Geology Matters

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

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WELCOME

Welcome to the autumn edition of **Geology Matters**. In this issue we feature the **Information Technology (IT)** and **Information Management Programme (IMP)** Sections of the GSI. Computers are so fundamental to what we do that like most organisations GSI has separate section to look after these important activities. We feature the historical development of the GSI computer systems as well as providing some information on our current system and capabilities. We then go on to showcase a number of our information management flagship projects – web-mapping, the Terrafirma Project, the document management system and the key to much of what we do – our databases.

Our guest contributor for this issue is **Barry McSweeney** (Research Coordinator at the Department of Communications, Marine and Natural Resources) whose article deals with the governments **Strategy for Science, Technology and Innovation**. We start a new series in this issue, which features summary articles on the geology of individual counties. These should be of interest to those studying geography for their Leaving Certificate. In this issue we start with the **Geology of County Longford** and the **Geology of County Wexford**. We will be preparing the summaries for all counties but if there is a preference for which counties should come next please let us know. Professor **Bernard Leake** recently donated his field sheets for Connemara to the GSI and we brief look at them and the wealth of information that they contain. The GSI recently had a **pilot airborne survey** flown over three areas of the country. We review the areas flown and look forward to the information they can add to our geoscientific knowledge database.

We also have our regular features **Director's Discourse**, **Recent Publications** and **Rockbits** where we take a look at some less technical matters of rocks.

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If you would like to provide feedback on any aspect of Geology Matters, either for publication or simply to comment on any aspect of the newsletter please send your comments to gsisales@gsi.ie

Entries are invited for the 8th **Du Noyer Geological Photography Competition.**

See page 5 for details.

DIRECTOR'S DISCOURSE

This issue describes a series of airborne geophysical surveys which were carried out in various parts of the country in June 2006. These are not the first airborne geophysical surveys to be carried out in Ireland. It is now about a quarter of a century since an extensive airborne magnetic survey was undertaken over the Midlands. Although using a single technique at relatively low resolution, the results of this survey have been used ever since in mineral exploration and a variety of research projects. In more recent years, as part of the Irish National Seabed Survey, laser-based bathymetric mapping of coastal waters was completed in a number of bays on the west coast of Ireland and these have important applications in maritime safety and shipping development.

...we have become increasingly aware that our environment is not entirely benign...

The recent airborne surveys had equally important applications, being capable of mapping out areas with potential for high indoor radon. They can also outline the extent of important aquifers and assist in the assessment of their vulnerability to pollution. Applications in mineral exploration and infrastructure development are just additional examples of what these surveys have to offer. They provide high resolution images of the subsurface on a systematic basis, regardless of whether bedrock exposures exist or not and regardless of whether the environment is urban or rural.

GSI is currently examining the potential relevance of such surveys to a wide range of applications including the monitoring and assessment of natural hazards. While Ireland is blessed with a relatively safe environment, free of catastrophic earthquakes and volcanoes, we have become increasingly aware that our environment is not entirely benign. The occurrence of indoor radon is one issue which many communities in recent years have had to face. Another natural hazard is landslides, dramatically brought to national attention a few years ago by events in Galway and Mayo, and recent research work suggests that the national incidence of such hazards has been underestimated. Airborne surveys may have a role in such situations.

It is pleasing to report that there has been a broad welcome for the recent airborne surveys from both local communities and the media. They can provide important information on our natural environment that might otherwise not be available and the results of the 2006 surveys, in due course, will be important in illustrating this. Meanwhile GSI aspires to delivering such benefits on a nationwide basis and looks forward to receiving adequate funding to achieve this.

Strategy for Science, Technology and Innovation (2006-2013)

Barry Mc Sweeney

This strategy was developed by the Interdepartmental Committee in response to a request from the Cabinet Sub Committee on Science, Technology and Innovation. It follows on from the National R and D action plan 2004 and is based on the results of the SWOT analysis of Ireland as a knowledge based economy, which was carried out under the aegis of the office of the Chief Science Adviser in 2005. The Strategy was approved by Government in June 2006.

Content of Document

The broad context, vision and challenges facing Ireland in its attempt to become a knowledge-based economy, is presented in the opening chapter. The details on the development of 4th level education is presented in chapter two and is based on the report of the Research Funders Group on research capacity (2005), OECD report on HE system (2004) and other work. The Strategy includes doubling the number of PhD students, recruitment of 350 additional principal investigators, 1050 additional researchers and 350 technicians/ research assistants. It provides for new buildings to house the researchers and highlights the need for new methods of training graduate students. It underlines the importance of developing a career structure for researchers and the need to attract

researchers to come to Ireland in order to develop the defined research capacity.

The commercialisation aspects of research is covered in detail and a range of schemes are outlined in the context of R and D for Enterprise (chapters 3 and 4). An overarching structure is proposed for Technology Ireland (IDA and EI working together with SFI). The schemes include support for higher education-industry collaborative research and industry led networks. The role of the Institutes of Technology is recognised in the context of regional innovation. The role of the education system in providing strong foundation to the knowledge-based economy is captured in chapter 5. Actions are presented across primary and secondary level and measures to improve the awareness of science are highlighted. The use of the transition year in guiding students towards is proposed as are a range of curriculum changes.

The sectoral research efforts are presented in chapter 6 including DCMNR led Energy and Marine sectors. The other sectors include Agriculture and Food, Health and Environment. The need and benefit of a Geosciences strategy is included as a subsection of Energy.

There is an emphasis on cross cutting activities in the context of whole of Government approach.

The all-Island and International linkages are presented including the EU Framework Programme and the plan to improve participation rates by the establishment of new support mechanisms i.e. a new National Support Structure.

The steps required to implement the strategy are presented in the final chapter.

Comment

Irish research has been neglected and serious investment only commenced in the last 5 years with the establishment of SFI and the PRTLI. Currently we invest less than average of EU countries at 1.6%GNP and far from the Lisbon target of 3%GDP by 2010. This investment will increase our investment in research to about 2.5% of GNP. This is a large bold plan, which aims to put in place adequate research capacity to support Irelands aim of becoming a knowledge-based economy.

...Ireland can significantly improve its attractiveness towards international mobile young researchers...

However, most countries in the EU are also increasing their research capacity in an attempt to achieve Lisbon targets. Currently there is a shortage of researchers worldwide. Ireland does not have a high research reputation as yet - therefore we need to differentiate our research environment in order to attract researchers from abroad. This is accepted in the SSTI and the establishment of researcher career paths is outlined. This matter is to be considered by the Advisory Science Council. Ireland can significantly improve its attractiveness towards international mobile young researchers by establishing attractive career structures for researchers.

The intention of stimulating the interest of Irish youth in science is highly relevant and necessary and the range of actions outlined should lead to an increase in the number of students opting for science and engineering.

The Geosciences community should be guided by the SSTI in defining a national geosciences strategy.

Barry Mc Sweeney is the Research Coordinator at the Department of Communications, Marine and Natural Resources.

