IRISH MINING &
QUARRYING SOCIETY

ANNUAL REVIEW

2016

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Notes from the Editors 2016

IRISH MINING & QUARRYING SOCIETY

The Irish Mining and Quarrying Society (IMQS) revolves around the members who operate in the extractive industry on a daily basis. The Society extends far and wide, across a range of sectors, services and geographies. It is for this reason that the IMQS Annual Review committee chose the theme of the SOCIETY itself for this year's Review, in order to demonstrate the variety of individuals, companies and activities that combine to make our industry one of the most influential in Ireland (and overseas).

The diversity of our Society is clear from the assortment of authors and subject matter included in this Review. Companies traditionally associated with the mining and quarrying industry e.g. Boliden Tara Mines, Cement Manufacturers Ireland, Roadstone Ltd. and the recently closed Lisheen Mine have included articles on the environmental and sustainable management of their facilities and products, during both the operational and closure phases of development. IMEC, in their paper on surface dewatering, also highlight the efficiencies that can be derived from thinking outside the box.

A new area for the extractive industry in Ireland, Solar Energy, is introduced by Elgin Energy Services Ltd. At a time when Ireland is struggling to meet its EU targets for renewable energy, the use of available brownfield and greenfield lands might be a welcome addition to company portfolios in our sector. The environmental and financial benefits of an alternative use for vacant landholdings are worthwhile considerations.

We are delighted to have the latest policy updates and industry news courtesy of the new Minister of State, Mr. Sean Kyne T.D., the Irish Concrete Federation (ICF), Euromines, Geoscience Ireland, the Irish Mine Rescue Committee (IMRC), the Quarry Products Association of Northern Ireland, the Institute of Quarrying (IQ) and the European Economic and Social Committee (EESC). In addition, this year's Review includes a comprehensive industry review by the newly elected IMQS President, Mr. Brendan Morris.

Last year we focused our Review on industry milestones. However, a long standing member of the editorial committee has his own personal milestone this year. On the occasion of his 90th birthday, we are very honoured to have a number of articles from the ever-prolific Mr. Tony Killian! In particular, it is timely that Tony has provided an article on the 1966 explosion at Nelson's Pillar, "Demolishing the Myth", a version of which also featured in the Irish Independent earlier this year (alongside features marking the centenary of the 1916 Easter Rising). Thank you to Tony for his unremitting dedication to the Annual Review and the consistent high standards that he sets as he researches and prepares each paper throughout the year. The IMQS Council and members would like to wish Tony and his family ever good wish and good health for the future.

We thank our advertisers without whom this publication would not be possible; all of our feature writers and regular contributors, our publisher 4 Square Media (with the assistance of Darryl Magee) and Assistant Editor Elizabeth Murphy (TOBIN Consulting Engineers), for their continuing support of the Irish Mining and Quarrying Society.

A special word of *"Thanks"* to Brendan Morris, IMQS President, for his valuable contribution to this publication.

the **Editorial Team**

Siobhán Tinnelly (Chairperson)

Sean Finlay

Keith McGrath

Ronan Griffin

Tony Killian

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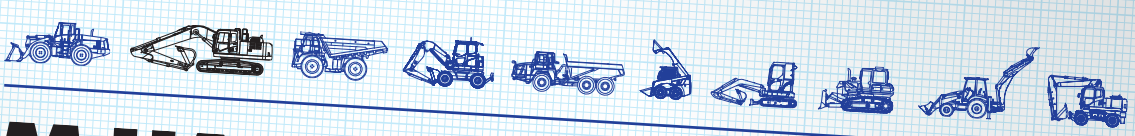

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We would like to give special thanks to Sean Finlay, Siobhan Tinnelly, Tony Killian, Ronan Griffin, Keith McGrath and Brendan Morris for their support and expertise in the production of this Journal.

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ANNUAL REVIEW: EXTRACTIVE INDUSTRY IRELAND
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Ministers Foreword

by Mr. Sean Kyne, T.D., Minister of State for Gaeltacht Affairs and Natural Resources

I am very pleased that one of my first tasks following my appointment as Minister with responsibility for Natural Resources in July is to contribute a foreword to the Irish Mining and Quarrying Society's Annual Review.

The extractive industry makes a significant contribution to the economy and as Minister I want to maintain and promote a vibrant minerals industry which is both sustainable and contributes to jobs and economic growth.

In 2015, Ireland's two underground zinc-lead mines (Lisheen and Boliden Tara Mines, Navan) accounted for 24% of European zinc mine output and 7% of European lead mine output and Ireland ranked 11th and 16th in the world in relation to zinc and lead mine output respectively. In 2015, Ireland for the first time in many years fell from first to second place for European zinc mine output. This was not unexpected following the closure of the Galmoy zinc-lead mine in Co Kilkenny in October 2012 and the winding down of operations in the Lisheen zinc-lead mine in Co Tipperary in 2015. Indeed, 2015 marked the end of production at the Lisheen mine which is operated by Vedanta Resources Plc. It produced over 22Mt of ore grading approximately 11.5% zinc and 2% lead since it first commenced mining in 1999. Nonetheless, Ireland is still a significant player and Boliden Tara Mines' underground operation at Navan, Co Meath maintains its status as the largest zinc mine in Europe.

In terms of industrial minerals, Irish Gypsum Ltd, a subsidiary of French multi-national Saint Gobain, continued production from its underground mine at Drummond, Co. Monaghan. Approximately, 250kt of gypsum was produced in 2015 which fed the company's production facility at Kingscourt, Co. Cavan.

Against this background of mine closures, I am committed to ensuring that the search continues for new resources and I am glad to say that mineral exploration is very active with the numbers of active prospecting licences, currently standing at 500 and a total of approximately 100 new applications received this year to date.

Ireland's strong reputation as an attractive investment jurisdiction for mining and exploration companies was once again recognised by the Fraser Institute of Canada Survey of Mining Companies for 2015, which ranked Ireland 4th in the overall Investment Attractiveness Index of 109 jurisdictions, up from 11th position out of 122 in 2014. On the Policy Perception Index which ranks the attractiveness of Government mining policies to industry, Ireland ranked an impressive first place in 2015 for the third successive year.

The Minerals Development Bill which consolidates and updates our statutory framework should further strengthen Ireland's good standing as a place to do business. The Bill was published in July 2015 and will, when enacted, codify best practice procedures for exploration and mining. The Bill has completed all stages in the Seanad, and we expect the Bill to be enacted in 2016.

My Department continues to promote Ireland in association with Northern Ireland (DETI and GSNI) at the annual Prospectors and Developers Association of Canada (PDAC) Convention and Trade Show, the world's largest showcase for the mining and exploration industry. Attending this event continues to provide positive outcomes in terms of attracting inward investment.

My Department is also responsible for the Geological Survey of Ireland, and I am pleased to report on further progress under the Tellus Programme which is being rolled out nationally. Tellus is providing the latest airborne geophysics and ground geochemistry to provide an environmental and geological snapshot of the country and data that is greatly valued by the exploration and mining sector. In 2015 all of the data from the Tellus Border phase was released, while in 2016 the adjoining eastern and midlands data was made available as well as data from archive samples for south east Leinster, all of which is online for free as an incentive to exploration. This year the survey teams have been active in the west, with ground sampling and airborne surveys in Counties Mayo and Galway, as well as an airborne survey specifically to assist exploration in Waterford, which has already been made public. The programme, which received a Civil Service Excellence Award in 2015, remains on track to complete the country by 2023.

With regard to the quarrying sector, recently the GSI launched the fourth edition of the Directory of Active Quarries and Pits in Ireland and continues to provide assistance to the industry through work on standards, aggregate potential mapping, geological heritage and groundwater protection and is examining further opportunities to work with the industry and IMQS members as the economic recovery continues.

An additional way in which my Department works with your industry is through the Geoscience Ireland (GI) Job Creation Initiative delivered by the Geological Survey of Ireland and Enterprise Ireland, with assistance from the Department of Foreign Affairs and Trade. Since its inception in 2011, the GI network has grown to 28 companies providing services to international markets in geology, geotechnical and environmental engineering, water services and capacity building. Since late 2012, GI companies have created over 300 new jobs and aim to create a further 200 new jobs by 2017 and I am very pleased to acknowledge several prominent IMQS members active among the GI cluster.

I am very much committed, as is Government to supporting a sustainable future for the mineral and non-mineral exploration and development sectors so that positive impacts for the local, regional and national economies can continue to be enjoyed in years to come. Indeed, one of the things which struck me on learning my new brief was that the minerals industry is not concentrated in a few regional areas but operates throughout the country and in many rural areas, and therefore can make a significant contribution to regional and local economies.

I would like to thank the IMQS for the opportunity to address its membership through this foreword and to acknowledge the important work of both the Society and its members in fostering sustainable development in the extractive industries. My Department and I both look forward to the continuation of and the future success of this important sector.

Message from the IMQS President 2016

by Brendan Morris, LTMS Limited – Lisheen Technical & Mining Services

In keeping with the Annual Review theme of 'Society', I have acknowledged the various groups associated with the mining and quarrying industries as I wrote this note. The Irish Mining and Quarrying Society (IMQS) is unique in that it embraces mining, quarrying and some sectors of the construction industry and the resulting interaction between the groups is very positive. The IMQS is focused around the geological natural resources of Ireland; how they are discovered, developed, processed and marketed and all sectors are well represented.

Ireland is one of the best places for exploration and mining, according to the Fraser Institute 2015 annual survey of mining companies. Ireland moved up ten places in *Investment Attractiveness* to 4th place of 109 jurisdictions across the world. For *Policy Perception*, Ireland ranked 1st for the third year in a row. That's great news for a country that had no real mining industry sixty years ago. Something good is happening!

I believe that we take a pragmatic approach to most issues in Ireland and, in this case, we understand the benefits of the mining industry and, as a collective, the Irish people are making it happen. There is a legacy of poor mine closures over the past forty years but the most recent closures at Galmoy and Lisheen are excellent examples of how mines can be explored, opened, operated and closed in a positive and responsible manner. This recent success came about with the significant effort and co-operation from mining companies, local communities, the government and its agencies.

An important ingredient is trust and all parties are working in a responsible manner together in order to support mining and exploration operations. However, there are still some 'professional objectors' who oppose anything with a dirty history, such as mining, and simply do not trust mining companies. The very interesting lithium prospect in Wicklow has had opposition from some of the local community on the basis of the mining legacy of past operations but this opposition group have not recognised the good work at recent operations and their environmentally responsible closures.

Everyone has the right to be heard and there are good mechanisms for objection within the planning process, but we should not make it any more difficult for exploration and mining companies to do business here by making the process more complex and follow some countries where planning permission for exploration and mining is now so difficult that companies are staying away. Mining brings substantial benefits to employment, local economies and community welfare, and is good for Ireland. Why should we expect to get our metals from elsewhere when we have some of them here in Ireland?

There is a high level of exploration activity in Ireland at present and a few prospective mines with potential. However, the Pallas Green project near Limerick is currently on hold awaiting decisions by Glencore Xstrata, but Conroy Gold in Monaghan is active with an exploration programme and International Lithium is busy in Wicklow.

Tara Mines continues to operate at a high production rate of zinc and lead, after almost 40 years and they are considering future mining activity at depth. The Drummond gypsum mine in Kingscourt is operational and has replaced the open pit operation after many years of production.

The recently closed Lisheen zinc and lead mine is going through the closure process at a cost of €25 million, with the mill being dis-assembled for shipment to Cuba and the site now established as a 'Green Energy Hub'. The site was designated as a 'Model Demonstrator Site' by the EU in 2015 and the Lisheen Wind Farm now produces 60MW of power or 1-2% of Ireland's average power supply. Galmoy have recently attracted a recycling project to their site. The Silvermines Hydro Electric Power Station Project is now being developed from the existing disused open cast site.

Although one of the most attractive locations for mining investment and policy, Ireland recently lost its position as the 10th largest producer of zinc and lead in the world and the top in Europe, a position now taken by Sweden. China tops the list globally with a production rate of 4.9 million tonnes of zinc, which is more than the sum of the production of next four countries together; Australia, Peru, USA and India. Zinc prices were volatile in 2015, starting at $2,200 per tonne in January 2015 and peaking at $2,400 in May, before the slide to below $1,500 in December. There has been a recovery in 2016 with the price in June at $2,000. Zinc price forecasts are somewhat mixed but generally indicate that demand will outstrip supply and the price will be maintained at €2,000 per tonne or above, during 2016.

It is important to note the level of mining activity in Northern Ireland. Kilroot salt mine in Carrickfergus has been in production since 1965 and now produces half a million tonnes of de-icing salt per annum. Gold exploration and mining has been ongoing in County Tyrone for a number of years and most recently at two gold mining operations near Omagh. Galantas Gold owns and recently operated an open pit gold mine and have now received planning permits for an underground mine. Dalradian Resources also operate a mine in the region and during 2015 and 2016, work on site focused on the underground exploration program which is designed to support a feasibility study and submission of a planning application for an underground mine.

There are a number of initiatives being driven through the Irish government and its agencies which support exploration and mining activities. **Tellus** is a ground and airborne geoscience mapping programme, collecting chemical and geophysical data that is undertaken by the Geological Survey of Ireland and is funded by the Department of Communications, Climate Action and Environment, formerly known as DCENR. Tellus involves two types of surveying; airborne geophysical surveying and ground-based geochemical surveying of soil and streams. The Tellus programme aims to complete surveying the entire island of Ireland on a phased basis, completing 50% by end 2017. **Irish Centre for Research in Applied Geosciences (iCRAG)** was established in 2014 by Science Foundation Ireland with funding of €18m along with an additional €8m from industry partners. ICRAGs overarching objectives are to significantly de-risk Ireland's offshore and onshore hydrocarbon and mineral resource exploration, to ensure safe and secure groundwater supplies and to engage with citizens and policy makers to explain the nature of resource related industries. **Geoscience Ireland (GI)** is a network of 27 Irish based companies, delivering integrated expertise in water, minerals, environmental and infrastructure development to clients in over 50 countries. GI is supported by the Geological Survey of Ireland and Enterprise Ireland. The GI network provides design, consultancy and contracting services to multilateral agencies, governments and the private sector.

