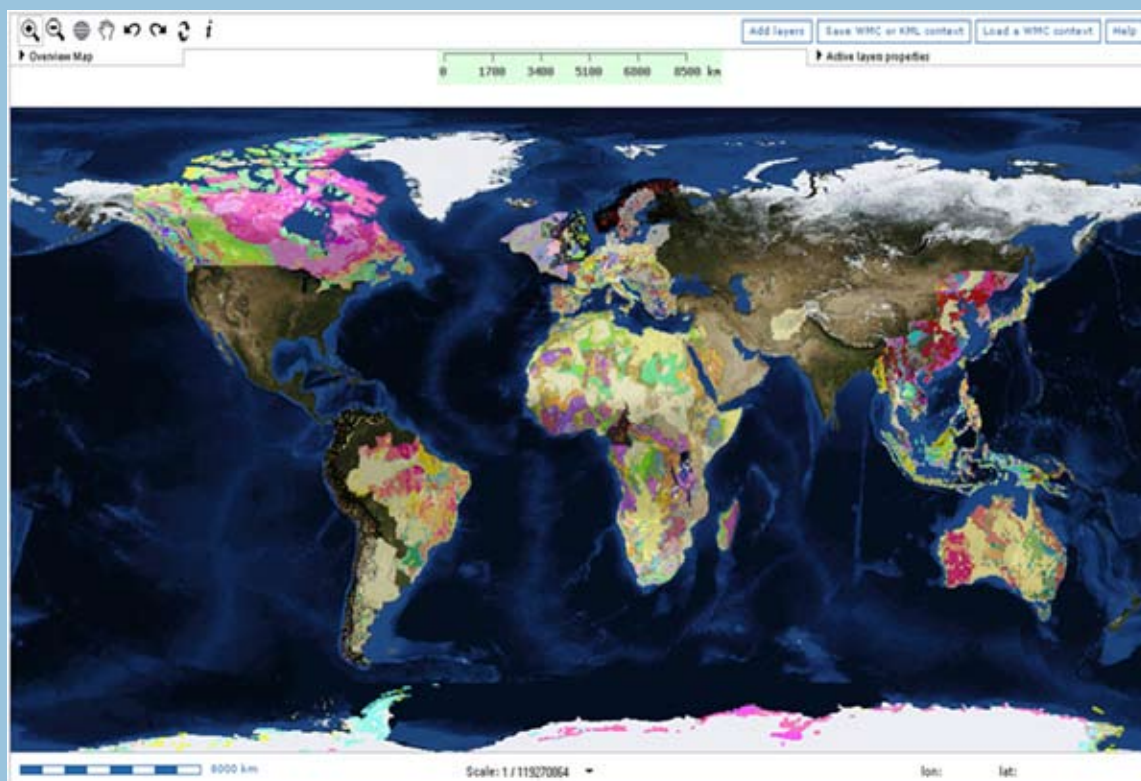
Technical Information

Getting down to the technical details, OneGeology is based on the principal of interoperability, with maps produced on individual servers, and sent directly to the web client. Currently 125 datasets are



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View of some datasets on the www.onegeology.org portal



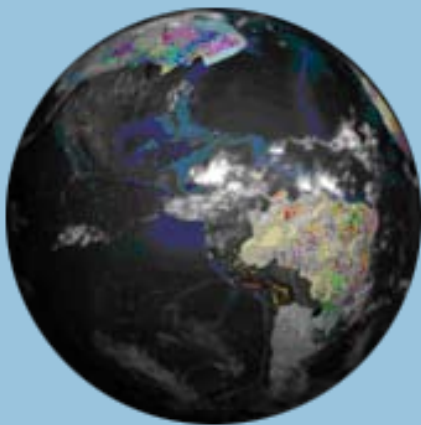
EAGE Near Surface Geophysics Conference Dublin, September 2009

Xavier Pellicer & Enda Gallagher

being served from 40 countries. Hosted by each Geological Survey, each participant delivers its map or maps through a standard web service (WMS/WFS). The list of metadata, or data about the data, is collected into a catalogue service and managed "centrally". With this in place the portal can then display/aggregate all the maps. The central portal is located in France and is run by the French Geological Survey, BRGM. There were 420,000 visits to the portal at www.onegeology.org in the first six months, 50,000 on the opening day. Recently, the portal stayed up even when hit 29 million times in one month, a testament to the resilience and strength of the service provided. A Technical Working group defines standards for OneGeology, and provides technical specification for the services and the portal. They also provide "Cookbooks" which explain to participating Geological Surveys how to set up the services using open source software, and they provide technical support. Another working group has developed a standard language to exchange geoscientific data, GeoSciML, which is based on GML (Geography Markup Language). To guarantee consistency, the project team also have links with standardization bodies.