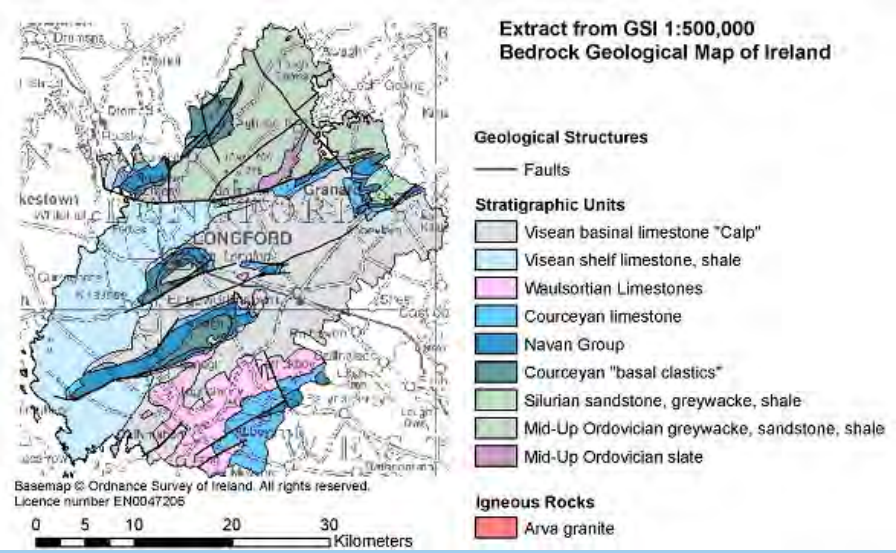
A GEOLOGICAL SYNOPSIS OF COUNTY LONGFORD

Introduction

The geology of a county can often define the nature of the landscape, farming, industry and the architecture of a county. In this synopsis of the geology of County Longford we will briefly describe the underlying Bedrock Geology and its links to the mineral industry and a well know public building in Longford Town.

Bedrock Geology

The geology of County Longford can be divided in two – a northern upland region with older rocks (Ordovician and Silurian rocks – about 450 to 420 million years old) and a southern lowland region with younger rocks (Carboniferous – about 350 to 330 million years old). The older rocks are slates, shales, sandstones and greywackes (sandstones with a mixture of fine and coarse fragments) while the younger rocks are limestones. The older rocks have been folded and metamorphosed by the Caledonian Orogeny (this was a continental collision and mountain building episode, similar to modern day Himalayas!) while the overlying Carboniferous rocks are largely flat lying and have not been folded. The Arva granite of Caledonian age (approximately 400 million years old) was forcefully intruded into the Ordovician rocks towards the end of the Caledonian mountain building event.



Some geological facts:

Oldest Rock Unit: the Glen Lodge Formation shown as Mid-Up Ordovician slate on Map. These are early Caradoc Shales, and are approximately 450 Million years old.

Youngest Rock Unit: "Calp" Limestones, approximately 330 million years old and known as the Lucan Formation. These are dark grey, cherty limestones and shales that stretch eastward across the country to Dublin, where they are commonly used as a building stone.

The most common rock types in County Longford are:

1. Calp limestone (347 km^2 or 33% of the county)
2. Shelf limestone (215 km^2 or 20% of the county)
3. Greywacke, sandstone and shale (191 km^2 or 18% of the county)

Geology and the Mineral Industry

In the 1960s and 1970s mining companies carried out exploration that resulted in the discovery of the Keel deposit. The minerals discovered were sphalerite (zinc sulphide) and galena (lead sulphide). There was however insufficient mineral present to open a mine. Mineral exploration continues in a number of areas in Co. Longford today.

Geology and Architecture

Longford courthouse is a five-bay three-storey over basement, double fronted courthouse built on the main street in 1793, probably on the site of an earlier building. The steps lead up to a Doric entrance door-case below a central first-floor Venetian window. The attic storey was added in 1859 to1860 and a pair of single storey bridewell extensions were added to either side of the street entrance about 1900. A number of different limestones have been used at different times, including fossiliferous

and crystalline types to construct the building. Longford town is built on limestone bedrock from the Meath formation which includes a wide range of limestone types including micrite, oolite, argillaceous bioclastic limestone, and silty limestones. However, traditionally stone was brought in from limestone quarries such as Trelick and Cloondara from outside Longford town where better quality building stone could be sourced.

Longford Courthouse with detail from the doorcase showing carved stone used in its construction

Suggested further reading (GSI publication):

Morris, J.H., Somerville, I.D. and MacDermot, C.V. 2003. A geological description of Roscommon, Longford, Westmeath, and adjoining parts of Cavan, Leitrim and Galway, to accompany the Bedrock Geology 1:100,000 Scale Map Series, Sheet 12, Longford – Roscommon, Geological Survey of Ireland. 99 pages.

IRISH GEOLOGICAL ASSOCIATION/GEOLOGICAL SURVEY OF IRELAND

DU NOYER GEOLOGICAL PHOTOGRAPHY COMPETITION 2006

Entries are invited for the Eight Du Noyer Geological Photography Competition

George Victor Du Noyer, who served as a geologist with the Geological Survey of Ireland from 1847 to 1869, was a skilled field artist whose numerous sketches and pictures, with their combination of artistic skill and technical accuracy, were the "field photographs" of their day. This competition seeks to encourage the same blend of artistic and scientific skills through the medium of photography.

The photographs entered may be recently taken images but older, historical photographs, especially ones not in any archive and liable to be lost, would be welcomed and so conserved.

Entrants may submit photographs [prints, slides, digital images etc. are all acceptable] illustrating an aspect of field geology

Total prize money of €600 will be awarded

All photographs entered must be clearly labelled with the following information:
Name, address, telephone number, Email of entrant/photographer
Short title description of geological/historical content of photographs
Place and Date when taken
[Please write on a label and stick it onto the back of the photographs]

The competition will be judged by a panel including representatives of the IGA, the GSI and external nominees and their decision will be final. Entries will be exhibited and prizes awarded at the GSI Awards ceremony in December. Entries will be returned after the competition.

Entries should be posted in an envelope marked "Du Noyer Competition" to: The General Office, Geological Survey of Ireland, Beggars Bush, Haddington Rd, Dublin 4.