The **Quarry Industry** is showing signs of improvement following years in the doldrums, with the market reportedly very competitive at present. Quarry owners indicate that the recovery is still slow in rural areas, with most of the benefits being seen in the cities and North Dublin in particular showing very positive recovery. Production in Building and Construction Index statistics from the Central Statistics Office show that the volume index has increased by 13.6% and the value index has increased by 11.9%, from 2015 to 2016.

Planning permissions granted for houses are up by 9.7% from Q1 2015 to Q1 2016. There are some reports that Section 261 delays from An Bord Pleanala are making it difficult for quarry owners to plan ahead. During the boom, some quarries were producing materials with problematic pyrite and mica levels and the results of this are becoming a problem in some construction which was built during the boom.

The Quarry Safety Partnership (QSP) is a group established by the Health and Safety Authority Quarry Policy Group in 2013, with representatives from employers groups (Irish Concrete Federation/Construction Industry Federation), employees groups (ICTU/SIPTU) and interest groups such as our own IMQS. The group seeks to address issues of concern in the industry and to look at potential events and promotional activities. This group is helping to fight the battle against serious injuries and fatalities. In our industry, there were 15 fatalities from 2001 to 2008 and a reduction to 8 in the years since then. There are still too many fatalities and safety must be at the forefront of all quarrying and mining activities.

Dublin was recently the venue for the **6th Round-table on Strategic Implementation Plan of the European Innovation Partnership on Raw Materials**, organized by the European Economic and Social Committee (EESC). I had the pleasure of representing the IMQS at this event, while other IMQS members such as Sean Finlay (Geoscience), Eibhlin Doyle (DCENR) and Gerry Stanley (GSI), represented their own groups. A number of other Irish and European organisations and private companies were represented. There was good discussion around two main topics: "How can the mining sector better contribute to Irish economic and industrial growth" and "What needs to be done from a European and Irish policy perspective to enhance industrial development and the social licence to operate in Europe and Ireland?"

The Irish were well represented at Ireland Day at the **Prospectors and Developers Conference (PDAC)** in Toronto on March 7th. Ireland's Ambassador to Canada, Ray Bassett, formally opened the event which was supported by Enterprise Ireland. The Irish stand was sponsored by the Geological Survey of Ireland and Enterprise Ireland and was a joint effort with the Geological Survey of Northern Ireland.

I would like to congratulate the Irish Association of Economic Geologists and the Mining and Heritage Trust of Ireland who both held separate conferences in June and the Institute of Geologists of Ireland who regularly organise educational evening seminars (often in collaborationwith the IMQS). These gatherings serve as great forums for learning and for networking within common interest areas.

Following very successful competition results in recent years in Ireland, UK and Europe, the Tara Mines team has been invited to participate in the **World Mines Rescue Championships** in Sudbury in August and Roy Tallon of Tara, has been invited to be an adjudicator at the event. We wish both the team and Roy every success at this great event.

On behalf of the council of the IMQS, I would like to congratulate **Denis Naughten** on his recent appointment as Minister for Communications, Climate Action and Environment and to **Sean Kyne** for his appointment as Minister of State for the Gaeltacht Affairs and Natural Resources. Their support in ensuring that exploration, mining and quarrying are maintained as a high priority in the coming years will be much appreciated. IMQS are available to provide assistance to both Ministers.

I would like to express my gratitude to the members of the **IMQS council** for their continued support since I took up the role of President earlier this year. Siobhan Tinnelly set a very high standard as President during the last two years and her support has been invaluable.

The **IMQS website and LinkedIn page** continue to attract much attention from both members and non-members. We always welcome information that may be of interest which can be used on either forum.

We are all looking forward to the **Annual Dinner Dance** on November 26th at the Ballsbridge Hotel. A new band, Vegas Nights, will provide the entertainment for the night.

In summary, and in the spirit of the 'Society' theme, I hope that the communities within exploration, mining, quarrying and construction continue to work together for the betterment of the industry in Ireland and that we can maintain the high standard which has been set in recent years. I would like to see more engagement with those who see our industry in a negative light, so that we can work together to ensure that mining and quarrying can be good for Ireland and its people and not harmful to our environment. It's better to light a candle than curse the darkness.

Activities of the Society

May 2015 to May 2016

Current Membership:

224	Ordinary
2	Fellows
12	Honorary Fellows
7	Honorary Members
10	Corporate

by Alan Dolan, Boliden Tara Mines and IMQS Hon. Secretary

Dates of Council Meetings

Since May 2015, the Council met on 7 occasions.

2015 – September 1st & December 8th.

2016 – January 12th, February 23rd (AGM), March 15th, April 12th & May 10th.

Council Members:

In 2016, ***Peter Kinghan*** and ***Philip Morrissey*** stepped down as Council Membes. Their input into to the society was greatly valued.

Brendan Morris, Managing Director at LTMS Limited (Lisheen Technical & Mining Services), was elected President at the AGM. Brendan holds a Degree in Mining Engineering from Camborne School of Mines, is a Chartered Engineer and holds a Master's Degree in Business. During his career, Brendan has held many technical and managerial positions in both the mining and quarrying sectors. We wish him well during his tenure as president. The Council also welcomed two new Members in 2016. ***Keith O'Shaughnessy***, Compact Product Support and Health & Safety Manager for Pat O'Donnell & Co Ltd. and John Francis, Customer Account Manager, Finning Ireland Ltd.

Keith McGrath, Director with McGrath's Limestone Works Ltd. is Vice President. ***Leslie Sanderson***, Director of Services for ECS Turbowash Ltd. is Honorary Treasurer and ***Alan Dolan***, Ground Control Engineer at Boliden Tara Mines, is Honorary Secretary.

Other council members are: Former President ***Siobhán Tinnelly*** (Associate Director at Tobin Consulting Engineers), ***Mike Lowther*** (Manager of Mining at Boliden Tara Mines), ***Mick Flynn*** (Projects Manager at Boliden Tara Mines), ***P.J. O'Donnell*** (Director at Pat O'Donnell & Co. Ltd.), ***Sean Finlay*** (Director of Business Development at Geoscience Ireland), ***Ronan Griffin*** (Property Manager at CRH Estates) and ***Ciaran Greenan*** (Location Manager at Roadstone Ltd.).

Carol Sanderson, Executive Secretary, manages membership and communications. Carol also maintains our web site and co-ordinates many other tasks for the society.

Thank you all for your dedication and commitment.

The Extractive Industry Review 2015

The 2015 publication was edited by Sean Finlay, Tony Killian, Siobhán Tinnelly, Ronan Griffin and Keith McGrath. The theme for last year was "2015 - A year of Milestones". These milestones included the 50th anniversary of the opening of Tynagh Mine, the first gas at the Corrib Gas Project, the 25th anniversary of the closure of both the Arigna and Sliabh an Iarainn mines and The Lisheen Mine closure in late 2015. The review also contained other diverse articles which will be of interest to any reader.

The 2015 Annual Review is available to download from the IMQS web site, **www.imqs.ie**, and was published by 4 Square Media.

Conferences / Seminars / Industry Events

(More details on website at **www.imqs.ie**)

- **"The Application of Enhanced Ground Penetrating Radar (GPR) in Mining, Engineering and Environmental Projects"**
  The IMQS and IAEG jointly hosted this presentation by Charlie Williams, CEO of Terravision Exploration Limited. It was held on Thursday June 9th, at the Lecture Theatre, Geological Survey of Ireland, Beggars Bush, Haddington Rd., Dublin 4.
- **"Solar Energy Development in Ireland"**
  Held at Finning Ireland Ltd, Rathcoole, Co Dublin on May 5th 2016, this seminar was presented by Michael Moore of Elgin Energy Services Ltd. It was aimed at members who might consider the potential for solar energy projects on available land, located within sites traditionally associated with the extractive industry. It was preceded by a safety presentation by Phil Lewis from Finning Ireland Ltd. which focused on new developments in plant and equipment within the extractive industry.
- **"Sort Crushing Myths - Expect Results"**
  Following the AGM on February 23rd 2016, our first evening seminar of the year, "Sort Crushing Myths - Expect Results" was presented by Jouni Mahonen, Global Head of Sales Support in Aggregates Business with METSO.
- **"Tynagh Mine: A Celebration"**
  To celebrate the 50th anniversary of the opening of the Tynagh mine, the IAEG, IMQS, IGI, DCENR & GSI organised a special conference in the Loughrea Hotel on the 29th & 30th of January 2016. This unique event included the viewing of core recently drilled at Tynagh, a series of talks on the mine and its discovery and a photographic and memorabilia display followed by a formal dinner.
- **IoQ-NI Stone Crushers Ball**
  The annual Institute of Quarrying (Northern Ireland) Stone Crushers Ball took place in the Europa Hotel, Belfast on October 23rd 2015. Siobhán Tinnelly presented a summary of the extractive industry in the Republic of Ireland at the dinner.
- **Annual Field Trip & Golf Competition - Lisheen Mine Co. Tipperary**
  The annual field trip took place on Friday, August 28th 2015. The visit included a general introduction to the mine, a presentation by Lisheen staff, a visit to the surface and underground works, and a visit to the mill area. The mine ceased production in December 2015. The Annual IMQS Golf Competition took place at Rathdowney Golf Club following the mine visit. Winner – Noel O'Dwyer.
- **Site Visit – Sandvik**
  On May 21st 2015 IMQS members travelled to the Sandvik Factory, Ballygawley, Co Tyrone, for a site visit. See **www.imqs.ie** for a summary and photos.

Submissions

- **Call for Evidence - Permitted Development Rights for Mineral Exploration**
  On behalf of IMQS members, Brendan Morris submitted a reply to the call for evidence pertaining to Part 16 of the Schedule to the Planning (General Permitted Development) Order (Northern Ireland) 2015. This schedule deals with exploration activities. See **www.planningni.gov.uk** for more details.

Paying your subscription could not be easier. Just log onto imqs.ie and click 'Becoming a member'.

Representations

(more details at **imqs.ie**)

- **Irish GeoScience Network**
  The IMQS continues to represent its members on the committee of the Irish GeoScience Network. This committee aims to improve communications among the geoscience community and to review the issues of the day and any new legislation that may affect IMQS members. The most recent meeting was held on 10th February 2016.
- **EFEE (European Federation of Explosives Engineers)**
  EFEE was founded in 1988 and has 25 member nations. The IMQS represents Ireland as a member nation at EFEE council meetings. Among other projects, it is currently working to introduce a pan-european shotfiring licence which makes it simpler for a shotfirer to work in other countries within the EU. The EFEE AGM was held on April 11th and 12th 2016 in Telford UK. For more details visit **www.efee.eu**.
- **QSP and QSCS steering committee representation**
  The IMQS was represented on both the Quarry Safety Partnership steering group and Quarry Skills Certification Scheme group by Les Sanderson, Ciaran Greenan and Keith O'Shaughnessy. The most recent meeting for QSP was in the HSA Head Office in Dublin on 24th May 2016. QSCS meetings are on-gong. See the IMQS web site and LinkedIn for more details.

Annual Dinner Dance 2015

The annual IMQS Dinner Dance was held at the Ballsbridge Hotel, Dublin, on Saturday, November 28th 2015. Our Guest Speaker was Mr. John Kearney, former Chairman and Chief Executive of Northgate Exploration Limited and Chairman of Minco Plc. John described the pivotal role of the Tynagh Mine, and the people involved in its discovery, in the renaissance of the Irish mining industry. He entertained the audience with a very reflective and humorous speech.

Music was by 'The Legends of Swing Band'. The Close Brother's sponsored photo booth was again a great hit and the delicious handmade chocolates from Smiley Monroe. Particular thanks to the companies and individuals who sponsored the impressive spot prizes, and, of course, to all the members of the IMQS Council who helped organise the event. Photos from the night can be viewed on the IMQS website.

Mine Rescue

- **European Mine Rescue Competition**
  The All Ireland and UK Mine Rescue competition 2015 was hosted and run by Somincor, Lundin's Neves Corvo mine in Portugal from the 7th to the 9th of May 2015. The competition was renamed the 'European Mine Rescue Competition' for this event.
- **Boliden Tara Mines, Mine Rescue Competition 2015**
  Due to some teams being unable to travel to Portugal, the annual internal Boliden Tara Mine Rescue Competition on 9th & 10th October 2015 was opened to external teams. Siobhán Tinnelly attended on behalf of IMQS members and presented the IMQS-sponsored 'Best Captain' medal to Mr. Paul Booth from Winsford Mine.
- **Mutual Training**
  Mutual training was established in 2003 and facilitates all mine rescue teams to train in unison at different mine sites. In 2016 to date, two sessions have been held, one at Boliden Tara Mines and the other at the Dalradian Curraghinalt Mine, Co. Tyrone.
- **International Mines Rescue Competition in Sudbury, Canada.**
  In August 2016, over 40 teams from all over the world will compete at this prestigious event. Boliden Tara Mines will represent Tara Mines, Ireland and Sweden.
  A full summary of the activities of Mine Rescue are outlined in this Review.

Future Events

- **Annual Dinner Dance 2016**
  This year's annual dinner dance will be held in the Ballsbridge Hotel, Dublin 4 on November 26th 2016.
- **Annual Field Trip 2016**
  The annual field trip will take place in August 2016. It will be to the Irish Cement Works, Platin, Drogheda, Co Louth.

Events are continually being organised, so keep up-to-date at **www.imqs.ie** or at the Irish Mining and Quarrying Society page on LinkedIn.

IMQS Web Site

The IMQS website is managed by Carol Sanderson and continues to have a high level of activity. For the year ending May 31st 2016, a total of 5,280 visits were made to the website. As in 2014 - 2015, features that proved most popular were the News & Events section where upcoming seminars, new regulations and legislation are posted and the Jobs section where vacancies, in Ireland and abroad, are advertised regularly.