The Future

Future aims include increasing the number of countries participating, and moving progressively from delivering data by WMS, which provides data as an image/raster, to WFS which provides data with Geometry (points, polygons, lines) and attributes (text). With the aim of getting more sustainable governance and funding, it is hoped to move OneGeology to a not-for-profit incorporated status.

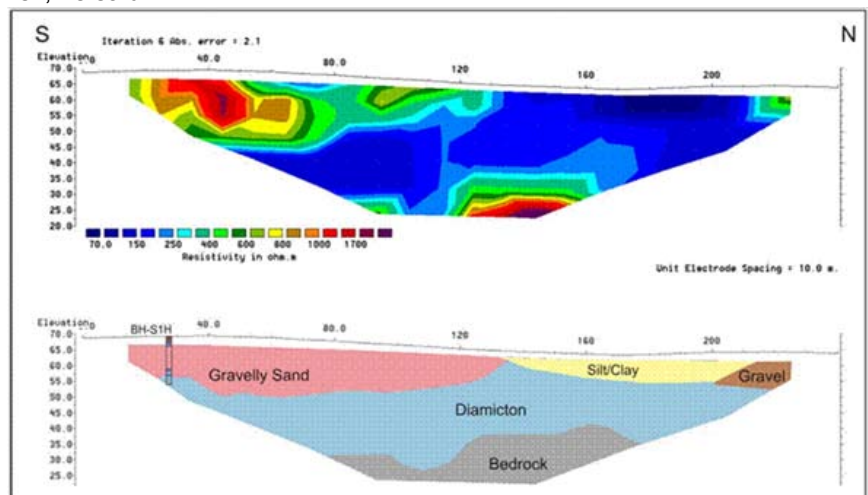


Mapping the Earth's rocks

300 leading scientists from all over Europe converged on Dublin from 7-9 September for a conference that celebrated cutting-edge Irish geological research. "Near surface geophysics" is an important component in Ireland's recent infrastructural development. It involves the extensive study of the earth that lies immediately underground. The conference, which was hosted in Trinity College Dublin, highlighted various Irish projects and methodologies spread across a range of sectors including engineering, environment and archaeology, together with examples of their application to Irish projects.

This is an area of geoscience with considerable potential for developing a specialist knowledge-based internationally-traded service industry. That was according to the minister who opened the conference, Conor Lenihan, Minister of State at the Department of Communications, Energy and Natural Resources. "The important role that engineering geophysics has played over the last 15 years in ground investigation for major infrastructural projects in Ireland's National Development Plan has encouraged the conference organisers – the European Association of Geoscientists and Engineers – to select Ireland to host the conference for the very first time", he said.

In explaining the importance of near surface geophysics to Ireland, conference organiser, Peter O'Connor, referred to the unprecedented nature of Ireland's infrastructural and industrial development over the last decade. Much of this has required large scale ground investigation studies, he said. "These studies now make use of near surface geophysics techniques to help us gain a more detailed understanding of the underlying environment of the site, for example, how sound it is for its planned purpose." Appropriate use of geophysical methods assists in assessing if the siting of a development in a particular location is appropriate, reduces overall project costs and minimises risk, he said.