The closing date for entries is: Friday, 17th November 2006

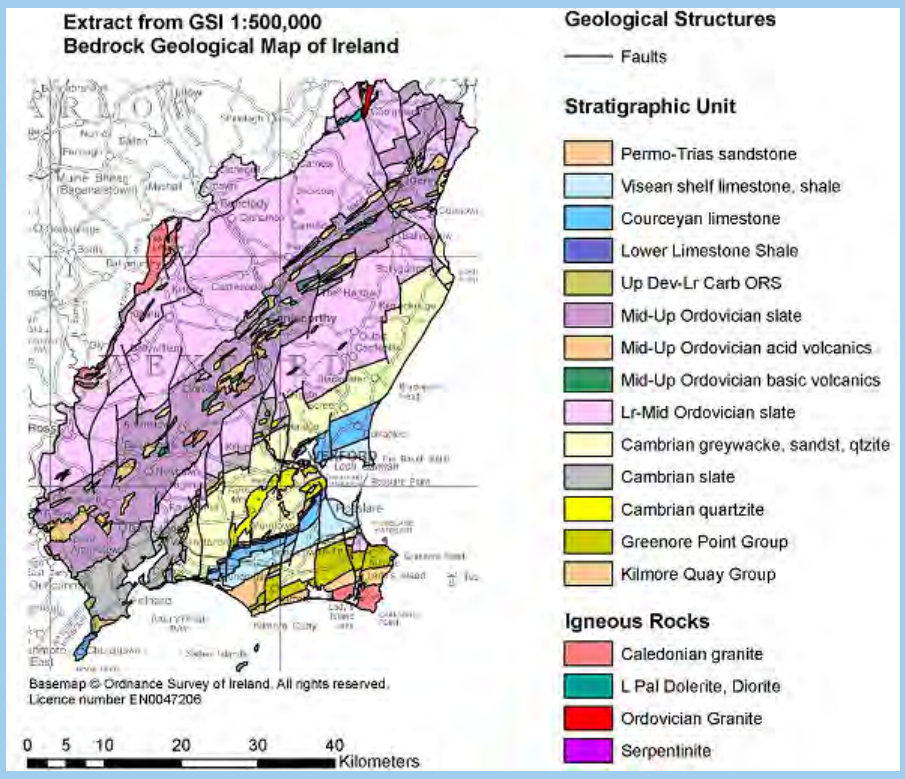
A GEOLOGICAL SYNOPSIS OF COUNTY WEXFORD

Introduction

The geology of a county can often define the nature of the landscape, farming, industry and the architecture of a county. In this synopsis of the geology of County Wexford we will briefly describe the underlying Bedrock Geology and its links to the mineral industry and some architecturally important historic buildings.

Bedrock Geology

The geology of County Wexford is a record of more than 400 million years of the earth's 4,600 million year history. Some of the oldest rocks in Ireland are found in the Rosslare Complex in the south east of the county (The Greenore Point and Kilmore Quay Groups are older than 620 million years). Some of the youngest rocks too are found in the southeast, the Permian to Triassic aged Killag Formation (Permo-Trias sandstone on map) date from some 250 million years ago. The bulk of the geology of the county comprises Ordovician slates and volcanics dating back to a vanished ocean bed, which was approximately 450 million year old. Overlying the Ordovician there is a succession of Devonian sandstones (ORS) passing up into Carboniferous Limestones and up into the Permo-Trias rocks.



<u>Some Geological Facts:</u>

Oldest Rock Unit: Both the Greenore Point and Kilmore Quay Groups have histories dating back beyond 620 million years.

Youngest Rock Unit: The Killag formation (Permo-Trias sandstone) dates from 'only' about 250 million years ago, and forms some of Ireland's youngest rocks.

The most common rock types in Co. Wexford are:

1. Slates (1630 km^2 or 69% of the county) Cambrian and Ordovician
2. Greywacke, sandstone and quartzite (348 km^2 or 15% of the county)

Fossil Localities: Hook Head, spectacular fossil assemblages occur in the Carboniferous limestones.

Geology and Mineral Industry

Modern mineral exploration commenced in the 1960s and continues today. The principal commodities being sought are copper, lead, zinc and gold in the volcanic rocks along the centre of the county. In the 19th Century lead was obtained from the Caime mine, near Enniscorthy.

Ferns Castle – built of local volcanic and slate rocks

Geology and Architecture

The stone fortress of Ferns Castle, Co. Wexford is a towered keep, or a 'donjon', probably completed in 1224 or 1225 by William Marshall the Younger, and is one of four remaining 13th century castles of this type known in Ireland. The masonry of the castle is coloured light pink to cream and green volcanic rock, sometimes appearing pinkish as the rock ages. A close look at the masonry shows that it was built in stages, with the stone appearing as differently coloured bands as the wall height increases. Wilkinson (1845) noted that "The old castle at Ferns, Co. Wexford contains local slate rock". The masons obtained their building stone by digging a defensive moat into the bedrock. Some English limestone from Dundry Hill, Bristol was transported here to decorate the circular chapel on the first floor of the south-east tower.

Tintern Abbey, Co. Wexford is a Cistercian monastery, built on land bequeathed by William Marshall, Earl of Pembroke, in thanks for landing safely in Bannow Bay after being threatened with shipwreck in 1200. A red-coloured sandstone (Old Red Sandstone) containing large quartz pebbles was used for the quoins, or cornerstones, and carved work of the abbey. Dundry stone from near Bristol was also used for carved detail and mouldings. The bedrock beneath the Abbey is known as the Booley Bay Formation, made up of grey to black mudstones with siltstones. The bedrock is buried beneath Quaternary deposits, and was not used in the construction of the main part of the Abbey. The masonry used for the castle is likely to have been brought in by boat from somewhere else along the coast.

Tintern Abbey built of Old Red Sandstone

Detail of the cornerstones where quartz pebbles can be seen

Suggested further reading (GSI publications):

Tietzsch-Tyler, D. and Sleeman, A.G., 1995, Geology of Carlow-Wexford: A Geological Description, with accompanying Bedrock Geology 1:100,000 Scale Map, Sheet 19, Carlow – Wexford, Geological Survey of Ireland,

Tietzsch-Tyler, D. and Sleeman, A.G., 1994, Geology of South Wexford: a Geological Description of South Wexford and adjoining parts of Waterford, Kilkenny and Carlow to accompany the Bedrock Geology 1:100,000 scale map series, Sheet 23, South Wexford, 64 pages

Sleeman, A.G. (ed.) 2006. The Geology of Wexford; report to accompany the 1:50,000 scale Bedrock (GIS) map Sheet 77. Geological Survey of Ireland, 44 pages.

Changes at Principal Geologist Level

Earlier this year some changes in responsibilities at Principal Geologist level took place. The Principal Geologists and their respective responsibilities are as follows:

Dr. Eibhlin Doyle
- Groundwater Section
- Minerals Section

Dr. John Morris
- Bedrock Geology Section
- Quaternary and Geotechnical Section
- Geological Heritage Section

Mr. Koen Verbruggen
- Information TechnologySection
- Marine Geology and Geophysics Section

THE DEVELOPMENT OF IT IN GSI

Mary Carter
(Head of Information Technology, GSI)

When I arrived in GSI in November 1980, there was no IT section. Each geologist had to write his/hers own programs in FORTRAN and send them, in boxes to Kilmainham where there was a central Civil Service mainframe computer. These programs were printed out, each line on one card, and transported by messenger. The computer attempted to interpret the program and often there were errors. The box of cards was then sent back to the geologist informing him or her that there was an error at line number such and such. Upon correcting the error the box was returned to Kilmainham to try again. The boxes went back and forth until the program ran, then the data were added, and a printout received.

Then there was Hewie, a calculator attached to a microscope, which had two tape cassette drives and could be programmed in its own version of BASIC. Running a program meant you had to get exercise, but didn't have to bother with punch cards. I was based in Hume Street, but Hewie, was at first in Kildare Street, then Aubrey Flegg moved it to Baggot Bridge House, where he was based. He had programmed it with a database of mineral localities, and had written a driver to allow them to be plotted out on a small A3 pen plotter, on a photocopy of a map at whatever scale, as long as it fitted on the plotter!