Posting adverts is currently free of charge. You may forward any jobs you may consider relevant. Your advertisement will be viewed by members and followers who have a specific interest in the extractive industries.

To help pay your subscription quickly and easily, just click 'Becoming a member' on the home page and follow the instructions. For those who prefer paper transactions, we still accept cash and cheques!
See also the "Links" page on the web site for other organisations related to the extraction industry.

Online Courses/Flexible Learning for the Extractive Industry

A number of online courses are being run by the University of Derby, UK. Courses can be part-time, full time and online and range from individual modules to degree level qualifications. Further information can be found at either of the following web addresses: **www.quarrying.org/education** and/or **www.derby.ac.uk**.

If you know of other courses you think may benefit our members, please let us know.

IMQS Communications/ Emails/Social Media

As well as keeping our members up to date with the latest news and events in the extractive industry, we also receive communications via email and social networking.

The IMQS has a busy group page on LinkedIn (Group: Irish Mining & Quarrying Society) with 314 members. If you are not already a group member, why not join and catch up with some colleagues or maybe connect with somebody in your area of business. All members of the Irish Mining & Quarrying Society are encouraged to contribute to this active group and join in the discussions.

To help reduce our paper usage and postage costs, we are communicating with members, where possible, through our web site, email and other electronic means of social media. Email addresses continue to be sought and updated.

If you have not received an email communication from us recently, please email **info@imqs.ie** to have your details updated and keep in touch!

Conclusion

I would like to express my sincere appreciation to our President Mr Brendan Morris and Vice-President Mr. Keith Mc Grath for their leadership and dedication to the work of the Society. I also wish to thank our Treasurer Mr. Les Sanderson for maintaining the accounts over the past year and to the other current officers and members of the IMQS Council who often serve on several sub-committees to voice and protect the interests of our members. I would particularly like to acknowledge the essential work done by Carol Sanderson, our Executive Secretary.

Finally, I would like to thank you, our members, for your patronage. The Society cannot exist without your continued support.

Alan Dolan
Honorary Secretary
Irish Mining & Quarrying Society

Alan Dolan is a Ground Control Engineer at Boliden Tara Mines and has spent many years in the drill and blast sector.

Paying your subscription could not be easier. Just log onto imqs.ie and click 'Becoming a member'.

Highlights of the Year

by Siobhán Tinnelly, Associate Director, TOBIN Consulting Engineers and IMQS Past President

BREXIT

We didn't think it would happen – but it did! The UK voted to leave the EU and we are all concerned with the impact that this move will have on the Irish economy and the construction industry, in particular.

Taoiseach Enda Kenny stated that *"the Government has adopted an initial Contingency Framework to map out the key issues that will be most important to Ireland in the coming weeks and months. This will be an iterative process as issues emerge and recede in the course of negotiations"*.

Priority issues identified include UK-EU Negotiations, British-Irish relations, North Ireland, Trade, Investment, North-South Border impacts, Competitiveness and macro-economic issues, Research/Innovation funding and Energy.

Business group IBEC is concerned that Irish jobs are already under threat as the UK prepares to embark on its exit from the European Union and points to a "full-blown currency crisis" and says "an urgent, targeted national response is essential".

"For exporters, the speed of sterling's decline is on a par with the 1992 currency crisis. Irish exporters to the UK are already 15 per cent less competitive and things could get much worse."

It will be important for all industry bodies to work together in the interest of our members as the BREXIT transition becomes a reality over the next two years. As our nearest neighbours in Northern Ireland deal with the repercussions of the referendum, it is very interesting to read the thoughts of Mr. Gordon Best, Chairman of the Quarry Products Association of Northern Ireland (QPANI) within this year's Review.

Top of the Class - Zinc!

Zinc is the best performing base metal to date in 2016 with a 39% rise in price this year on the back of major mine closures, including Lisheen Mine and Century in Australia.

In July 2016, Vancouver-based Trevali Mining jumped 5.1% after the company announced expansion of high-grade silver-lead-zinc mineralization at the Magistral North and Oyon Zones at its Santander zinc mine in Peru. Trevali has been described by investment company Haywood Securities as a company *"poised to become the marquee mid-tier pure-play zinc producer in a market facing a significant medium-term supply issue. Hence, we would not be surprised to see the Company garner a premium market valuation on the back of higher zinc pricing"*.

On a side note, the CEO of Trevali is Dr. Mark Cruise. Mark graduated with a degree and PhD from Trinity College Dublin (TCD). He has worked for Anglo at Lisheen Mine and is currently involved with iCRAG, sponsoring a number of projects with Balz Kamber at TCD.

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Irish Mine Rescue Committee 2015-2016

Good Progress in Difficult Conditions

by Mike Lowther, Chairman IMRC (Boliden Tara Mines)

Although market conditions for mining in Ireland have been difficult in recent years, and two Zinc-Lead mines with experienced rescue teams have closed, the IMRC has continued to co-ordinate mine rescue activities in Ireland north and south, and to strengthen links with the UK, Portugal, Spain and Canada.

The All Ireland and UK Mine Rescue Competition was held in Somincor Lundin's Neves Corvo Mine in Portugal in May 2015. This was the first European Mine Rescue Competition and was reported in the 2015 IMQS Annual Review.

Following this event the calendar has been busy. Mutual training exercises for IMRC-affiliated teams were held at Kilroot (Irish Salt Mining and Exploration), Dalradian Resources in Tyrone (twice), and Boliden Tara Mines.

In October BTML hosted a competition at which seven teams from Ireland and UK competed.

Tynagh team from 1973

The team of judges was comprised of Mine Rescue and First Aid experts from Ireland, Portugal and Wales and headed by Pat Griffin, Senior Inspector HSA.

The winning team were Vedanta Lisheen in their final competition before disbandment. The best Captain (receiving the IMQS Cup and Medal) was Paul Booth from Compass Minerals' Rock Salt Mine in Cheshire, England.

Of note was also the Dalradian Resources team, competing commendably for the first time and with Orla McKenna in their ranks – the first woman to compete in Mine Rescue in Ireland.

December unfortunately saw the closure of the Vedanta Lisheen Mine in Co. Tipperary, and with that the disbandment of their Mine Rescue team. Guided by their Mine Rescue Officer, Ian Johnstone, Lisheen Mine Rescue have been integral in the Irish and UK mine rescue effort for fifteen years, taking part in many real emergencies, practices and competitions. They were wished good luck on disbandment and thanked for their great efforts.

In January 2016 a conference was held in

One of the Boliden Tara Mines Teams receiving instructions from the judges, at the October 2015 competition.

Congratulations Boliden Tara Mines!

Congratulations to the team from Boliden Tara Mines who represented Ireland at the 2016 International Mines Rescue Competition in August 2016.

Twenty-eight teams, representing 13 nations, competed in a number of events including an underground scenario, fire-fighting and first aid.

This was the first time that an Irish team participated in this competition, which was held at Sudbury, Canada.

We are delighted to inform our members that the Tara Mines team were awarded a silver medal in the category of 'Best Overall Team'!

An incredible performance by all accounts and a reflection of the dedication, professionalism and skill of all involved in Mine Rescue Training in Ireland and the commitment of the Irish Mine Rescue Committee (IMRC) to this specialist area of Health and Safety training in the extractive industry.

Congratulations to everyone involved!

For more information, visit the following link: **http://imrc2016.ca/ or search #IMRC2016 on Twitter for competition photos and team news!**

Feedback from the Judging Committee to Paul Booth, Captain of the Compass Minerals Team.

Dalradian Resources in action.

Ian Johnstone (MRO Lisheen) receives a memento from Roy Tallon to mark the disbandment of the Lisheen team.

Loughrea, Co. Galway, to mark the 50th anniversary of the opening of the Tynagh Mine in 1965. An IMRC stand was set up at the conference to show how equipment and techniques have evolved over the last five decades.

The photo from May 1973 shows the first Mine Rescue team in the modern Irish Mining industry.

In March 2016 Dalradian Resources completed the joining protocol and were formally accepted as full members of the IMRC.

Strong links continue with the Irish Air Corps, and there have also been strong connections established with the Police Service of Northern Ireland; work continues in setting up cross-border air and road back-up from the emergency services for Mine Rescue, north and south.

In August 2016 Boliden Tara Mines Limited Mine Rescue have been invited to participate in the International Mine Rescue Body's bi-annual International Mine Rescue Competition in Sudbury, Canada. Roy Tallon, BTML's Mine Rescue Manager, has also been invited to judge at the event. This competition will host twenty teams from around the world, with large press and TV coverage, and it is a great honour for Tara and Roy to represent Ireland and Boliden.

So despite difficult conditions, the IMRC have been very active in the last year, strengthening working bonds, and friendships, in our specialist underground world.

The Judges at the 2015 competition.

The Lisheen Mine Team - Winners of the 2015 competition.

Geotechnical Assessments and the stability of quarry working faces

(as per the 2008 Quarry Regulations)

by Jonathan Talbot, Director, Advanced Mining Solutions (AMS)

The 2008 Health, Safety and Welfare at Work Act Quarry Regulations came into operation on 1st May 2008. It replaced provisions formerly applied in the Mines and Quarries Act, 1965. The new act comprises of 9 sections dealing with all aspects of the safe operation of a quarry.

A large section of the legislation is concerned with quarry stability and safe extraction in order to ensure quarry faces are stable and safe for those working in proximity to the excavation.

Since its introduction, adherence to the guidelines has been mixed among many operations and in recent times stability related accidents in Irish quarries have reminded us the importance of using these guidelines combined with professional technical advice to ensure the safety of all persons working within Irish Quarries.

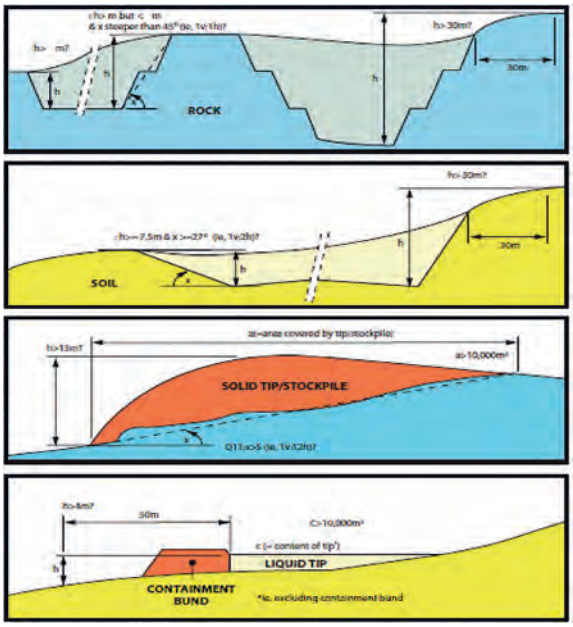
The legislation helps identify what is defined as a significant hazard to quarry stability. In operations where these significant hazards are found a geotechnical specialist must be employed to conduct a geotechnical assessment.

A geotechnical assessment is defined under the legislation as: "An assessment carried out by a geotechnical specialist identifying and assessing all factors liable to affect the stability and safety of a proposed or existing excavation, tip or lagoon."

The assessment must include an up to date quarry survey as well as detailed, scaled cross sections and site investigation plans as well as conclusions of the geotechnical specialist as to:

- The safety and stability of the excavation, tip or lagoon and whether it represents a significant hazard.
- Whether remedial works are required and when they should be completed.
- When the next geotechnical assessment should take place.
- Any changes to the operating procedure which arise as a result of the assessment.

What is a Significant Hazard?



Hard Rock

- Where a face height exceeds 20m.
- A crest to toe angle of steeper than 45°.
- Floor of excavation is more than 30m below the level of any land within 30m of the boundary of the excavation.

Soils of weak rock

- Vertical height of excavation exceeds 7.5m and face angle exceeds 27°.
- Floor of excavation is more than 30m below any land within 30m of excavation boundary.

Solid Tips and Stockpiles

- Average gradient of land covered by tip exceeds 1:12.
- Total height of tip exceeds 20m.
- Area of land covered by tip exceeds 10,000m².

Liquid tips and lagoons

- Contents of any lagoon more than 4m above the level of the land within 50m of the perimeter (of the contents of the lagoon).
- Contents of the lagoon exceeds 10,000m³.

Methodology of Assessment
(example carried out by an AMS geotechnical specialist)

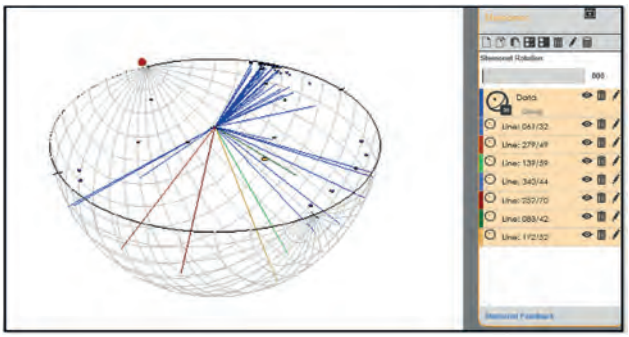
A walkover survey of the site is required to examine visually the response of soils and rocks to the quarry working method. A geotechnical specialist must also determine whether there are any tension cracks or evidence of past failures. Photographs and written documentation of anything with significant impact to the quarry stability must be taken during the course of the walkover survey. The specialist discusses in detail with the quarry manager the past history of the quarries development as well as what the short, medium and long term plan for further quarry development is in order to aid in assessing the current and future quarry stability.

Once the specialist has identified the extent and location of the stability hazards and how the major structures and hazards are placed relative to the excavation, the specialist can select safe positions to measure discontinuity orientations around the quarry. A detailed discontinuity orientation and condition survey is then conducted.