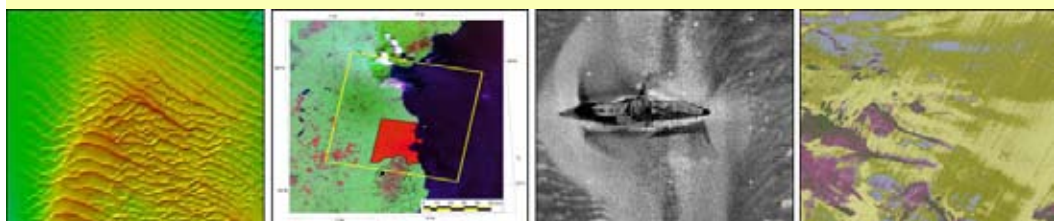
Electrical Resistivity Tomography (ERT) profile. This technique generates profiles of the sub-surface, showing variations on the resistivity of materials to electrical current. Lithological variations occurring within 25m of the subsurface can be inferred. Main variations are related to grain size and sorting. Moreover depth to bedrock can be estimated with high accuracy.

Ireland's two biggest near surface geophysics projects were presented at the conference in great detail. These are the INFOMAR and TELLUS projects. The former refers to Ireland's seabed survey that is currently concentrating on mapping the shallow seabed surrounding Ireland (and is documented elsewhere in this newsletter). The Tellus project was a recent airborne geophysical study of the earth across Northern Ireland. It collected scientific data on rocks and minerals which will help manage the environment and support sustainable natural resource development. As well as the presentation of these projects, Irish scientists from varying backgrounds presented on a range of subjects, including the mapping of peat areas in the Irish midlands and the characterisation of landslides using a range of geophysical techniques. The conference website is hosted at www.eage.org.

Third Irish Earth Observation Symposium, GSI, November 2009

Irish Scientists Gaining Ground in Earth Observation Race

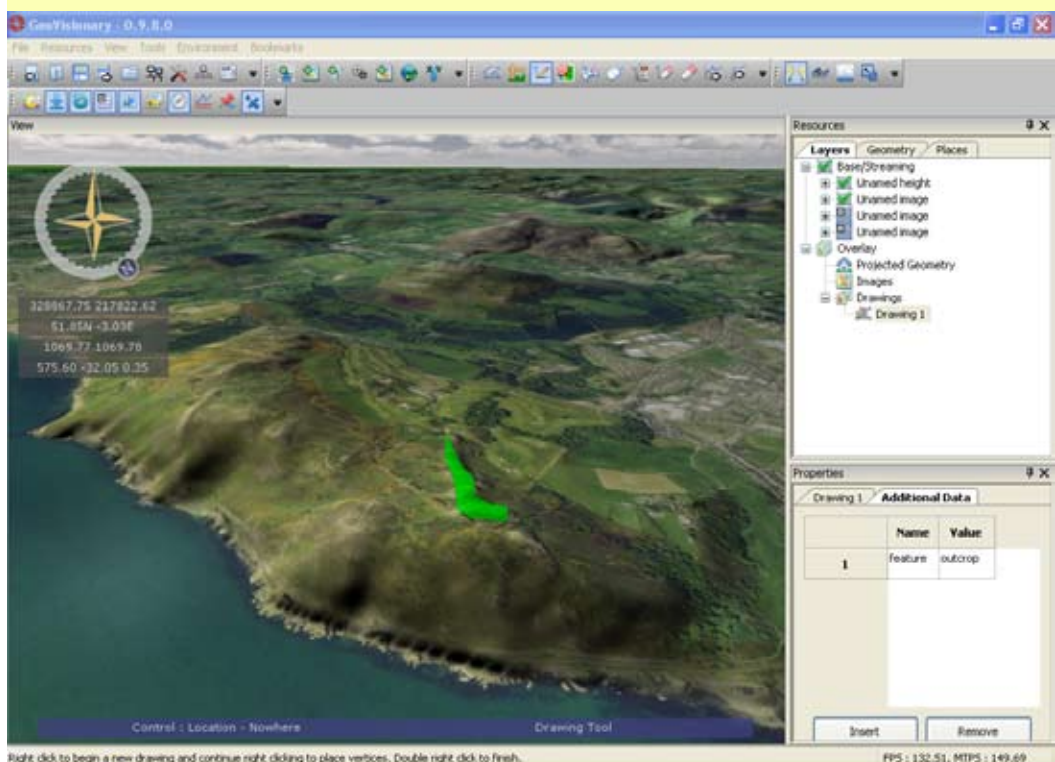
Enda Gallagher



Irish scientists make infrastructural projects more efficient by contributing information gathered remotely. That's one of the messages that was repeatedly communicated at Ireland's premier gathering of Earth Observation specialists which took place in GSI offices 12-13 November last.