My first job was dealing with Prospecting Licence (PL) applications and renewals and I programmed Hewie to give me a list of renewals every month, and to give me a list of data which was to be placed on Open File. Others also wrote programs.

The next advance was the PDP 11/24. Datatrieve was purchased, our fist commercial software package, which made it easy to create a database. But we still had to do our own plotting, but this was now done on an A0 pen plotter. The PDP had the advantage of having a modem, and terminal emulation software. So having converted my program to FORTRAN 77 I could run it from Hume Street, but only on a direct line. This meant that it had to be done while others with whom I shared an office (Ralph Horne and Piers Gardiner) were at lunch. Also it was important to warn Kathleen, our telephonist, not to use the line.

Perhaps I should digress and explain our phone system. Most of us just had phones, whereby you rang the switchboard to have your line physically plugged in to the shared line, and then the number was dialled. Kathleen would check the line periodically to check if it as still in use and on hearing silence she would physically unplug it from the switchboard. As with today's phone lines you cannot share a line between your computer and someone making a voice call, so the shared line could not be used. Ralph and then Piers had a separate line with its own number. This could be used to dial into any computer with a similar modem and terminal emulation software. However, the computer made a lot of noise, so I would tell her in advance when I was calling a computer, and she would wait for me to call her on another line when I was finished, telling her to unplug it without checking the line. This meant I could program from Hume Street just walk down for the output, or ask Aubrey to give it to the messenger, but only at lunchtime, or when Piers or Ralph were away.

Conor's Osborne (Ozzie) sewing machine or PC

In the meantime Conor McDermot got impatient and got an Osborne 1 with his own money. The first portable PC, in the GSI, it looked like a sewing machine, with a small screen, and had database and word processing software to progress his borehole database.

Then in 1987 we got our first PC's and got lots of software we didn't have to write ourselves AutoCAD, Geosoft, Dataflex (database), Fortran 77, Design Graphics, (drawing package) Statgraphics (statistics). There were 6 PCs at first all in one room. But slowly they were dispersed to the Sections around the building.

The last historic achievement would be connection to the Internet, which was available first on a single PC in the server room on an ISDN line and finally on everyone's desktop PC, in 2002!

CONoR Project – (Centrally Organised Network of Records)

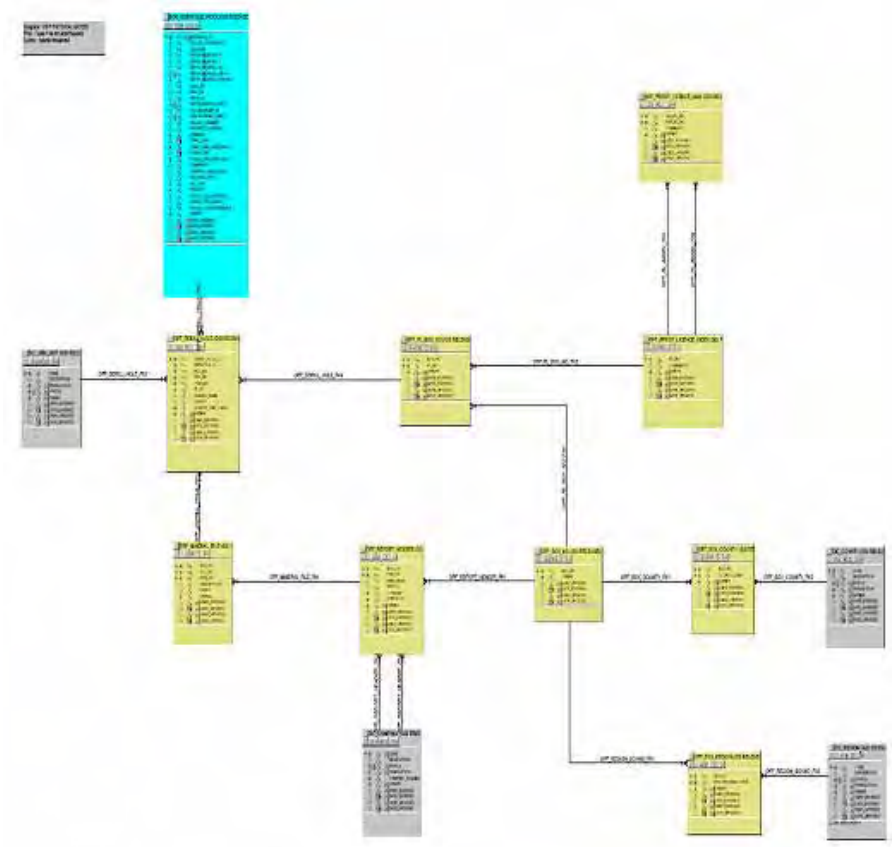
Mairead O'Dwyer & Joe Carey

CONoR is an integrated corporate database development project being run by the GSI IT section. The objective of CONoR is to establish a central database containing geo-science data (text, maps and images) from sections within the GSI. Though it is a descriptive acronym, the project title CONoR is also a tribute to our former colleague, Conor McDermot, whose idea it was to develop such a database.

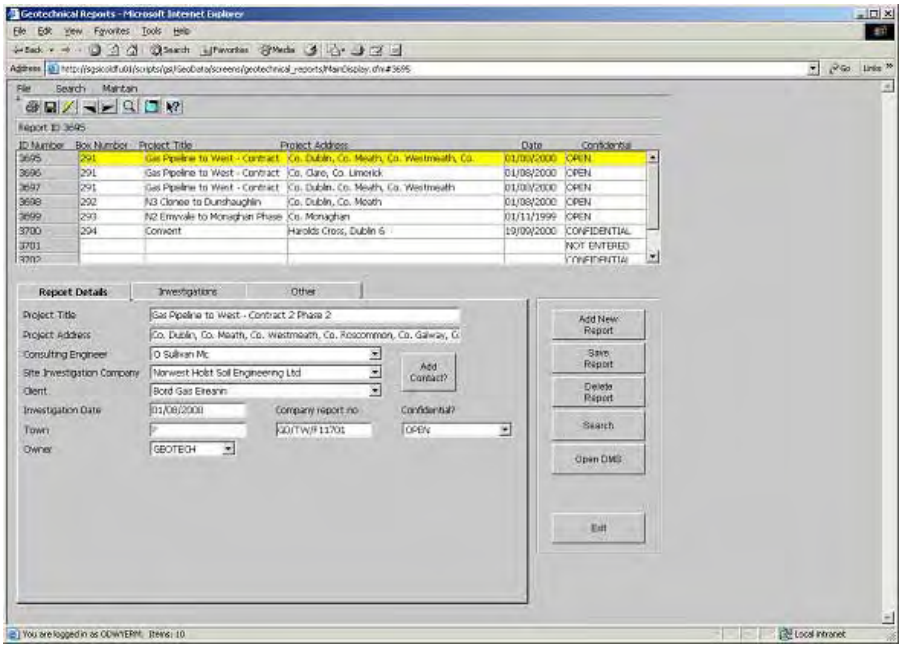
The project is run in conjunction with the British Geological Survey under a Memorandum of Understanding. The project consists of two parts, the first being the re-modelling of the database and loading of the data, the second being the development of a web-based application to query and manage the database.