Fractured Quarry Face

Once these investigations are complete this data may be used to analyse the stability of the excavation using standard empirical methods as well as statistical software. Using Stereographic projection software, the primary discontinuity sets are highlighted and the most likely failure modes (planar, toppling or wedge)

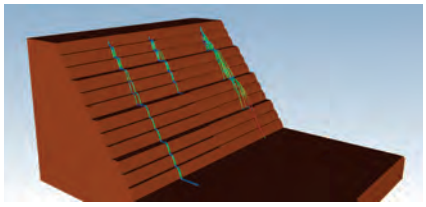
identified for each quarry face. This is done by ascertaining which discontinuity poles fall within the failure envelope of each quarry face orientation.



Discontinuity Analysis using 3 dimensional stereographic projections

The most likely failure modes for each face are highlighted and changes to the face orientation or working method can be recommended in order to mitigate against the hazard of large scale planar, toppling or wedge failure occurring in the face.

In addition to the discontinuity analysis a statistical analysis of smaller rockfall hazards can also be conducted in order to determine the optimum face angles, heights and orientations as well as stub bench and rockfall bund dimensions and the likelihood of rockfalls affecting fixed or mobile plant beneath a particular face.



Rockfall Simulation

By combining visual, empirical and statistical analysis of stability and risk within a quarry the specialist can come up with a series of recommendations to ensure the safety and stability of the excavation. Designs and protection measures arising from the assessment need to fit the circumstances of the particular operation. Installation of barriers, fill and use of excavation or blasting are usually the most cost effective remediation measures for quarry operations however if necessary face profiling or mechanical support measures may be required.

A full, quality report detailing the findings of a site investigation, analysis, assumptions made during the analysis and the recommendations of the geotechnical specialist must be produced as part of the assessment. The period of time before the next assessment should also be specified and if necessary periodic visits should be made to ensure that the quarry is progressing with the recommendations outlined in the report.

Demand for quarry products is on the rise again after a prolonged downturn. The challenge in this growing environment for a quarry operator is to maintain the highest standards in safety whilst staying competitive in a highly cost sensitive industry. However, it is the quarries which are fully compliant with their planning conditions, environmental and health and safety legislations that will be in the best position to take advantage of the upturn.

About AMS: Advanced Mining Solutions (AMS) is a multidisciplinary consultancy based in Kilkenny. The services on offer from AMS can help a quarry to drive forward in this environment with the highest standards of efficiency, quality and above all safety for its employees. AMS also offers a range of other services for mines, quarries, construction and infrastructure projects including: quarry surveys, ground support design, sprayed concrete, geotechnical monitoring, mine backfill, concrete testing, CQA management and borehole and trial pit logging. (www.advancedminingsolutions.com jtalbot@advancedminingsolutions.com 00353 (0)87 4134333)

Year of change in more ways than one in Northern Ireland

by Gordon Best, Regional Director QPANI

2016 to date has certainly been a year of change in more ways than one in Northern Ireland. In May of this year we reduced the number of Government Departments from 12 to 9 together with a voluntary exit scheme that has resulted in some 2000 civil servants taking early redundancy from the public sector.

The purpose of the NICS-wide Voluntary Exit Scheme, launched on the 2nd March 2015, was to address the significant budget pressures facing departments in the context of the agreed 2015-16 Budget, by delivering an NICS pay bill reduction.

By the time these last exits take place, 2,990 people will have left the NICS under the Scheme, saving around £87 million per year in pay bill costs. While this will cut the cost of running the public sector in NI the impact on industry such as ours has been significant with the lost of many long serving and experienced civil servants who QPANI had developed an excellent working relationship and understanding with. The work has already started in building new relationships and awareness of our vitally important industry.

May of this year also saw the NI Assembly elections and the forming of an opposition at Stormont. This means the two largest Unionist and Nationalist in the form of the DUP and Sinn Fein are in charge while the two smaller Unionist and Nationalist parties, the UUP and the SDLP, form the official opposition. Many believe this will lead to a more normal form of politics and certainly the early indications are that since the election back in May a more can do and will do attitude is developing at Stormont and "Delivery" is the name of the game being played. Only time will tell if the Politicians have taken on board the message that " they must do better" they got on the doorstops during the election campaign.

At the time of writing this article QPANI have arranged meetings with three of our new Ministers of Infrastructure, Finance and Environment to discuss, not only matters of concern our Members have, but to bring solutions in areas such as improving and speeding up the planning process, investment in and maintenance of our infrastructure, protecting and enhancing our environment and the contribution the quarry products can make.

Since the EU Referendum on June 23rd and the subsequent result to "Leave the EU", by a small margin it must be said, the vacuum of decision and discussion around what happens next and the finger pointing between the leave and remain camps threaten to poison the developing good relations at Stormont. In terms of the Quarry Products Industry in the North our main concerns are,

1. Significant volumes of construction materials move across this border every day and the impact of the introduction of a hard border and possible tariffs would have a significant commercial impact.
2. The negative impact of Brexit on the agriculture industry and food and drink industry in Northern Ireland will be significant and this is causing great concern as those sectors are the main customers of the quarry industry here.
3. We also have great concern over the potential slowdown in the UK economy and subsequently the GB Construction market as a result of Brexit. The precast concrete industry in NI are major players in the GB market and as a result help to sustain many small quarries and sand pits in NI who are their supply chain.

The next number of months will be crucial but let's hope common sense prevails when final decisions are made on the basis of facts and realities rather than scaremongering and made up figures that influenced the way people voted.

On the Planning front our work continues with the new 11 local Councils as they draft their Local Development Plans. I have been doing the rounds with local Planning offices furnishing them with Industry information on employment levels, turnover, mineral safe guarding issues and advocating the need to protect responsible businesses against the growing black market and illegal quarrying and development. I am also delighted to report we have 27 local planning offices currently engaged on the new Mineral Planning for Mineral Planning Course administered by the Institute of Quarrying. As the economy continues to improve demand for aggregates will increase and with it the growing threat from those who would wish to undermine the legitimate Industry. QPANI have been in contact with a number of regulatory agencies

Outgoing Chairman, John Shannon; Gordon Best, Regional Director; Eamonn Finnegan incoming Vice-chair and Colin Emerson, QPANI Chairman

highlighting the various scams being used to evade planning, local rates, Vat and aggregates levy. We have also highlighted our frustrations to senior planning officials about the length of time it takes to get enforcement action taken against what are blatantly obvious breaches of planning law. This set against the expense and numerous hoops that many of our members have to jump through to tick all the boxes in order to get planning permission. The work goes on!!!

Significant progress has been made on the Development of the new Construction Materials Level 3 Engineering Apprenticeship with South West College and Southern Regional College. We have 15 QPANI member companies supporting the initiative.

The Level 3 GOLD Construction Products Engineering Apprenticeship provides an opportunity for young people to undertake an engineering based Level 3 BTEC National Diploma and NVQs at levels two and three whilst in employment with leading companies within our sector. This development is seen as the starting point for a suite of learning and development opportunity which will be developed by the Colleges in partnership with QPANI and the industry as we seek to provide progression pathways up to Foundation Degree and beyond. The working group has developed the brand 'Engineering Rocks' to provide a focus for information and marketing of this and future initiatives and I advise you to keep up to date with developments by following us on Facebook : www.facebook.com/swcengineeringrocks .

The general public around Northern Ireland will also start seeing our new "Concrete Built IS Better Built" strapline appearing on an increasing number of our members delivery vehicles. Our Concrete Development Group has recently met with the Northern Ireland Federation of Housing Associations to discuss issues of concern from construction material suppliers. Among these were:

1. Use of Quality Assured Concrete and CE Marked materials.
2. Promotion of responsible sourcing and environmental best practice.
3. Use of competent and qualified concrete layers on housing association sites.

We have agreed to hold regular quarterly liaison meetings, facilitate direct liaison with key personnel within the Housing Association Design Teams and Procurement Teams and facilitate regular engagement between HAs and QPANI members at a local level.

Our work on Health and Safety continues unabated and our continuing close partnership with HSENI is proving invaluable as we strive to achieve zero harm within our Industry.

Arrangements are well advanced for this year's All Island Safety Conference in the Armagh City Hotel on the 19th October and we look forward to welcoming many IMQS members to what should be a very informative event and great opportunity for networking.

QPANI have recently published our 2016 Industry Journal. We are honoured that for the 2016 edition we have the First and deputy First Ministers writing our Foreword and messages from 6 Executive Ministers. The focus of the 2016 Journal will be "Delivering for Northern Ireland… Sustaining Communities and Building Growth" and on portraying the positive message about the importance of the construction materials supply chain to our economy and how we help construct and maintain our built environment that provides us with the quality of life many take for granted. We are delighted that once again we have a detailed and informative message from IMQS in the 2016 Journal.

On a very positive note it is heartening to once again see our Membership remaining strong as companies renew their faith in QPANI and what we are doing to protect the license to operate for everyone.

As always I am honoured to be asked to pen this short article for the IMQS Journal and may I wish IMQS and all your members every success in 2016 and the coming years ahead.

Irish Concrete Federation
Health and Safety

by Vincent Flanagan – Chairman, Irish Concrete Federation Health & Safety Committee

On behalf of the Health and Safety Committee of the Irish Concrete Federation (ICF), it gives me great pleasure to contribute to the Annual Review of the Irish Mining and Quarrying Society. In particular I would like to thank the outgoing President, Ms Siobhan Tinnelly for the invitation to contribute to the review and to wish the incoming president, Brendan Morris, Lisheen Technical & Mining Services, the best of luck in his new role as President of the Society.

The ICF Health and Safety committee is comprised of safety experts from the quarrying, readymix concrete and precast concrete activities of our membership throughout the country. The committee was reconstituted last year by merging of the relevant safety committees of the ICF and the Irish Precast Concrete Association. This has given new life to our committee and I am happy to say that our committee which meets quarterly, harnesses the expertise of a group of extremely professional and dedicated safety experts from a large number of ICF members. The role of the committee is to use this expertise to assist, inform and educate ICF members at large on developments in safety related issues within our industry. Additionally, I am particularly pleased to say that the committee itself has become a very useful network of safety professionals within our industry which can be used to generate new ideas and assist in the dissemination of these ideas to our membership.

The committee has already undertaken a major safety initiative this year with the holding of regional quarry safety workshops in association with the Health and Safety Authority (HSA). The impetus behind these workshops arose following a meeting between representatives of our committee and the Health and Safety Authority last year at which concern was expressed by inspectors within the Authority on the general safety standards in Irish quarries. With this in mind, the ICF and the HSA held three quarry safety workshops in early 2016, which were extremely well attended by ICF members. The workshops featured a presentation by Jim Holmes of the HSA on issues such as HSA interactions with the quarry industry, current safety concerns and the implications of prosecutions for companies and individuals. Jim's presentation was followed up with a presentation by Clive Kelly, a member of the ICF Health and Safety committee, on practical advice for addressing some of the key safety concerns identified by HSA. The presentations highlighted some of the key essentials that are required by quarry operators, including safety statements, induction records, training records, certification of work equipment, electrical checks, brake testing, PPE registers and daily, weekly and monthly check sheets. It is fair to say that the major safety concerns in Irish quarries in 2016 are identical to those which have always existed, in particular working at height, mobile plant, isolation and stability of quarry faces. Tragically, there has already been a fatality in our industry in 2016 arising from a quarry face collapse, again highlighting the fact that we operate in a dangerous industry which requires a constant vigilance on safety.

At a recent Irish Concrete Federation Quarry Safety Seminar is Gerry Farrell, Chief Executive ICF; Clive Kelly, ICF Health & Safety Committee; Jim Holmes, Inspector Health & Safety Authority and Lillian O'Neill, Inspector Health & Safety Authority.

The ICF Health and Safety committee has recently met with the Health and Safety Authority with a view to holding a Quarry Safety Week in October as a further initiative to promote safety in our members' quarries. The week will consist of focused toolbox talks by quarry operators for staff which will be held in tandem with targeted inspections of quarries by the Health and Safety Authority. ICF would like to express its gratitude to the Health and Safety Authority for their assistance on all of these initiatives throughout the year to date.

The other safety initiative on which the ICF has cooperated with the Health and Safety Authority has been in our pre-stressed concrete operations. ICF was particularly pleased that the HSA decided to carry out a targeted inspection of pre-stressed concrete operations throughout the country earlier this year. This initiative followed the methodology adopted by the Health and Safety Executive (Northern Ireland) in the past and involved HSA inspectors inspecting 22 pre-stressing locations. The businesses had been notified in advance of the inspection and ICF had hosed a joint briefing session with HSA before any inspections had taken place. This approach of focusing on a specific sector of the industry has been generally very well received by both the pre-stressed concrete companies and the inspectors involved in the initiative and it is our strong opinion that a similar approach should be considered by the HSA as a template for future initiatives in other sectors.

In conclusion, it is my genuine hope that the apparent but still fragile recovery in the construction sector will lead to an increase in activity among ICF and IMQS members in the coming years. However it is equally important to realise that often the greatest risks of accidents occur at a time when activity levels are increasing following a protracted period of low activity levels, low profitability and low level of investment in plant equipment and personnel. **Therefore, I would appeal to all involved in our sector to immediately put safety to the forefront of their list of priorities so that the industry will prosper in both a vibrant and safe operating environment.**

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Industry Review

by Gerry Farrell, Chief Executive of the Irish Concrete Federation

As ever it gives me great pleasure to contribute to the annual review of the Irish Mining and Quarrying Society (IMQS). At the outset I would like to thank the Society and the editorial committee for the invitation to contribute and indeed to thank IMQS for their continued support and commitment to the development of common approaches and partnerships on issues where we share a common interest. Our industry, while critically important in the construction and economic life of the island, is small in size and all of our resources should be pooled wherever possible in order to maximise the efficiency and effectiveness of our efforts.