Earth Observation is a fast-growing area of scientific research and, from a small base just a few short years ago, Ireland is now contributing a range of outstanding research methodologies and projects to global understanding of the dynamics of our Earth. The *Third Irish Earth Science Observation Symposium* proudly showcased some of the best contributions by Irish scientists to date.

According to the Symposium's Technical Director, Michael Sheehy (GSI), *"information being acquired in Ireland is contributing to a global understanding of climate change and how our planet functions. For example, such information is being used to develop*



Screen shot from GSI's new geovisionary software

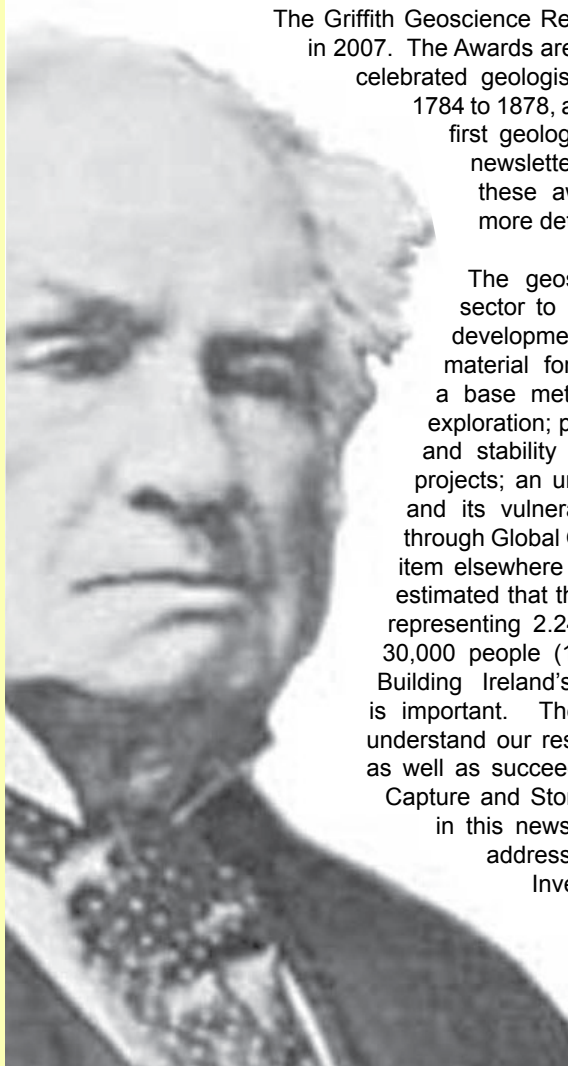
Griffith Geoscience Research Awards

EurGeol Dr. Eibhlin Doyle PGeo

strategies for coping with coastal and river flooding, and it is also being applied to identify areas susceptible to landslides." He went on to explain that Earth Observation is primarily delivered via a mechanism of remote sensing, whereby the sensor being used is not in contact (remote) with what it's recording (sensing). Various applications are involved in Earth Observation – land, sea, air and space – and the technologies used include satellite, ship-based and airborne.

A recurring theme throughout the proceedings was Ireland's overall importance in the global Earth Observation story. Our unique geographical position at the edge of continental Europe and the North Atlantic presents interesting challenges in acquiring Earth Observation data. Many of the presentations, delivered by a strikingly youthful band of Irish scientists, demonstrated remarkable achievements in successfully negotiating these challenges.

The Symposium attracted over 80 delegates who, as well as gaining exposure to a wide-ranging programme of talks, were treated to two different demonstrations by GSI and the Ordnance Survey of Ireland on their work in Earth Observation. GSI unveiled its new geovisionary suite in a very well-received workshop. The Symposium's keynote speaker was the highly respected Earth Observation expert from the British Geological Survey, Dr. Colm Jordan, himself Irish. The Symposium also touched on the work of the European Space Agency, enabling Ireland to maximise her return on investment in this organisation. Proceedings concluded with Dr. Fiona Cawkwell, UCC, announcing that UCC were hoping to convene a working group/steering committee that will consider the future directions of Earth Observation in Ireland. Further details on the symposium, including the presentations, can be found at the dedicated web-pages available here <http://www.gsi.ie/News/Earth+Observation+Symposium.htm>.