The data modelling involved a major re-engineering of the existing database, GeoData. The BGS developed the data model in consultation with GSI. The database consists of 141 tables and contains eight of the GSI's principal datasets; Metadata, Mineral Exploration Reports-Open File, Geotechnical Reports and investigations, Groundwater Wells, Bedrock Boreholes, Map Catalogue and Seabed Survey. The data model also includes dictionary tables, technical metadata, project, core inventory, chemical, lexicon, geo-location and company/contact details.

A web-based application is being developed in Cold Fusion (CF - a programming language) and will



Data model for the Seabed dataset



Screen shot of application for Geotechnical section

replace the GSI's existing Visual Basic GeoData application. The CF application consists of sets of screens which allow users to display, insert, update and delete data held in the Oracle database. The system will be readily available and more reliable and upgrades will integrate seamlessly without disrupting users.

The new application will provide a solution for an Internet mapping service by way of ArcIMS and ArcSDE software that are used to deliver dynamic maps, GIS Data and Internet Mapping services via the Web. Screens for six of the eight datasets have been developed and there is fine-tuning being carried out on screens for the final two.

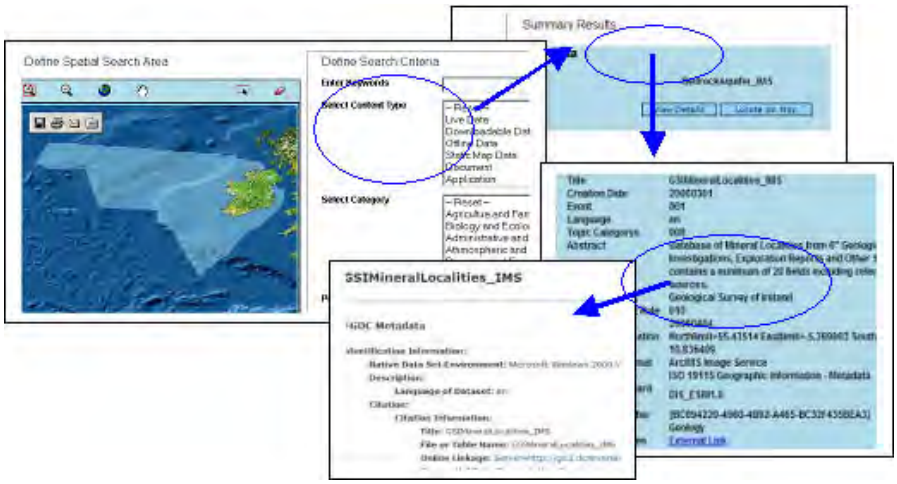
The new database will be rolled out in-house to GSI staff so that they can query and manage their own datasets. The public will also be able to view geological data via this CF interface in the Customer Centre in GSI offices. It is expected to make it available to the public over the web in the future.

METADATA PROJECT/ IRISH SPATIAL DATA EXCHANGE SYSTEM (ISDE)

Silvia Caloca

Metadata, often called "data about data", consists of a file containing information about a dataset; that is the content, structure, currency and availability. The information contained in the metadata file can be information on GIS layers, databases, maps, samples etc. All digital data should be accompanied by this descriptive information to aid users' understanding of the dataset that is being used. In a data rich organisation like GSI, metadata is vital.

GSI compiled metadata initially as part of the 1:100,000 Map series, and more recently as part of the corporate database project CONoR (see article on CONoR in this edition of Geology Matters). As a result metadata is now available internally and also externally for selected datasets through web sites such as: http://www.epa.ie/metadataxml (principally Water Framework Directive related data), http://www.marinedataonline.ie, http://mida.ucc.ie/pages/atlas/atlas.php (both mainly marine/Irish National Seabed Survey data), and http://gistst01.marine.gov.ie/metadataexplorer/. The exchange of data is essential to avoid duplication of effort and to ensure that organisations are aware of available datasets.



To facilitate this process the Irish Spatial Data Exchange System (ISDE) has been created. This Information Society funded project builds on an initial joint MI-GSI project, expanded to include more partners and has created a shared site for searching the Marine Irish Digital Atlas (Coastal and Marine Resources Centre), the Department of Communications, Marine and Natural Resources, the Marine Institute and the Environmental Protection Agency data. Each participant will house metadata servers in their own organisation and will be linked to a single portal. The system provides a structure to support maintenance and updating of the metadata and will also facilitate access to public datasets.

The ISDE web page serves as a point of entry for new information. When a query is processed, the system will search for the most up to date metadata entered by GSI, (EPA, MI, etc) and a link to our server will be automatically created.

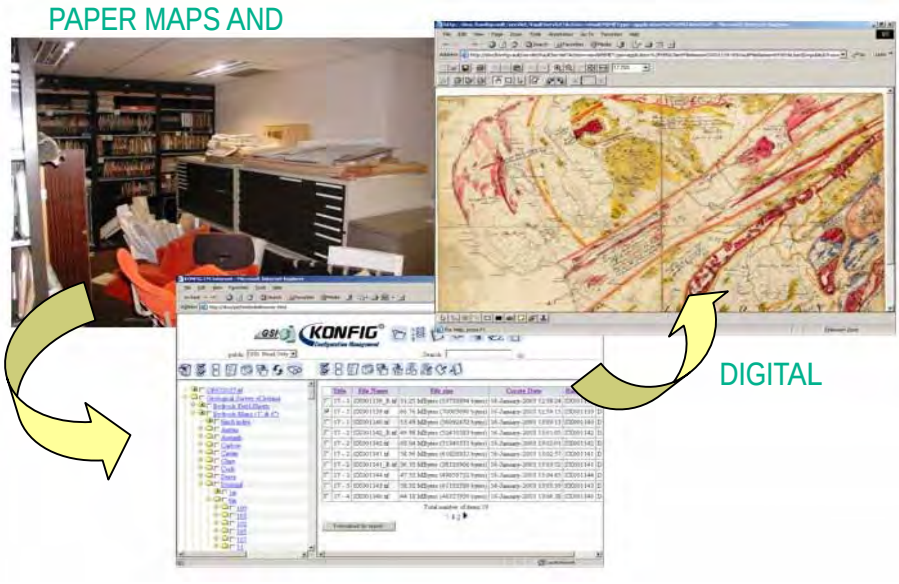
The ISDE portal will display a map (see below) with search boxes, where data can be queried either by area or topic and then subcategory. The system searches all connected metadata servers and returns metadata in a summary list. Further options include viewing details of the metadata, locating them on the map and/or going to the web page on the GSI Metadata server and viewing a full description (as shown below). Metadata are also available for download. Use the link below for a demo of this work in progress:
http://62.77.188.181/isde/default.aspx

THE DOCUMENT MANAGEMENT SYSTEM (DMS)

Charise McKeon

The Geological Survey of Ireland (GSI) is responsible for providing geological advice and information and for the acquisition of data for this purpose. The format of this data now varies from digital datasets to paper maps but historically data records were all in paper format. In addition, one of the statutory roles of the GSI is to act as a National Archive for geological materials.