At this point in my annual contribution to this publication I normally give the federation's perspective on **economic matters** and the general market place for construction materials in Ireland. At the risk of repetition I will simply reiterate the point made in previous years that while a welcome recovery is taking place, it is both fragile and uneven. Indeed, the outlook for the remainder of 2016 remains somewhat mixed for ICF members. Investment in the foreign direct investment sector in Dublin has certainly boosted activity in that region. However it is a different story outside of the capital. The continued pressure on farm incomes combined with a low level of investment in public infrastructure and housing in the regions has dampened demand for our members' products. Indeed, the recent general election highlighted the fact that the benefits of overall national recovery have not permeated to the regions and this singularly remains the biggest threat to businesses located throughout the country. While it is early days yet, it is also hard to see that the recent Brexit vote in the UK could be anything other than a negative influence on the sector, particularly for those manufacturers who have built up a strong presence in the UK in recent years. It is incumbent on the government to ensure that access to the UK market is protected in the future in order to protect the Irish export sector on which so many jobs depend.

The current challenges for our member companies were clearly articulated by the publication in late 2015 of a **"Competitive Analysis of the Construction Materials Sector on the Island of Ireland – an Update"** which was supported by the ICF, the Quarry Products Association (Northern Ireland) and InterTrade Ireland. While it is the case that industry reviews often tend to tell those of us in the industry what we already know, it is very important that we have a reference to which we can point, when dealing with other stakeholders whose decisions impact on our industry. Indeed, the value of completing such a report was evident in the run up to the general election whereby the key messages which emerged from the review were used by the ICF in its pre-election message which was sent to all members and given to candidates seeking election. These points included the strategically critical importance of the quarry and concrete products industry, the impact of the current level of underinvestment in construction in Ireland and its concentration in Dublin, and the importance of a level playing pitch in terms of regulation. In this context, the strategic review of the industry highlighted that Government investment in infrastructure remains well below what is needed for Ireland to remain a favourable location for foreign direct investment and job creation. Currently the level of construction is approximately half of what it is in a normal developed economy and until such time as Government investment reaches a sustainable level and the constraints to house building are removed, it is unlikely that there will be any significant upturn experienced in the activity levels of our members nationwide.

Notwithstanding these issues, ICF remains committed to improving the **operating environment** for all our members and our involvement in areas from safety, transport and planning to technical standards and marketing are testament to this fact. In 2015 ICF launched a new **certification and traceability initiative** whereby members will certify the origin of the product supplied to each individual site in order to improve confidence in the supply chain. This initiative which was driven by our Business Development Committee was well received by all of the other professional bodies and representative organisations in the construction industry and was launched by the Minister of State with Special Responsibility for Housing in July. ICF will continue to promote this initiative throughout 2016.

Our **Transport Committee** continues to focus on safety and the cost of transport. ICF held a major seminar on safety with the Road Safety Authority which was well

attended by members and representatives of An Garda Siochana and the Health and Safety Authority. ICF is meeting with the RSA in the coming weeks in order to look at a future safety initiative in the area of load security. This committee has also focussed on the issue of the ever increasing cost of transport and the committee produced a costing template for individual members to assist them to calculate their own individual transport costs and maximise efficiencies.

In 2015 ICF was finally successful in having legislation enacted in order to speed up the process of **planning regularisation** for members who found themselves in substitute consent as an outcome of Section 261A of the Planning and Development Act. The legislation was signed during the summer and a substantial number of our members are availing of the provisions of this legislation, which outlines a once-off opportunity for those quarries already in the substitute consent process to apply directly to An Bord Pleanála for authorisation for future extraction. Unfortunately at time of writing, there have been no decisions emanating from An Bord Pleanála in respect of these applications and ICF is currently seeking a solution to ensure that decisions are made without any further delay. As a general point, ICF is strongly of the opinion that this process is a major step towards putting the quarry industry on a sustainable footing for the future.

Our **Health and Safety Committee** continues to focus on the issues of safety, particularly in quarries and in our precast concrete plants. Unfortunately there were two fatalities in quarries in 2015 with a further fatality recorded already in 2016. ICF has recently completed a roadshow of workshops for members in conjunction with the Health and Safety Authority (HSA) on quarry safety. Our new committee Chairman, Vincent Flanagan will deal with this in detail in a separate article for this publication. We also greatly welcome the Health and Safety Authority's decision to follow in the footsteps of the Health and Safety Executive of Northern Ireland (HSENI) in auditing pre-stressed concrete operations throughout the country. A total of 22 locations were audited by HSA inspectors with a very favourable response from both operators and the inspectors themselves.

Our **Technical Committee** continues to develop standards and guidance through participation on the many industry committees of the National Standards Authority of Ireland. In particular, our members were highly involved in the development of guidance on the standard for aggregates for use under concrete floors and footpaths and are currently working on updating guidance on aggregates for concrete. In July we held a major technical seminar for members on the developments in standards and their implications for certification and building control. The Technical Committee looks forward to assisting the ICF to educate all of our members and indeed other stakeholder organisations on the content and benefits of these standards and guidance.

With support from Cement Manufacturers Ireland, ICF recently reformed the **Concrete Development Group** to focus on the marketing and PR needs of our industry. The committee has agreed to focus on agriculture and third level education initially but will also focus on areas such as housing, education and skills and concrete design as its programme of work develops. It is a sign of confidence in the future that, as an industry, we are once again prioritising the promotion of the many benefits of aggregate and concrete products to stakeholders in order to ensure that such products remain the sustainable construction materials of choice in the future.

I will sign off by once again thanking the IMQS for their support and assistance throughout the past year and I wish the Society and all of its members the best for the remainder of 2016 and the coming year. In particular, I would like to congratulate Siobhan Tinnelly on her successful tenure as President of the Society and to wish Brendan Morris well in taking up the role as Siobhan's successor.

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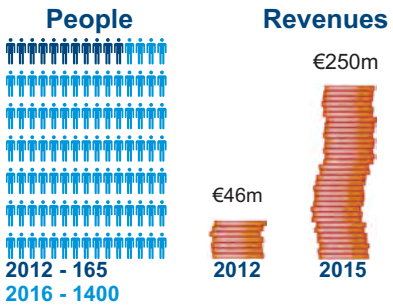

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Zinc Lead Mine, India

Geothermal Wells, UK

Geotech Harbour Assessment, France

Gold Mine, Ghana

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Vedanta - Lisheen Mine
The New Benchmark for Mine Closure

by Stephen Wheston – Site Manager, The Lisheen Mine and Paraic Maher – Mine Closure Project Manager, The Lisheen Mine

Lisheen Mine is an underground lead and zinc mine wholly owned by Vedanta Resources plc, a diversified natural resources major listed on the London Stock Exchange. Vedanta has mining operations in India, Africa, Australia and Ireland and the company is committed to operating to the highest international standards for safety and sustainable development and works with stakeholders and local communities to achieve its sustainability goals.

The genesis of Lisheen Mine dates back to its initial discovery in 1990. Throughout its planning, construction, operation and now closure, Lisheen Mine has been a world class operation, implementing the highest international standards throughout the entire Mine life cycle. The operation located near Thurles on the border between counties Tipperary and Kilkenny, was a leading mining/Mineral processing company that extracted lead and zinc ore from 200m below ground, over a period of 15 years. Ore was refined in a surface processing plant before sale to international customers. Production ceased in late 2015 and Lisheen Mine is now well advanced in the implementation of its Mine closure plan or CRAMP (Closure Remediation and Aftercare Management Plan) which will ensure there is no impact associated with the mining operations now that mining has ceased. This paper aims to document progress on closure works at this time and to also give an insight into the actual process of implementing a Mine closure plan.

Implementation of the Mine Closure Plan

Responsible and effective planning for Mine closure is a complex challenge and requires detailed interaction and co-ordination with all stakeholders to ensure a robust plan is developed and implemented. Planning for Mine closure is the key to successful implementation.

***Fig. 1** – Planning for Responsible Mine Closure.*

Prior to the commencement of mining operations, and indeed prior to receipt of the relevant permits required to carry out mining, Lisheen Mine had prepared a comprehensive Mine Closure plan which was assessed and approved by the various Statutory Authorities. The closure plan was costed and funds to implement the plan were put in place by Lisheen. At the outset of the project $32.8 million USD was placed in a secure bank account. The account is secured by the need for three Statutory Authorities signatures (as well as Lisheen's) to withdraw funds.

Over the years the closure plan was revised to take account of developments of best practice in the industry and any changes in legislation. An aftercare programme also ensures that a comprehensive plan is in place (and funded). In line with international best practice, Lisheen Mine embarked on a programme of 'progressive rehabilitation' from 2008. The purpose of which was to allow the Mine to reduce the liability sooner rather than later. It allowed the skills and knowledge of staff still employed by the Mine to be used to implement the plan and most importantly it demonstrated to all stakeholders that the plans devised actually work and that there was tangible evidence of this.

Status of Physical Closure – July 2016

There are a number of key aspects associated with the implementation of physical closure:

1. Re-watering of the Mine and a return to baseline groundwater conditions.
2. Removal of all surface plant that does not have a sustainable reuse option, and return of the ground to baseline conditions.
3. The blocking and sealing of all Mine openings in line with the Lisheen Mine Ground Control Management Plan.
4. Rehabilitation of the Tailings Management Facility.

Re-watering of the Mine

Following the completion of backfilling from underground locations and the removal of potentially hazardous material (oil / fuel etc.) as well as the removal of underground equipment of value (mobile plant etc.), preparations were made to re-water the Mine. Each area of the Mine was signed off by a competent person to confirm that the area had been cleared and was suitable for re-watering. The water pumps were turned off on 30 December 2015, allowing the Mine to re-water. A regime of water quality was in place before re-watering commenced and will continue for decades into the aftercare period.

International consultants prepared a hydrogeological report as part of the closure plan and all actions from that report were incorporated into the CRAMP. This included the construction of three low pressure barricades to assist with the compartmentalisation of water within specific areas of the Mine workings.

The water table has shown a rapid recharge and reflects the large water volumes that were at the Mine during the operation (in excess of 100 million litres of water were discharged from the Mine on a daily basis during the winter months).

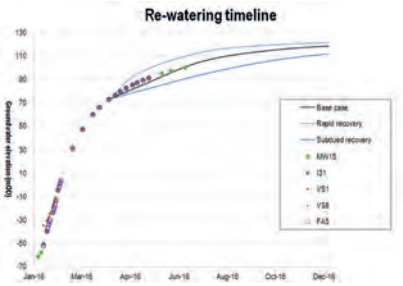

***Fig. 2** – Rate of rise of water within the Mine.*

As the Mine re-waters the more saline water associated with the sulphide orebody, being of a higher density, will begin to form a chemocline. As a result of this chemocline the mineral rich water that contains salts will 'sink' to a lower depth in the groundwater. The active aquifer, used for drinking water abstraction etc. in the region, which is c. 40m BGL (Below Ground Level) will in essence 'float' on top of the denser water associated with the Mine and mineralisation in the region. In time; as anoxic and anaerobic conditions become established in the Mine, metal sulphates will precipitate as sulphides and settle, thus becoming immobile.

Early testing is already indicating that the chemocline is becoming established (to date it has only been possible to test to a depth of 70m BGL). The figure below shows monitoring data taken from Monitoring Well number 9 (MW9) and this demonstrates that conductivity is increasing as groundwater depth increases. This in turn is validating the groundwater model that predicted any potentially contaminated groundwater associated with re-watering of the Mine would remain confined at depth.

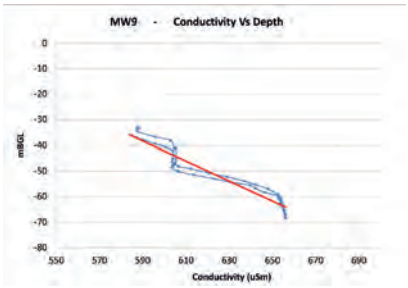

***Fig.3** – Sampling water quality within the underground workings as the Mine re-waters*

Removal of surface plant

In early 2016 Lisheen Mine successfully negotiated the sale of all surface plant to another international natural resources company and since March 2016 the process of disassembling the processing plant for shipping overseas has been underway. A team of over 100 contractors were on site to carry out this complex work.

***Fig. 4** – The Lisheen Mine site prior to closure.*

***Fig. 5** – The SAG and Ball mill exposed and awaiting removal.*

Lisheen Mine retained all mobile plant, pumps and other items such as electrical equipment for resale and at the time of this report is in the process of selling off these assets in a competitive tender process.

***Fig. 6** – A selection of underground mobile plant assembled on surface ahead of sale.*

Blocking and sealing of all openings to the underground workings at Lisheen Mine

Sealing off all openings to the Mine is important as part of the Ground Control Management Plan, to ensure ground stability around the Mine and also from a health and safety perspective to ensure there is no possible means of access to the remaining underground workings once mining has ceased. It should be noted that the actual void remaining underground is minimal as the vast majority of the underground workings were backfilled as part of the mining process to ensure ground stability; circa 90% of the mining areas excavated underground were backfilled with competent material as part of the mining cycle and Mine closure plan.

In total Lisheen Mine had 12 vertical shafts (of varying diameter) and each had its own dedicated backfilling plan. The location of the shafts and an example of a backfilling plan are shown in the figures below:

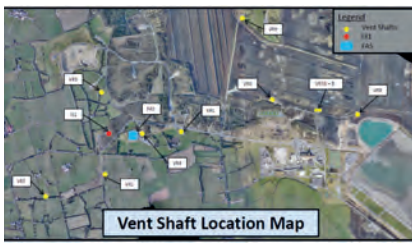

***Fig. 7** – Location of vertical shafts into the Mine workings.*

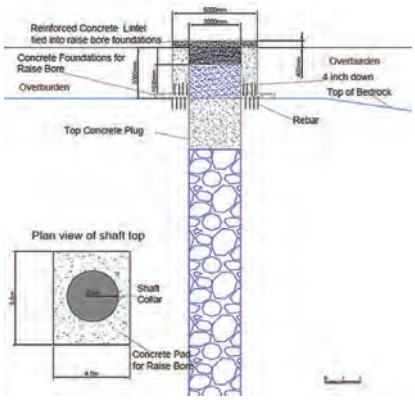

***Fig. 8** – Typical fill detail for a vertical shaft.*

Prior to filling the vertical shafts it was necessary to remove certain fixed plant that may have posed an obstruction to the fill material.The picture below shows specialist workers operating in the Fresh Air Shaft (FAS).