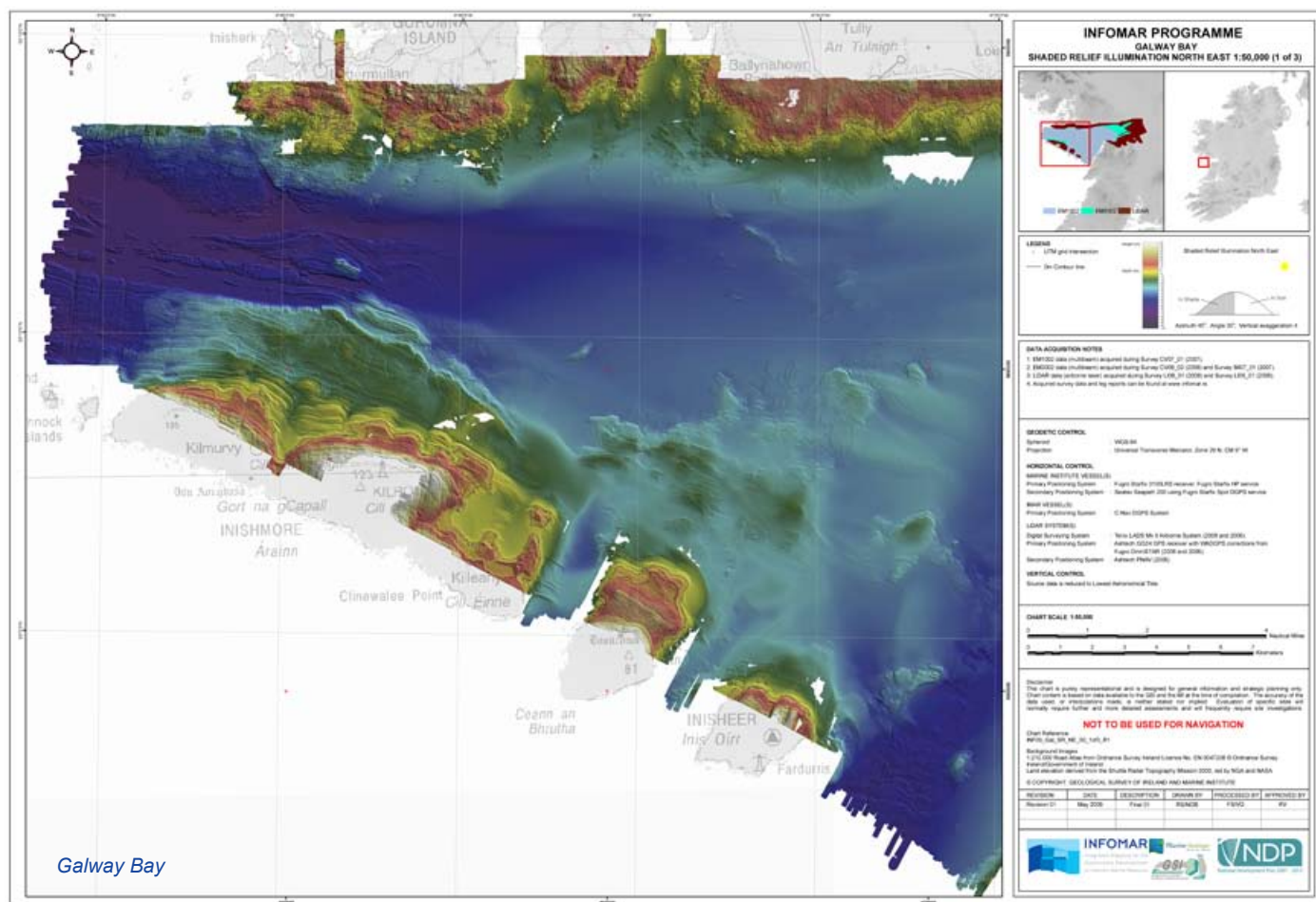


The Griffith Geoscience Research Awards were established in 2007. The Awards are in honour of Richard Griffith, the celebrated geologist and engineer, who lived from 1784 to 1878, and is credited with developing the first geological map of Ireland. In previous newsletters we have briefly discussed these awards but now we will provide more detail.