In late 2001, a project funded by The Information Society, was undertaken to implement a Document Management System in the GSI. This major project involved scanning of paper records and loading of the imagery into a user-friendly system with the aim of providing greater access to the data for the Staff of GSI and the Public. The resulting dataset came to 1.4 Tb (Terabytes) in size, one of the largest collections of imagery in the state. Access to the DMS is through a web interface, currently on the GSI intranet, which is also available for public use in the Customer Centre at the GSI offices in Beggars Bush.



Datasets from all sections in GSI were considered for inclusion and those selected were deemed to be the most valuable and useful to the Customers of GSI and for future use in GIS Projects. These include: 19th Century 1":1 mile and 6":1 mile scale bedrock and Quaternary field sheets, geotechnical site investigations and borehole records, exploration records in the form of open file, mine records and mineral localities, geophysical and marine datasets, groundwater wells and almost all reports and publications of the GSI. These datasets now exist in high-resolution digital format. Many of the paper documents are unique and in a fragile condition from years of use and are now preserved which is essential for records of this nature.

In 2006 the DMS was upgraded with new software. This now facilitates greater speed in opening the large high-resolution documents. As part of the DCMNR GIS Strategy 2005-2008 it is planned to develop an application to integrate the GSI's Document Management System in a GIS application so that the data can be spatially queried and utilised. For example, Open File (exploration records) would be available through the GIS application by selecting the relevant Prospecting Licence number. More paper records is due to be added to this existing extensive databank and future plans involve introducing new software to enable access to the documents and maps through the web.

BRÉIFNE WEB-MAPPING

Gráinne Ní Shé

Bréifne is a collaborative initiative between the Geological Surveys of Ireland (GSI) and Northern Ireland (GSNI), the Academy of Irish Cultural Heritages at University of Ulster (Magee), and the local authorities of five counties: Sligo, Leitrim, Roscommon, Cavan and Fermanagh. The Special EU Programmes Body (SEUPB) funded the project, under the Programme for Peace and Reconciliation 2000-2004, with an overall aim to promote sustainable economic development within the region, particularly within the tourism sector.

The project area covers approximately 3,500km^2, delineated by the Sligo Coast to the west, Lough Key to the south and Lough Erne to the north and east, with the principal focus on an "upland core" encompassing the Dartry, Arigna, Sliabh an Iarainn, Cuilcagh and Bricklieve Mountains.

The team based at GSI have carried out development work on a customised web-mapping interface as a method of delivering and explaining the heritage of the region. It is intended that the Bréifne Web-Mapping ArcIMS site will help people plan a visit to the Bréifne region. The site can also be used for educational purposes. Users can select the information of interest to them; navigate around the map and print hard copy maps and reports. The website contains information on accommodation, restaurants, activities, as well as information on sites of geological archaeological, ecological and cultural interest.

The site can be accessed from the main Bréifne website (http://www.breifne.ie/) by clicking on the "Create your own map" link. This leads you into an introduction page about the site and then an option to enter the basic or advanced site. The basic site was designed with the first time user in mind. There are six easy steps to follow which will guide you through the process of selecting your area of interest, zooming, creating a report, printing a map and using hyperlinks to find additional information.

The advanced site is similar but has some additional functionality. This site was designed for users familiar with web-mapping sites. Extra buttons are available to allow the user greater flexibility to explore the data.

The project is innovative in depicting the tourism potential of the region through the medium of the internet. Users can enjoy the delights of this fascinating part of the country before they arrive. Go on, try it (www.breifne.ie).

PILOT AIRBORNE SURVEY

Eibhlín Doyle and Gerry Stanley

During the month of June a pilot high-resolution airborne geophysical survey took place over three selected areas in Ireland. The three areas selected were (Figure 1):

1. Cavan-Monaghan-Leitrim (part of)
2. Castleisland area,
3. Silvermines area

The challenges for each of these three areas is different, and the different geophysical systems on board were used to assist in understanding the issues in each of the three areas.

Cavan-Monaghan-Leitrim ties in with work already underway by the Geological Survey of Ireland (GSI) where a groundwater protection scheme has commenced. It is hoped that the airborne survey will provide the necessary detailed information to feed into the groundwater protection scheme. In addition it will tie in with the work carried out by the Geological Survey of Northern Ireland.

The Castleisland area has recorded elevated radon levels in buildings. This area was covered by the airborne survey to gather an improved level of detail on the bedrock geology and identify geological units and or structures, which may have potential for radon. Analysis of the data will be carried out in conjunction with the RPII.

The Silvermines area is a former base metal mining area. Selection of this area ties in with other ongoing programmes to rehabilitate the site.