***Fig. 9** – Workers access the Fresh Air Shaft to assist with the removal of the Alimak Emergency Exit equipment from the Mine.*

***Fig. 10** – Removal of a section of the Alimak from the Fresh Air Shaft.*

The shafts were filled with rock (of different diameter depending on its placement location) and concrete. The figure below shows placement of the large diameter rocks. All work on shaft filling was overseen by an independent engineer as part of a Construction Quality Assurance plan (CQA).

***Fig. 11** – Tipping rock into a vent shaft.*

***Fig. 12** – Vent Raise 9 – prior to backfilling and rehabilitation.*

***Fig. 13** – Vent Raise 9 – Backfilled and rehabilitated.*

The most significant opening to the Mine was the main decline. A 1.6km access ramp into the Mine, by which all employees and equipment entered and left the Mine.

***Fig. 14** – Vehicle exits the main decline.*

The first activity was the construction of a barricade in the decline at a depth of 20m below surface and above this barricade rock and concrete was placed to a length of over 130m along the decline, to provide a robust geotechnically competent plug.

Fig. 15 *– Employees work on the installation of the barricade at the base of the plug on the decline.*

Fig. 16 *– Top end of the plug on the decline.*

Fig. 17 *– Work to seal the portal section on top of the decline plug on the decline.*

Fig. 18 *– The completed decline / portal plug – covered over with overburden.*

Rehabilitation of the Tailings Management Facility.

From an environmental perspective the most significant aspect associated with Mine closure is rehabilitation of the Tailings Management Facility (TMF). As part of the planning process extensive research was carried out into best practice for closing tailings dams and Lisheen personnel visited a number of sites within Ireland and throughout the world to ensure that the methodology used at Lisheen would be equal to the best practice seen internationally. The Lisheen rehabilitation team was assisted by experienced advisors and consultants who have extensive expertise in the area of TMF rehabilitation. All physical works have been overseen by external (and internal) engineers as part of a rigorous CQA plan.

It is the view of Lisheen Mine that the TMF rehabilitation methodology sets a new standard for robustness in Ireland (and possible internationally). The cover is a composite cap made up of geotextile, 700mm of limestone rock and 300mm of soil. This 1 metre cap ensures that the tailings are comprehensively covered and decoupled from the grass that is growing on the surface. An engineered wetland system has been designed to ensure surface run off from the facility post closure will not have any negative impact on the environment.

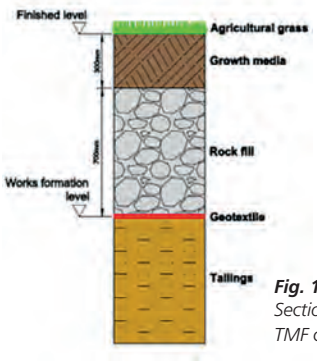

Fig. 19 *– Section of the TMF cap.*

As described at the outset, Lisheen adopted a progressive approach to rehabilitation to provide reassurance to all stakeholders. A series of procedures were put into place to gradually and sequentially rehabilitate the TMF area to produce a successful pasture cover that can be used for livestock rearing amongst other potential future uses.

Fig. 20 *– Overview of the TMF (pre 2008, prior to any rehabilitation work being completed)*

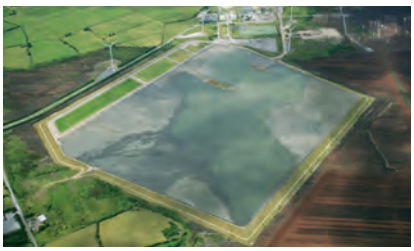

Fig. 21 *– Completion of Phase 1 TMF rehabilitation (c. 2010)*

Fig. 22 *– Completion of Phase 2 rock cap (Sept. 2013)*

Fig. 23 *– Completion of Phase 2, 3 & 4 TMF rehabilitation (Jun 2015)*

Fig. 24 *– Grass growth taking hold on Phase 3, 4 & 5 (July 2016)*

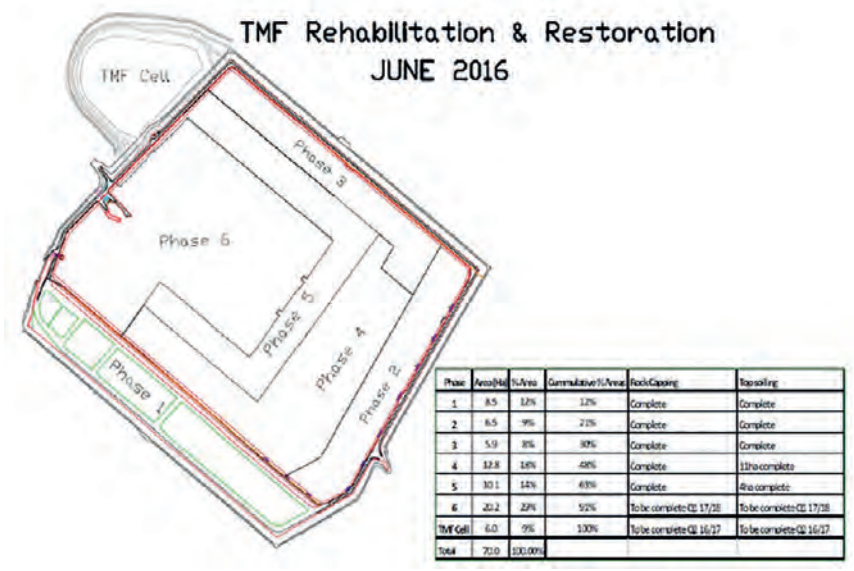

Fig 25 *– Schedule for remaining phases of TMF (plan for completion mid 2017).*

Fig 26 *- Tom Albanese, Chief Executive Officer of Vedanta Resources, pictured on a section of the rehabilitated tailings dam at Lisheen that is being used to farm cattle.*

Objective and Future Vision

Our primary objective is to restore the Mine site. Our vision is to attract replacement industry to our site to provide replacement jobs and sustainable growth. A taskforce has been in place for over two years to try and realise this vision.The taskforce, made up of members of local government and industrial development agencies, is chaired by an ex Minister of the National Parliament.

Our vision is to establish a 'Bio-economy Campus' on the site with multiple operations and jobs. Lisheen has been approved to be 1 of 6 European Model Demonstrator Regions which secures advisory support from European Sustainable Chemicals Support Service with access to economic & policy expertise & industrial network and provides a strong lobbying tool for Lisheen & potential tenants.

Lisheen Mine and Vedanta are committed to the implementation of a world class site closure that can be used as an example of best practice for the industry.Lisheen Mine has worked closely with the local community and many state agencies including the EPA and the Department of Communications, Energy and Natural Resources, as well the Tipperary County Council and other stakeholders on developing and implementing the closure plan. We would like to take the opportunity now to thank all of the people involved from those agencies for their assistance and continued support in our efforts to implement a robust and sustainable closure plan.

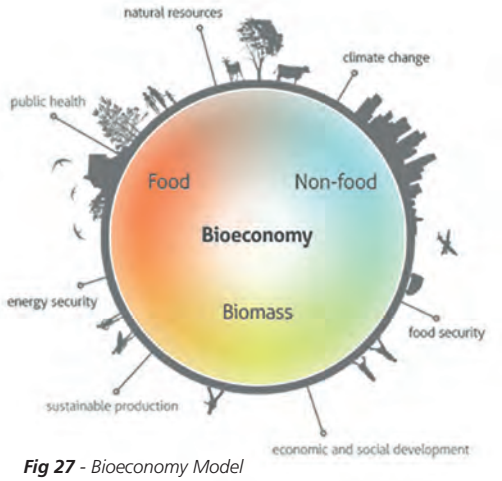

Fig 27 *- Bioeconomy Model*

Stephen Wheston *is currently the Site Manager at Lisheen Mine and has worked at Lisheen Mine in various Safety, Health & Environmental roles since he joined the company in 2003. Stephen has an MSc in Environmental Management and has over 20 years of experience of Sustainability Management within the mining and chemical sector.*

Paraic Maher *is currently the Mine Closure Project Manager at Lisheen Mine and has worked at Lisheen Mine in various roles since he joined the company in 2009. Paraic has an MSc in Project and Programme Management and BEng in Civil and Transportation Engineering and has over 14 years of experience within the mining and construction sector.*

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Integrated Constructed Wetland (ICW) for the treatment and management of Mine Influenced Water (MIW) at the Tara Tailings Facility

by Oliver Fitzsimons, Boliden Tara Mines

Boliden Tara Mines are currently investigating the possibilities for an Integrated Constructed Wetland (ICW) as part of the water treatment process post closure at the Tailing Storage Facility [TSF]. The key parameters requiring treatment are zinc, lead, nickel, manganese, aluminium, magnesium and ammonia. The tailings runoff water is also characterised by its high concentrations of Sulphate (SO4).

The main areas for this project are the two main contaminated water streams which require management both in the medium and in the long-term. The first concerns the seepage of water through the TSF embankments which is then collected by an interceptor channel. The second area is the runoff water from the soil cap which will be placed on the tailings surface once the filling process has stopped.

In nature wetlands are typically transitional zones intermediate between exclusively aquatic and terrestrial communities. Approximately 4% of the planet is covered in wetlands, the majority concentrated in mid-latitude and equatorial regions.

An integrated constructed wetland is a shallow surface flow wetland, which mimics the role and structure of naturally occurring wetlands. Such artificially constructed vegetated wetland ecosystems have proven effective in cleansing water of a wide range of nutrients and pollutants. ICW systems have shallow water depths and are densely vegetated with appropriate emergent plant species to intercept and cleanse through-flowing water. Treatment is achieved through a combination of physical, chemical and biological processes.

There are primarily three identifying features that define wetlands. Firstly their water table is above or at the soil surface for a significant proportion of the year, constituting a determining factor of their ecosystem. Secondly they possess an emergent vegetation, such as reeds typically helophytes, and thirdly they possess a soil characteristic of wet biotopes such as similar bacteria (anoxic, chemically reduced).

Every ICW has a site specific design that strives to optimally achieve a balance with nature by encouraging natural species to live there i.e. a 'Landscape fit' and 'Habitat Restoration'/Biodiversity' design. The primary vegetation types used in ICWs are emergent plant species that evolved to enable their roots to successfully grow in soils with no available or limited oxygen.

At Tara we are undertaking two separate pilot scale wetland experiments investigating two divergent methods to achieve similar goals, namely, Sulphate and Metal reduction in effluent waters. The results to date have proven very encouraging and provide a degree of confidence that the ICW approach will provide a sustainable, long term water treatment solution.

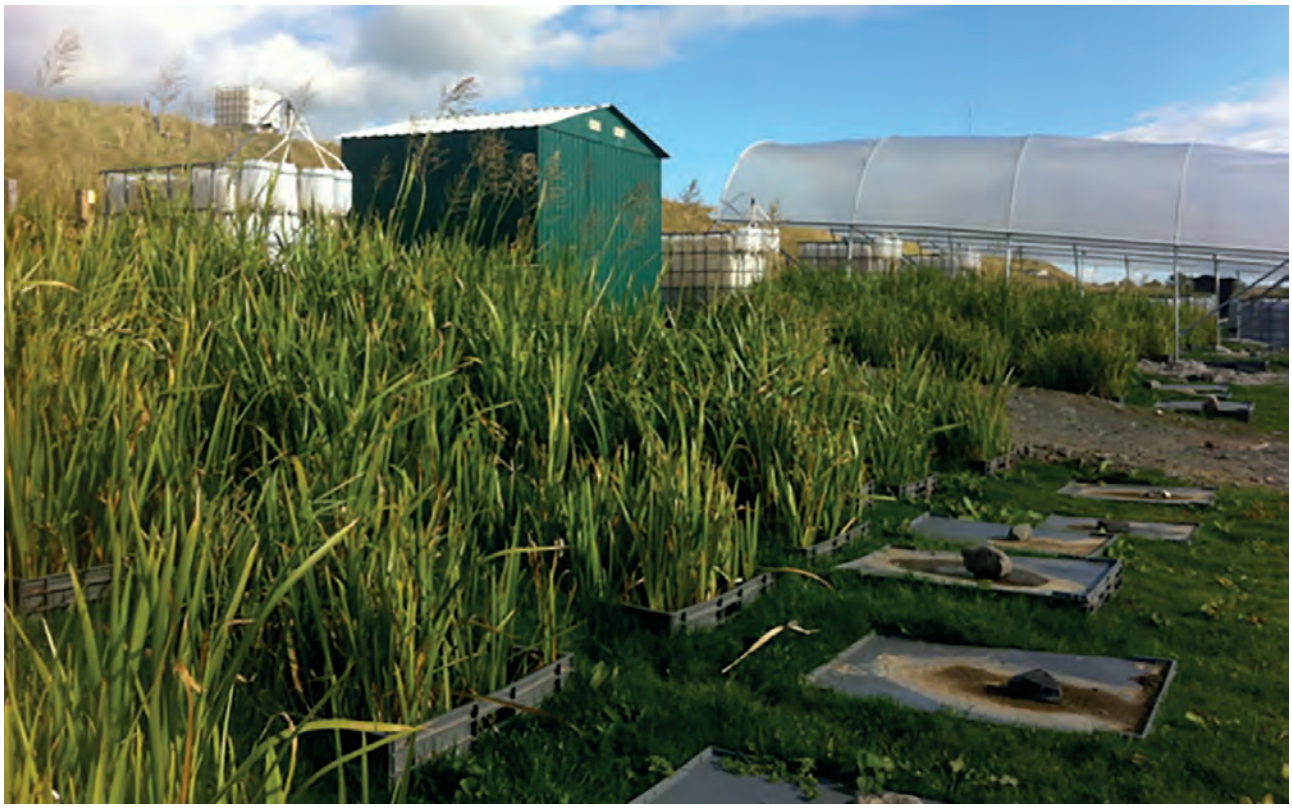


Plate 1: Tara's pilot scale ICW October '15

Competitiveness & innovation

- the non-energy raw materials sector provides solutions

by Dr. Corina Hebestreit, Euromines

This month the EU is publishing its annual report on the implementation of the European Innovation Partnership on Raw Materials: the EIP Scoreboard. The scoreboard tries to assess the situation of the industry in Europe and provides a basis for identifying future challenges.