The geoscience sector is an important sector to Ireland's growth and sustainable development. The sector provides raw material for the construction industry; has a base metal industry both in mining and exploration; provides information on the nature and stability of the ground for infrastructure projects; an understanding of our groundwater and its vulnerability; and encourages tourism through Global Geopark initiatives (see Geoparks item elsewhere in this newsletter). In 2006, it is estimated that the sector was worth €4.24 billion, representing 2.24% of GNP and employed over 30,000 people (1.4% of total Irish employment). Building Ireland's capacity in the geosciences is important. There is a need to manage and understand our resources, both mineral and water, as well as succeed in new areas such as Carbon Capture and Storage (CCS - see item elsewhere in this newsletter) and renewable energy to address issues such as climate change. Investing in geoscience research is necessary to provide answers and technologies for the future. It will build Ireland's capacity in the geoscience sector and expand the knowledge economy.

Four priority research categories were identified to guide the research to be carried out under the Griffith Geoscience Research Awards scheme. These priority areas also recognised the importance of making geological data easily available and the need to make geological information more accessible to the public and create awareness of the earth beneath our feet. The four areas identified are:

1. Open access to GSI data on a web-enabled basis.
2. Establish an Irish Geoscience Graduate Programme on an all-island basis which will provide access to specialised post graduate geoscience courses on a modular basis.
3. Produce and distribute geoscience outreach products (for example, DVDs, rock specimen sets, classroom posters) to primary and/or secondary schools.
4. To conduct high quality research on key geoscience topics especially on deep geothermal energy, carbon sequestration in geological formations and groundwater resources.



Applications for funding were open to Institutions on the Island of Ireland (32 counties) with €10 million being made available for the period 2007 to 2013 from NDP funding. Following adjudication by a three person international panel, a total of eight awards were made:

1. Seabed and groundwater data to develop new services and to model climate change (Biogeoscience Research Group, NUI Galway);
2. Protection of groundwater resources (Groundwater Research Group, Queen's University Belfast);
3. Improved understanding of deep seabed processes and basin analysis (Marine and Petroleum Geology Research Group, University College Dublin);
4. Modelling storage of carbon underground (Geophysics Groups at University College Dublin and University of Ulster);
5. Open access to GSI data on a web-enabled basis (Coastal and Marine Resources Centre, University College Cork);
6. Establishment of a fourth level Irish Geoscience Graduate Programme (Dublin Institute for Advanced Studies);
7. Provision of a range of educational products (Geoschol Group, Trinity College Dublin); and
8. A geoscience TV series (Holocene Ltd).

Each of these research projects have progressed since they were awarded in 2007 and in many cases have managed to leverage additional funds from the EU or private companies which could not have been done without the Griffith Research Awards acting as a catalyst. The following is a short description of each of the research awards

Seabed and groundwater data to develop new services and to model climate change (Biogeoscience Research Group, NUI Galway)

This research will expand our knowledge of Galway Bay's seabed. In addition, information will be collected for onshore groundwater in what is a well known karstic

environment. The aim will be to develop a more comprehensive understanding of groundwater, its vulnerability and interaction with seawater in the coastal area. The data collected and interpreted will provide information on past climate change which can inform our understanding of climate changes taking place today. The grant of €3,144,061 over the six year period provides funding for 4 post-doctoral research staff, 5 PhD students and 18 under graduate fellowships.

The grant has helped leverage EU funding for CORALFISH (>€15m) along with feeding into project such as Smart Bay and SLAN. It utilises data collected from the INSS and INFOMAR projects and demonstrates an excellent integrated approach both within the research team and with other projects.

Protection of groundwater resources (Groundwater Research Group, Queen's University Belfast)

This research seeks to provide a better understanding of Ireland's poorly productive aquifers and to evaluate

the impact of human behaviour on groundwater and how this affects the wider environment. Monitoring wells have been installed to study areas such as the Glencastle River Catchment (Co. Mayo), the Gortinlieve catchment (Co. Donegal), the Mattock catchment (Co. Louth) and at Oughterard (Co. Galway). The grant of €1,783,507 over the six years funds 2 PhD students, 2 post-graduate students and 3 under-graduates summer placements. The research has leveraged funding from the EPA Strive Pathways project of approximately €2m and installation of equipment on one test site by GSNI (value estimated at €200,000).