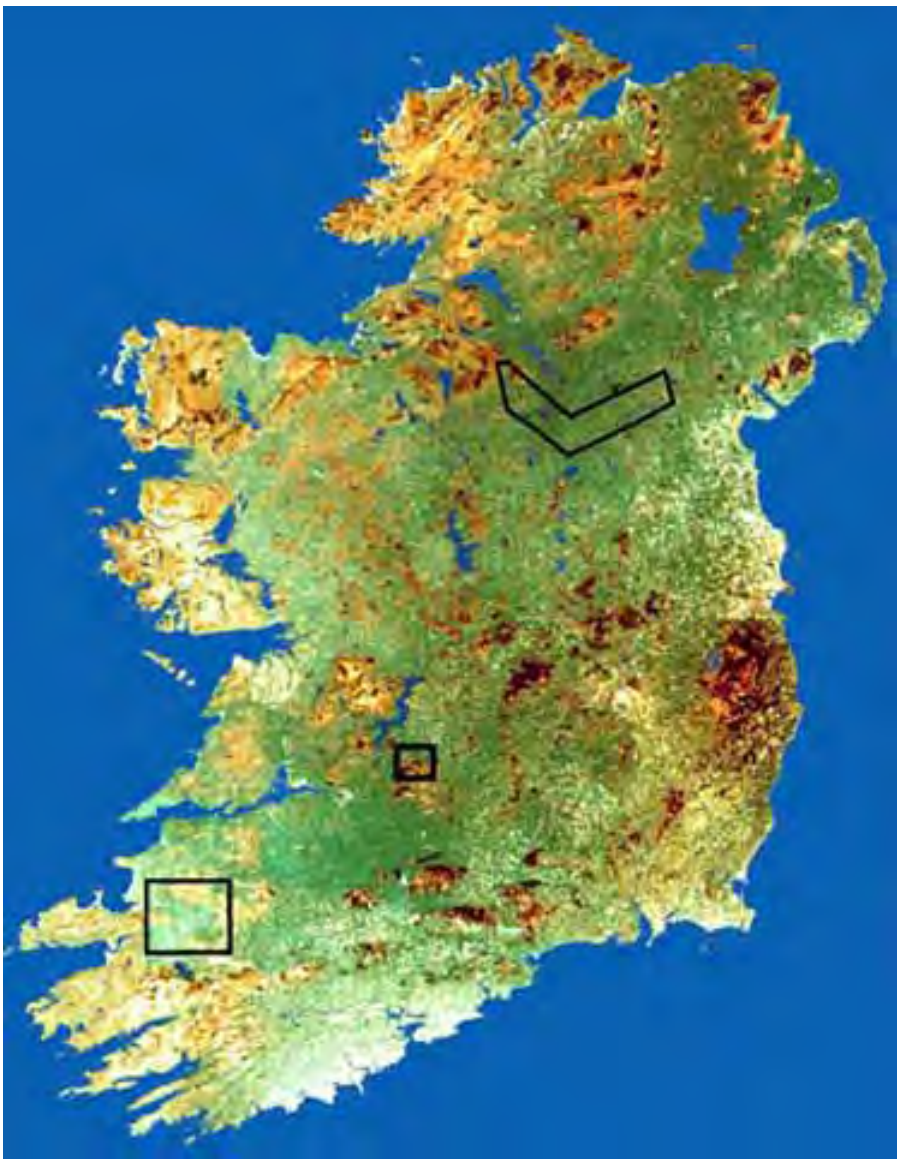


Figure 1. *Location of three survey areas*

The GSI contracted the Joint Airborne Geoscience Capability (JAC) which is a joint venture company specifically set up to carry out airborne geophysical surveys. The two partners in JAC are the Geological Survey of Finland (GTK) and British Geological Survey (BGS). The survey was conducted with a flight line spacing of 200m (Cavan-Monaghan-Leitrim (part of) and Castleisland, and 100m (Silvermines) and at low altitude (56m). The three main systems on board the twin otter plane (Figure 2) were magnetics, radiometric (gamma ray spectrometry) and frequency domain electromagnetics.

The different systems measure different properties of the earth. In the case of the magnetic system, the instrument measures the strength of the magnetic field of the earth. The magnetic field is a natural phenomenon of the earth. The strength of the magnetic field provides information on the different rock types under the ground (in general the more iron in the rock the greater the magnetic field strength). It also allows geologists and geophysicists to identify faults and fractures in the earth. Such faults or fractures are often pathways where water,

mineralizing fluids (to form mineral deposits) or radon travels through the earth.

In the case of the electromagnetic system the instrumentation measures the strength of the electromagnetic field set up locally by a current within special coils in the wingtips of the aircraft. The instruments on board the aircraft measure the electrical conductivity of the ground. Geologists and geophysicists interpret these measurements in terms of more or less conductive materials in the ground. Examples of conductive materials would be metallic mineral deposits, water-bearing gravels, water bearing cave systems in limestones (karst features), or leakage of contaminated water from landfill sites. The radiometric system measures the natural radiation given off by the earth. It is known that several naturally occurring elements emit radiation, e.g., potassium, thorium and uranium. Almost all of the radiation is harmless in the amount emitted. Certain rocks are naturally enriched in some of these elements. For example, potassium is known to be associated with certain granites and uranium is known to be associated with certain shales and also certain granites. Uranium is unstable and it decays to among other elements radon. In forming radon gamma radiation is emitted and it is this radiation that the aircraft instrumentation system measures. Radon as we know can be dangerous as it is known to be associated with lung cancer. The radiation emitted has a telltale signature which when measured by the aircraft system and the data processed by geophysicists allows us to identify those areas with elevated uranium. Once the source of the parent uranium is known we must then identify how and by what route the radon travels to peoples houses. Both the magnetic and electromagnetic systems help us identify faults, fractures in the rock and cave systems, which are the most likely travel paths. The radiometric system also allows us to identify areas underlain by peat and to estimate its thickness. Using the system therefore allow us to produce an estimate of our peat resources.

Figure 2. *Twin Otter aircraft with geophysical systems*

A necessary part of the survey also required that magnetic and GPS base stations were set up (figure 3). The base stations were set up at Enniskillen airport for the Cavan-Monaghan-Leitrim survey and at Kerry airport for the Castleisland and Silvermines areas.

In addition a public awareness campaign was launched and Aurum Exploration Ltd were commissioned by the GSI to provide logistical support to ensure that people on the ground were informed of the survey being carried out in their area. This included on the ground footwork as well as advertisements in local papers and radio. The survey was completed on the 27th June. The data was delivered 21st September and we are currently carrying out detailed quality assurance and quality control. We hope to provide some insights into the findings of this airborne survey in forthcoming newsletters.

Figure 3. *Magnetic base station*

PROF. BERNARD LEAKE'S FIELD SHEETS LODGED WITH GSI

GSI is delighted to have received colour copies of Prof. Bernard Leake's field sheets of Connemara. These record in great detail the geology of parts of the Galway granite batholith and the surrounding Dalradian metamorphic and Ordovician igneous rocks. The collection amounts to approximately 240 one-sixteenth 6" sheets, which are works of art as well as science. Prof. Leake's mapping has been included in the Geology of Connemara and Geology of South Mayo compilations, as well as in the GSI 100k Bedrock series, Sheets 10, 11 and 14. A new compilation map of Prof. Leake's more recent mapping of the central part of the Galway batholith is due to be published soon. The original field mapping from which all these maps are derived can now be consulted in GSI.

The lodging of these field sheets with us is a culmination of the collaboration GSI has enjoyed with Prof. Leake during the compilation of our 100k Bedrock map series. The maps will be scanned and added to the digital Document Management System for on-screen viewing in the Customer Centre, and ultimately these images will be georeferenced for inclusion in the evolving GSI geology map of Ireland.

GSI is keen to encourage such lodging of material with us and would welcome offers or enquiries. Alternatively, arrangements can be made to scan originals so that digital copies remain in GSI and the originals returned to the author or home institution.

Part of Prof. Leake's field sheet for the Errislannan area, near Clifden (Galway 35)

Leake, B.E., Tanner, P.W.G. and Senior, A. 1981. *The Geology of Connemara, 1:63,360 scale*. University of Glasgow.

Graham, J.R., Leake, B.E. and Ryan, P.D. 1985. *The geology of South Mayo, 1:63,000 scale*. University of Glasgow.

Leake, B.E. In press. *The geology of the central Galway granite and its northern margin, western Ireland, 1:25,000 scale.* Royal Society of Edinburgh: Transactions.

PUBLICATION OF REPORT - "LANDSLIDES IN IRELAND"

GSI – Press Release

An important report on landslides in Ireland has recently been published by GSI in association with the Irish Landslides Working Group. This Group was established by the GSI in early 2004, subsequent to the landslides at Pollatomish, Co. Mayo and Derrybrien, Co. Galway in the autumn of 2003, to examine the issue of landslides in Ireland. The report documents the work undertaken by the Group and represents a major contribution to the study of landslides on a national basis, the first of its kind for Ireland. The Irish Landslides Working Group is a multi-disciplinary team drawn from the universities and state agencies.

Until recently Ireland has been regarded as a comparatively benign environment as far as landslides are concerned. The events in 2003 indicated the potential damage that can occur because of landslide activity. It is likely that in the future there will be increased landslide activity as development in Ireland increases and expands into potentially hazardous areas. It is also predicted that climate change will result in increased landslide hazard. It is therefore important to act now to curb the cost of future landslide hazards through better understanding and mapping of these hazards and by improving the capability to mitigate and manage these natural disasters.