Of course, domestic production of raw materials is an essential part of the EU economy. It provides a reliable supply of inputs to many downstream industries (e.g. automotive, chemicals, and electronics manufacturing). Domestic extraction of construction minerals has increased since the 1970s, allowing the EU to remain more or less self-sufficient. Domestic extraction of industrial minerals on the other hand stagnated in the 1980s, and for metals — in spite of an exponential increase in demand — it even decreased slightly. On the other hand Eurostat data show that the EU processes more raw materials than it extracts. This difference can be explained by imports and recycling. Looking more closely at metal mining, it can be seen that several metallic raw materials are mined in the EU. Indeed, the EU has the potential to increase the current production start new production units. Nevertheless, domestic extraction of metals is largely insufficient to meet the EU s raw materials demand.

Providing value and employment

Taken together, raw materials industries in 2012 provided EUR 280 billion of added value and more than four million jobs. However, the economic importance of the raw materials sector goes far beyond the economic activities strictly related to the extractive and processing industries.

Looking at the metals value chain alone, the secure supply of raw materials is essential for jobs in downstream manufacturing sectors. These include the production of fabricated metal products, electronics, and machinery and equipment. It is estimated that more than 11 million jobs are affected, equal to 40 % of the jobs and value added from the EU s entire manufacturing sector.

If the EU wishes to maintain this employment it needs to ensure that the sector can expand in Europe. For competitive and technical reasons the sector needs to automate as much as possible which means job losses. Hence only if the whole supply chain can be kept and extended in Europe it will be possible to maintain this vital element of the EU economy.

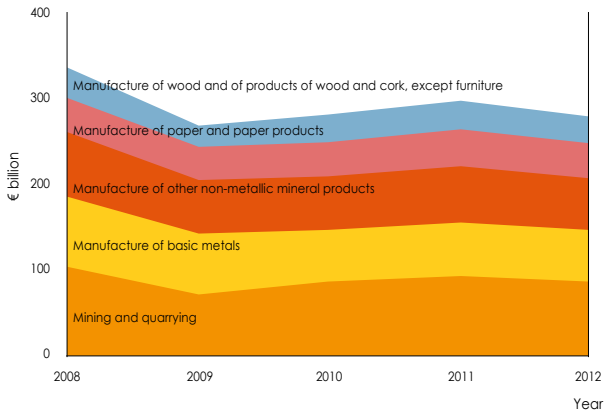
Innovation is essential for the EU to remain internationally competitive

EU statistics do not record exploration expenditure, hence the sector presents itself as an overall low R&D intensity sector which is not true. If these figures were taken into account, the situation would look different. However, even taking just the top R&D investor companies in the raw materials sector, they have almost doubled their annual R&D expenditure since 2003. Between 2003 and 2013, it grew more than twice as fast as public R&D investments. Now with the economic down-turn figures will drop again.

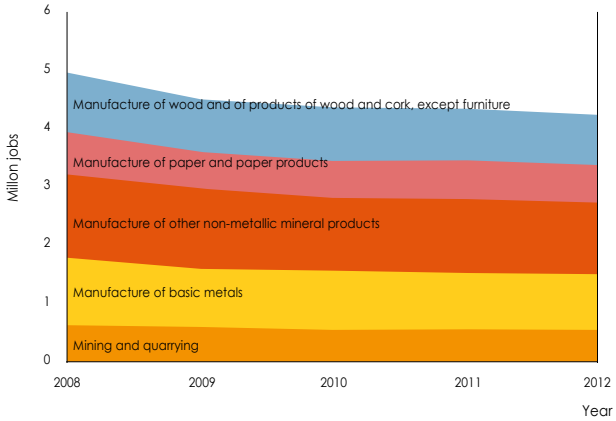
Facilitating access to risk capital and assisting companies to bring innovations to the markets will be necessary.

EU patent applications in the raw materials sector on the other hand show a decreasing trend. Nevertheless, in 2011, the EU still accounted for 36 % of patent applications filed by the EU, Australia,

Value added by raw materials sector in the EU



Jobs by raw materials sector in the EU



EIP Scoreboard 2016, based on data from Eurostat, retrieved on 20 May 2015. Value added at factor cost from the Annual detailed enterprise statistics for industry, code sbs_na_ind_r2. Number of employees from Industry by employment size class statistics (NACE Rev. 2, B-E), code sbs_sc_ind_r2.

Crucial Importance of national minerals policies

National minerals policies that ensure security of supply of important raw materials and ensure the sustainability of the extractive operations as well as their products are crucial to economic policies.

In general one can say that the following principles need to be adhered to:

PRINCIPLE 1: FAIR LICENCE ALLOCATION

The award of exploration rights should be done on an objective basis and generally with a view to free and open access, absent circumstances that suggest potential multi-party interest where tendering should be considered.

PRINCIPLE 2: WORK IT OR LOSE IT

An exploration company should be required to make an on-going financial commitment in order to maintain exploration rights.

PRINCIPLE 3: EXPLORATION PERIOD – SUFFICIENT FOR DISCOVERY

The exploration company should be able to retain its exploration rights for a period sufficient to give it a reasonable chance of making an economic discovery.

PRINCIPLE 4: RIGHT TO MINE

The right to mine is the central monument of any mining code; it refers to the exploration company s right to produce minerals, on an exclusive basis and free of third party interference, where such rights are granted on the basis of objective criteria and free of discretion, subject only to peripheral health, safety, environmental and other such operating authorisations.

PRINCIPLE 5: MINING PERIOD – SUFFICIENT FOR MINING DISCOVERY

The mining company should be permitted to hold mineral rights until the exhaustion of the known ore.

PRINCIPLE 6: OBJECTIVE, FAIR AND CLEAR GROUNDS FOR FORFEITURE

The mining company should be permitted to hold mineral rights until the exhaustion of known ore.

PRINCIPLE 7: SOCIAL LICENCE TO OPERATE TO BE ENCOURAGED

Modern mining codes should consider mechanisms for encouraging local community engagement, but a community veto over a project should be avoided.

PRINCIPLE 8: TRANSPARENT AND BALANCED ENVIRONMENTAL REVIEW

Environmental approval for proposed mines should be based on the principle that development should be facilitated, where reasonable to do so; the process should involve clear and objective criteria, with the assistance of expert input, within established (and staged) time frames, with the object of modifying impacts, where possible, and with a right of appeal or review.

PRINCIPLE 9: RESERVE POWER OF STATE TO ENCOURAGE DEVELOPMENT

All mining codes should consider the potential need, in limited circumstances, for state intervention to overcome regulatory, financial or other obstacles to the development or continued operation of a particular project.

PRINCIPLE 10: FISCAL FREEDOM

The mining company should be free to realize the value of an investment made.

Canada, Japan, Russia and the USA together (Indicator 9).

Finally, to be able to stay at the forefront of innovation, the EU needs the necessary knowledge and skills or skilled workforce. The mining and minerals sector in particular is already reported to be suffering from a significant talent shortage.

Framework conditions for mining in Europe

Looking at mineral exploration activities, data suggest that the EU s minerals potential is under- explored and under-exploited. Mineral exploration is an important step in the mining life cycle because it contributes to the discovery of potential new deposits and the opening of new mines. These activities also represent a low level of investment, in spite of the mineral potential in the EU. Furthermore, in recent years, investment in metallic minerals exploration has steadily decreased, both in the EU and globally. This is mainly due to a lack of incentives and access to risk capital, not due to lack of exploitable resources.

Institutional framework conditions — national minerals policies, data on mineral endowments, environmental regulations, public acceptance etc. — can either impede or expedite the development of mining operations. The policy framework and regulatory structure in particular are important factors that affect the EU s attractiveness to mining operations. Frequently updated or new legislation changing the requirements and impacting on the cost structure and weak implementation are deterring factors for investors. The sound proofing of administrative procedures would be recommended.

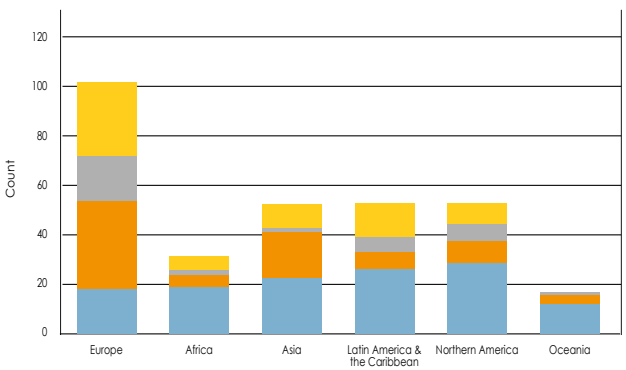
Public acceptance is another factor that greatly affects mining companies operations. Data show that public acceptance of extractive activities in the EU is low as compared with other economic sectors, which is partly due to the past performance of the sector, but also of the continued political support for the service industry which should not have neglected the existing industries whilst promoting new ones.

Environmental and social sustainability

Adapting to the climate change goals is one of the key challenges for the raw materials sector for the future.

Data on air emissions suggest already a decoupling between raw materials production and air pollution and greenhouse gas emissions. Between 1995 and 2009, emissions from the production of raw materials in the EU decreased by 10-40 %. Given that many parts of the raw materials industry are energy-intensive, this decrease is a reflection of the economic down-turn, fuel switches and the increased uptake and effectiveness of energy and air emission management systems in the EU.

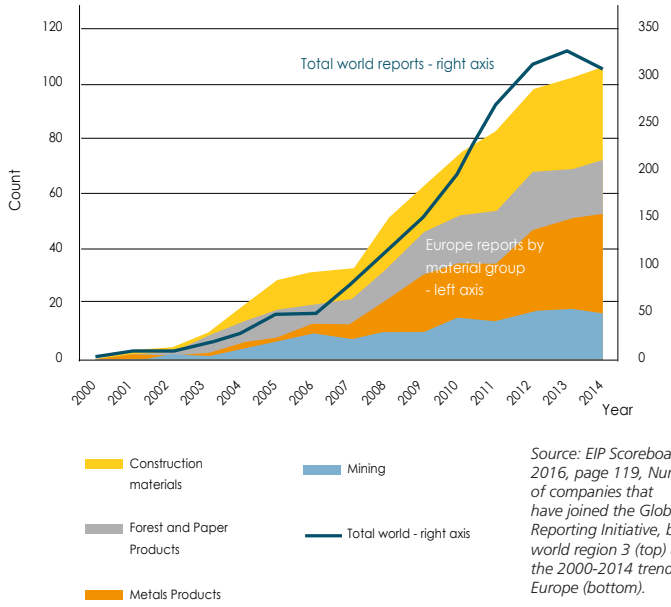
Raw materials companies publishing GRI reports by world region, 2014



Occupational health and safety is important for social sustainability. While the raw materials sectors are relatively exposed to occupational hazards — accident rates are at the same level as those of other high-risk sectors such as construction — accident rates have been decreasing since the middle of the 1990s. New technologies will continue to decrease hazards and risks in the sector.

Further, the EU raw materials sector is a world leader in sustainability reporting. About one third of the Global Reporting Initiative reports in the raw materials sector are filed by companies with their headquarters in Europe.

Raw materials companies publishing GRI reports in Europe and total world, trend 2000–2014



Source: EIP Scoreboard 2016, page 119, Number of companies that have joined the Global Reporting Initiative, by world region 3 (top) and the 2000-2014 trend for Europe (bottom).

Euromines in brief

Euromines is the recognized representative of the European metals and minerals mining industry. The members' main objective is to promote the industry and maintain their relations with European institutions at all levels. Euromines provides services to its members with regard to EU policy and forms a network for cooperation and the exchange of information throughout the sector within Europe. The association also supports contacts with the mining community throughout the world.

Euromines members are large and small companies who with their subsidiaries in Europe and in other parts of the world provide jobs to more than 350,000 people. Their activities and operations produce more than 42 different metals and minerals.

For some metals and minerals, Europe is the world's leading producer.

The association is based in Brussels and holds membership meetings twice a year. Its committees and working groups meet regularly throughout the year. Euromines also follows trade and investment issues for the mining industry both inside and outside of Europe.

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Aerial photograph of Irish Cement Platin, Ireland's largest cement factory. Over €200 million has been invested on the site in the last decade with the installation of a new modern energy efficient production line, Kiln 3.

Photo credit; Aerial Eye

Concrete Communication

by Brian Gilmore, Sustainability Manager, Cement Manufacturers Ireland.

A perspective from the cement industry on the requirement for effective communication about the sustainability benefits of concrete and its constituent ingredients.

Cement Manufacturers Ireland (CMI) was established in IBEC in 2003 and has three member companies in the Republic of Ireland; Irish Cement, Lagan Cement and Quinn Cement and an associate member in Northern Ireland - Lafarge Cement.

The members of CMI support 2,000 direct and indirect jobs in Ireland. The members compete on the island of Ireland to supply cement products to the domestic construction market and are also involved in the export of cement products to other European markets. The industry has invested in modern manufacturing facilities and operates to the highest international and European standards. CMI is a member of the European Cement Association, CEMBUREAU.

Our certified cement products are manufactured in compliance with the European Cement Standard (EN 197) and cement, in our opinion, is the key ingredient in concrete.

After water, concrete is the second most used substance on Earth. Each year the global concrete industry produces three tonnes of concrete for every man, woman and child on the planet.