Improved understanding of deep seabed processes and basin analysis (Marine and Petroleum Geology Research Group, University College Dublin)

This research has two objectives: the first is to develop a comprehensive understanding of deep-water sedimentary processes, with a special focus on modern and ancient sediments on the Atlantic margins. This information will be important in helping to promote petroleum exploration in our

waters by providing a better understanding of potential reservoir systems. It will also help to develop innovative techniques for sediment provenance analysis to assist in mapping sediment transport pathways. The second objective is to establish a premier global training site for petroleum geologists in County Clare where world-renowned sedimentary sequences can be studied in outcrop and in drill core along with geophysical logs. It will provide an analogue for a range of reservoir types that are important in many parts of the world. Drilling has already taken place on the site.

A grant of €1,545,257 over the six year period funds 2 post doctoral research posts, 4 PhD students and 5 undergraduate summer students. This research has facilitated linkages with Petroleum Infrastructure Programme funded projects, access to new PRTL funded analytical equipment, and has helped develop new links with industry. Additional research funding (>€100,000) from industry has been leveraged as a result of this Griffith award.

Modelling storage of carbon underground (Geophysics Groups at University College Dublin and University of Ulster);

This research develops methodologies to understand how injected carbon dioxide accumulates in underground reservoirs. Numerical simulations will be carried out on potential sites. The research will also assess the potential for deep geothermal energy based on the Earth's deep natural heat. Synthetic seismograms and numerical codes are being developed and this will allow interpretation and identification of potential sites and the ability to monitor CO₂ in the rocks in the future. This has significant benefits for Ireland in the search for potential sites for CCS to reduce our carbon emissions.

The combined grant for the two Universities is €1,163,957 over the six year period facilitates 2 post-doctoral research posts, and 4 under-graduate students to work on this topic.



Kilkee, Co. Clare. Image courtesy UCD Marine & Petroleum Geology Research Group

Open access to GSI data on a web-enabled basis (Coastal and Marine Resources Centre, University College Cork)

This project's main objective is to facilitate open access to GSI data on a web enabled basis. To date a total of six reports have been completed based on findings of research and investigations undertaken. These reports include detailed technical appraisals and focussed recommendations on geological datasets, systems, data models, data integration and user needs. Also covered in the reports are best practice for web-delivery of geological data and web enabled 3D/4D visualisation. A grant of €851,877 has been allocated for a period up to 2011 which facilitates three post-doctoral researchers to focus on these topics. A further €750 k in research funding for Irish participation in three new EU framework projects (2010-2013) has been leveraged in association with the Griffith award.

Establishment of a fourth level Irish Geoscience Graduate Programme (Dublin Institute for Advanced Studies)

This initiative involves five universities and one research institute and it aims to set up courses which will draw on the strengths, skills and expertise across them. It is hoped that this will broaden the background of PhD graduates by combining expertise between institutions and providing research and generic skills training. The main aim is to improve breadth and quality. A grant of €406,577 has been allocated to achieve this objective.

Provision of a range of educational products (Geoschol Group, Trinity College Dublin)

The objective of this project is to produce and distribute geoscience outreach products to primary and secondary schools. Rock sets, four classroom posters and an activity book have been circulated to primary schools in Ireland, and a dedicated website established. This website (www.geoschol.com) carries digital versions of the geoscience resources as well as links to geology institutions and educational sites. A grant of €120,000 was allocated to this project and it was completed in September of this year.

A geoscience TV series (Holocene Ltd).

The purpose of this project was to produce a TV series on "Planet Earth". However, progress has been slow as additional funding from other sources has not been forthcoming.

Progress on these projects was presented at the annual Griffith Research Awards seminar in GSI in October. Progress was reported through a mix of verbal presentations and poster displays. Researchers also availed of the opportunity for interact and engage with the other researchers present. Further information on the Awards, including seminar presentations, is available at <http://www.gsi.ie/Geoscience+Initiatives/Griffith+Geoscience+Research+Awards.htm>

Geoschol's Planet Earth Poster