"Landslides in Ireland" provides a comprehensive coverage of the key issues involved. It describes the different types of landslide including the mechanisms of failure and the earth materials involved. A national database of past landslide events has been created, and, although it lists only 117 events to date, a survey in the Breifne uplands of Sligo and Leitrim documented over 700 landslide events which have yet to be entered into the database. Clearly there are many thousands of undocumented landslide events across the whole of Ireland. The report also includes an analysis of the engineering properties of the earth and rock materials involved in the different types of landslides. Two major studies were undertaken to examine the feasibility of doing landslide susceptibility mapping in Ireland to predict where landslides are likely to occur. It has been confirmed that landslide locations can be identified both by field survey and remote sensing techniques. Also the digital datasets on topography, geology, and soils do exist to enable this work to be done.

...there are many thousands of undocumented landslide events across the whole of Ireland...

It is very important that these landslide issues are brought into the planning sphere, both with regard to development plans and development control. Chapter 6 sets out the current position with regard to planning legislation and guidance in Ireland, and outlines the steps that need to be taken to fully integrate landslide issues into the planning process. A chapter is devoted to landslides in Northern Ireland where the Geological Survey of Northern Ireland has documented many landslides, both around the edge of the basalt escarpment in Counties Antrim and Derry, and on the limestone escarpments in County Fermanagh. The landslides of late 2003 have stimulated considerable research into landslides in Ireland and Chapter 8 examines the research which has been done both before and after those events.

The report makes a number of important recommendations for future work on landslides in Ireland. It is important to increase public awareness of landslide hazard. The focus should also be on the expansion of the national database with a systematic survey of the country, the preparation of landslide susceptibility maps, targeted geotechnical research into the properties of landslide materials, and the integration of landslide issues into the planning process. Research proposals are made with regard to these.

Dr. Peadar McArdle, Director GSI, considers this report to be an important addition to our knowledge on landslides and slope instability in general in Ireland and it is hoped that it will stimulate further research in this area across a range of sectors and institutions.

NEW PRODUCTS AVAILABLE FROM THE GEOLOGICAL SURVEY OF IRELAND

	Format	Price
Groundwater Section:		
Donegal Groundwater Protection Scheme (GWPS) The of The Donegal GWPS comprises a main report, source reports, digital and paper maps.		
GWPS main report	Paper	€25.50
GWPS source reports (each)	Paper	€13.00
GWPS maps	Paper	€50.00 per map
A County GWPS scheme comprises seven different map themes (aquifer, vulnerability, groundwater protection zones).		
GWPS maps	Digital	€350 per theme
Or	Digital	€1,000 for full set
Bedrock Mapping Section:		
1:500,000 Bedrock Geological Map of Ireland *New updated poster map of the Bedrock Geology of* Ireland produced by GSI in conjunction with GSNI. Based on 1:100,000 scale GSI and 1:250,000 scale GSNI published maps.	Paper Map	€10
1:100,000 Sheet 11 Booklet , Geology of South Mayo A Geological description of South Mayo, to accompany the Bedrock Geology 1:100,000 scale map series, Sheet 11, *South Mayo*	Booklet *& Paper Map*	€25
1:50,000 Sheet 77, Bedrock Geological Map Wexford New Bedrock map showing outcrops locations, boreholes, mineral localities, palaeontological localities. 1st in a new series of 1:50,000 bedrock geology maps.	Paper Map	€20
1:50,000 GIS Bedrock Geology Dataset, Sheet 77, Wexford A GIS interactive version of the Wexford Sheet 77 map. All the data (in ESRI GIS format) and borehole logs used to produce the paper map, includes free ArcReader map viewer	CD	€200
Irish Landslide Working Group:		
Landslides in Ireland A major report into the nature and extent of landslides in Ireland (free PDF here)	Report	€20

ROCKBITS

Between a Rock and a Hard Place
and
other difficult decisions
(with thanks from Wikipedia – the on-line encyclopaedia)

The common phrase "**between a rock and a hard place**" has come to mean having to make a choice between two undesirable options. The phrase has come to mean being in a situation where one is between two dangers and moving away from option will cause you to be in danger of the other.

There are many situations where the phrase is used, for example, salesmen often use it in a bargaining situation "You've got me **between a rock and a hard place**; I'll sell it to you at the price you offer" or in a work situation "Trying to please two supervisors is like being between a **rock and a hard place**."

But how and where did the phrase originate? It is believed that the phrase originated in Greece with the phrase "between Scylla and Charybdis". Scylla was a large hydra-like creature living in a rock that endangered seaman in the Straits of Messina while Charybdis (sucker down) was a potentially fatal whirlpool on the opposite side. Scylla is the "**rock**" of the phrase while Charybdis is the "**hard place**".

In Greek mythology Charybdis was a sea monster who swallows huge amounts of water three times a day and then belches them back out again. She takes the form of a whirlpool and devours anything within range. She lies on one side of a narrow channel of water. On the other side of the strait was Scylla, another sea-monster. Scylla is a horribly grotesque sea monster, with six long necks equipped with grisly heads, each of which contained three rows of sharp teeth. Her body consisted of twelve canine legs and a fish's tail.

Traditionally, the location of Charybdis has been associated with the Strait of Messina off the coast of Sicily, opposite the rock called Scylla. The whirlpool there is caused by the meeting of currents, but is seldom dangerous. Recently scholars have looked again at the location and suggested this association was a misidentification and that a more likely origin for the story could be found close by Cape Skilla in north west Greece.

Another phrase commonly used is referred to as **Hobson's choice** which has a subtley different meaning to "**between a rock and a hard place**". **Hobson's choice** is an apparently free choice that is really no choice at all. In Hobson's choice the choice is "to take it or leave it". The first written reference to the source of the phrase is in Joseph Addison's paper, The Spectator (14 October 1712). It also appears in Thomas Ward's poem *England's Reformation*, written in 1688, but not published until after his death.

Where to elect there is but one, 'tis Hobson's choice — take that or none.

The phrase originates from Thomas Hobson (1544–1630), who lived in Cambridge. Hobson was a stable manager renting out horses to travelers. After customers began requesting particular horses again and again, Hobson realized certain horses were being overworked. He decided to begin a rotation system, placing the well-rested horses near the stable door, and refused to let out any horse except in its proper turn. He offered customers the choice of taking the horse in the stall nearest the door or taking none at all. Henry Ford was said to have sold the Ford Model T with the famous **Hobson's choice** of "Any color so long as it's black". (In reality, the Model T was available in a modest palette of colors, but the rapid production required quick-drying paint, which at the time was available in only one color—black.).

Hobson's choice is somewhat different from a **Catch 22** situation, where both (or all) choices available contradict each other. **Catch-22** is a term, popularized by Joseph Heller's novel *Catch-22*, describing a general situation in which an individual has to accomplish two actions which are mutually dependent on the other action being completed first. A familiar example of this circumstance occurs in the context of job searching. In moving from school to a career, one may encounter a Catch-22 where one cannot get a job without work experience, but one cannot gain experience without a job. Catch-22 situations are sometimes called vicious circles or the chicken and egg problem.

There are many other phrases used to describe difficult decision that face people, such as the **Prisoner's Dilemma** or **Morton's Fork** or "**between the devil and the deep sea**" or "**out of the frying pan and into the fire**". Have fun in finding out more about these yourself or not!