If you think about it, modern life is very reliant on concrete. Our homes, schools, hospitals, roads, bridges, ports, airports, water pipes are all dependent on concrete construction or contain concrete elements. Even though concrete is all around in the built environment, it remains largely 'invisible'. True, it can be hidden behind facades or buried underground as supporting foundations but even where concrete is exposed we tend to pass by unaware. Concrete as a material is largely taken for granted.

And this presents a problem. How can our industry explain the sustainability benefits of cement and concrete when many people use the terms interchangeably, are unclear about the manufacturing process and are unaware of how their daily lives and routines are so dependent on this ubiquitous construction material. In a world increasingly constrained by resources, where a future price on carbon will drive innovation and new markets, it is vital that we communicate clearly the contribution our industries are already making as well as how we are tackling the challenges ahead.

Even though concrete is such a widely specified and used material we must guard against complacency and ensure we communicate effectively to construction professionals and specifiers so that future material selection is based on informed decisions. And we do have a lot to say; the challenge is that we must make our messages relevant and appealing.

Readers of Irish Mining and Quarrying Society Review will be well aware that concrete is made primarily from four, on the face of it, 'ordinary' ingredients: aggregates, cement, sand and water. When combined in the proper proportions and produced in compliance with the appropriate concrete specifications and properly placed, concrete is a marvellous material. It provides flexibility of form, with strength, and durability. It is resilient even in the harshest conditions and yet delivers internal comfort for its occupants.

Concrete really is the backbone of sustainable construction. Sustainability is about using local materials in a resource efficient way and recycling those resources at the end of life.

Concrete is manufactured predominantly from local materials. It is durable - many of the buildings, bridges, dams and tunnels we use today were constructed decades ago using concrete. That is real resource efficiency.

Concrete structures can be repaired and refurbished, again an efficient use of resources because with minimal intervention the life of the building can be extended or it can be adapted for other uses.

And eventually at the end of its life the concrete can be recycled back into new construction projects. Concrete is 100% recyclable.

As a cement industry we are rightly proud of the role cement plays in delivering and sustaining our built environment.

But we are acutely aware that the role of this 'hydraulic binder' remains a mystery to many and that there are misconceptions about our

production process and our product. To help address this communication need, Cement Manufacturers Ireland has been working over the past few months on a series of short animated videos to provide simple and clear information on the key aspects of cement manufacture. The videos can be accessed on our website **www.cement.ie**. Two videos have been released and we are currently finalising the third.

The first video deals with **how cement is made**. A complex process which is controlled from a central control room in each of our members cement factories. From here the operators monitor and adjust all activities throughout the cement production process. The process starts with raw materials, natural rock, obtained from local quarries. The main raw materials we use are limestone, shale or clay, with small quantities of bauxite and iron ore.

These rocks are crushed into a fine powder through a series of mills in the cement factory. Chemistry is the primary focus during this phase - to ensure the correct proportions of the main minerals; calcium, silicon, aluminium and iron are present. Extensive testing and mixing is carried out during this preparatory phase to produce a fine-powdered, homogenous mix of raw materials called 'raw meal'.

The next phase involves extreme temperatures. Quite literally the raw meal must be 'melted' inside the cement kiln. The powdered raw meal is 'pre-heated' as it is fed, rotating at high speed through a series of cyclones to the kiln.

The kiln, a slowing rotating steel cylinder lined with special heat resistant bricks, is the heart of every cement factory. The kiln is fueled by powdered, shredded or liquid fuels that are injected through the burner pipes. The temperature at the main flame is over 2,000oC. These fuels are fully consumed in the kiln providing both energy and minerals to our process.

The temperature of lava flowing from a volcano is around 1,100oC. It is even hotter inside our kilns where the process must achieve a minimum temperature of 1,450oC – at this temperature the molten minerals start to form new 'clinker' compounds. The clinker is cooled as it exits the kiln and 'sets' into small spherical nodules.

The clinker is tested to ensure it meets strict standards. At this stage most of the hard work is now done and this clinker can be stored on site awaiting the final phase, milling to form the fine cement powder. This process is carefully controlled to ensure consistent high quality cement products are produced. During this phase other ingredients can be introduced with the clinker depending on the different types of cements being manufactured.

Once produced, cement is either packed in 25kg bags or discharged into powder tankers, for transport to the concrete producer.

The sustainability of cement production is advancing through the use of alternative fuels, investments in energy efficient equipment and clinker substitution which allows for the production of eco-efficient cements. All these developments mean that the modern cement industry can produce cement - this essential ingredient in concrete, with less energy, less resources, thereby contribution to a more resource-efficient concrete.

Our second short video in this animated series looks **at how waste-derived fuels are replacing fossil fuels in our cement kilns**. This is a vitally important initiative for the industry here in Ireland and one that is frequently misunderstood. Again the video sets out to clearly and simply outline what is involved in fueling modern cement kilns.

Modern high-tech cement production, this is a composite photograph of an autolab robot in action beside the main plant control room. Samples are automatically delivered to the autolab from throughout the plant for testing and the results pass directly into the central control system. Photo credit; DAK Photography

In the video we look at waste and describe how some materials can be easily recycled, like glass and aluminum cans, but have you ever wondered what happens to the waste that's not recycled?

Once collected the waste typically goes back to the waste sorting facility, where the different types of waste are separated and sent off to be processed back into new materials to make bottles, cans, paper and plastics. That's the best use of resources – making like for like.

But, what about the left-over materials, the waste that's not recycled? In the past this waste was sent to landfill where its value was lost and if the landfill was not properly managed this waste could give rise to pollution.

Now, in a partnership between the cement industry and the waste industry this residual waste can be processed by the waste management companies into a fuel, called **SRF, solid recovered fuel**. The SRF is produced to a specification so it is shredded and sieved and magnets are used to remove any small metal pieces. The SRF is then delivered to the cement plants on a just-in-time basis where it is off-loaded in to enclosed handling systems and fed directly to the kiln.

As you would expect of the cement industry, quality control is critically important so we sample all the deliveries to make sure we are getting the right quality fuel.

At the extreme temperatures inside our kiln every part of the fuel is fully consumed, whether we are using fossil fuel or a so-called 'alternative fuel' or both together. The choice of fuel has also no impact on the emissions from the factory. The cement plants are all licensed by the Environmental Protection Agency and must operate in compliance with strict European Industrial Emission Regulations.

By using alternative fuels like SRF the cement industry in Ireland is reducing imports of fossil fuels which improves the competitiveness of our industry, helps to secure long-term employment and also reduces our carbon footprint.

The cement industry in Europe started using alternative fuels more than 40 years ago and the increasing availability of these fuels has allowed a steady reduction in fossil fuel usage. On average 36% of the heat required to manufacture cement in Europe is now sourced from alternative fuels. In Ireland too, the availability of these alternative fuels is increasing, allowing the industry here to reduce its dependence on imported fossil fuels.

The use of fuel in cement kilns where the heat from the combustion of the fuel drives the clinker manufacturing process and any minerals components from the fuel becomes part of the clinker is known as 'co-processing'. It is a unique feature of the cement industry and means that everything is used and no waste is produced.

The importance of co-processing has been recognised in Europe because it helps to recover discarded resources, keeping them out of landfill and instead feeding them back into the circular economy.

And it is not just SRF that is used. A wide range of different, local waste materials can be turned into useful fuels suitable for the cement industry. Used tyres are a perfect example. Each year in Europe the cement kilns quite literally recover a 'mountain' of used tyres. For all these fuels, each cement plant works closely with their waste industry partners to ensure they receive the right quality of fuel.

Modern cement production not only produces quality cement, but also helps to improve our environment and the way we use limited resources. The cement and concrete industries are vital to maintaining a durable, resilient, built environment which supports the circular economy principles.

As the global population increases, concrete is one of the key building materials providing the new homes, schools, factories, transport infrastructure, power generation facilities, coastal and flood protection that we need.

Shaping the future through clever design with concrete construction will deliver comfortable and secure homes and the infrastructure for the smart cities of the future while helping to ensure we manage the finite resources of our planet.

Our two industries, cement and concrete, which are so intertwined must work to ensure that our messages are heard and understood. We have much to contribute to constructing a world where resources are valued, the needs of our growing population are met while also improving our stewardship of the earth.

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IQ
The Institute of Quarrying

Enhancing opportunities for everyone

by Julian Smallshaw (Head of Educational Development), Institute of Quarrying

The Institute of Quarrying is the international professional body for quarrying, construction materials and related extractives and processing industries. Our mission is to raise standards of professional practice, which we strive to achieve by providing globally recognised education and qualifications to everyone within our reach.

We deliver development and support opportunities to our worldwide membership of over 6,000 people across 50 countries, as part of our commitment to driving continued progress towards a safer, more sustainable and productive sector, enhancing opportunities for everyone, no matter where they are in their career.

Our membership reflects the multi-disciplinary nature of the businesses it serves, keeping an open door to chief executives and students alike. Consequently, our depth and breadth of knowledge is drawn from specialist across the sector, from geologists, surveyors, engineers, quarry managers, laboratory technicians, landscape architects and environmental specialists - to name only a few.

Beyond the core benefit of professional qualifications, our members enjoy advantageous access to a network of local branches, special seminars, safety events and site visits, alongside monthly copies of our Quarry Management journal and access to our new mobile app for recording CPD activities.

IQ membership demonstrates a visible and deliberate commitment to excellence in your role and a dedication to high professional and ethical standards and lifelong learning. Being part of the movement that advances the professionalism of quarrying means playing your part in attracting new generations of talented people into our midst, presenting a highly competent, world class image for our sector and enhancing the contribution that it makes to society.

Our history dates back to 19 October 1917 and as we approach our 100 year anniversary, we remember how we were forged from a meeting of 'The Association of Quarry Managers' in Caernarfon, North Wales. From those humble beginnings, our global network continues to grow, with offices in Australia, New Zealand, Malaysia, South Africa and Hong Kong.

The IQ Academy is home to all of our education and CPD services - critical elements in improving competence and raising skill levels. Our accredited programmes and training courses have developed from the rich knowledge and experience of our members over 100 years, but our delivery is cutting edge. Our online learning platform is blended with expert tutorials to provide a highly flexible approach that suits the individual as well as the business and we cover the whole range of skills and knowledge needed to be successful in one's current role and into the future.

We're very much part of an extended family providing additional resources and services through University partnerships, such as University of Derby in the UK, sister professional bodies such as the Institute of Asphalt Technology, and collaborations further afield, such as our partnership with the NSSGA (National Stone, Sand and Gravel Association) in the USA.

Our professional qualifications add true value to businesses, providing competitive advantage in a competitive world. For our members, the value of belonging to IQ is priceless. We're there for you throughout your career, supporting your learning and development and providing you with your professional home, as we have done for your colleagues over the last century.

Find out more about membership and all of the education and learning opportunities that we offer by visiting **www.quarrying.org**

IQ members learn from site visits and industry events.

A Bright Future for Solar in Ireland

by Michael Moore, Project Manager, Elgin Energy Services Ltd.

The 2020 renewable energy deadline is approaching and all eyes are on the renewable energy sector to see whether the Irish government can hit its renewable energy targets of 16% of all its energy coming from renewable sources. These targets include contributions from Transport, Electricity and Heat. It is expected by industry that these targets will not be met due to the lack of development in the Transport and Heat sectors. Consequently the renewable electricity sector must contribute more to achieve the overall objective of reducing CO2 emissions.

Solar energy projects will prove vital to help diversify our energy portfolio to assist in the decarbonisation of energy use. In 2014, wind contributed 19% to the electricity generation portfolio. Solar will be required as wind alone will not enable the country to move towards a low carbon future as tidal and wave technologies struggle to develop commercial operating platforms. Photovoltaic (PV) technology was developed by NASA in the space race in the 1950's however it is only now that costs have reduced significantly from $70/watt in the 1970's to $0.45/watt today. This cost reduction now makes it feasible for countries in northern climates such as the UK and Ireland to commercially develop solar energy projects.

There has been over 500 applications submitted to ESB Networks for connection of solar farms in the Rep of Ireland totalling over 3,000MW since May 2015. It is estimated that 1500MW is achievable by 2020 which equates to 5% of Ireland's electricity demand. Land options (solar lease agreements) are now being signed across the country from Cork to Leitrim. The extractive industry may prove vital in making land available to assist in the roll out of solar across the country as county councils look at utilising brownfield sites.

Over 65 planning applications have now been submitted to local planning authorities and 13 applications have received full planning permission (July 2016). The visual impact of solar installations is a key concern in the assessment and sites that are located away from communities have significant advantages. It has been notable that all applications to the ESB and planning authorities are located in close proximity to the existing ESB substation network. This is in contrast to the UK system where developers have been able to connect into 11 & 33kV overhead lines. This substation connection policy is currently being challenged and will have a very significant impact on the viability of a proposed site however it is unlikely to change in the short term.

Elgin, Wales Full-Site

IRISH ENERGY MARKET

Ireland has a total demand of approx. 6,000 MW (or 29TWH) and is highly dependent on imported fossil fuels. Last year Ireland imported over 90% of its energy supply. The country spent €6.9 billion in 2013 to foreign nations to supply the fuel required to power our coal and gas burning stations as well as importing biomass fuels to assist in the burning of peat at power stations around the country.

There is currently high electricity demand concentrated on the east coast with its large population and increasing industrial output. The emergence of data centres on the periphery of the M50 and the proposed new facility in Athenry will put further pressure on the system operators to meet electricity demand with generation. The new Apple data centre in Galway will have a demand three times the size of Intel which to date has been the largest user of electricity in the country. These data centres are looking for power purchase agreements or PPAs with renewable energy companies and are actively looking to support renewable energy projects.

It is envisioned that the future for electricity generation in Ireland and Europe is a blended mix of thermal plant, wind, solar and storage technologies supported by European and Irish government. Recent calls on the government to close large fossil burning stations are welcomed by the renewable industry and could facilitate the diversion of the €136 million of annual subsidies paid to these plants to more sustainable sources of electricity supplies such as solar.

The emergence of windfarms across the country in recent years has made significant inroads into diversifying the generation mix to include a sizeable renewable portion. Approximately 2,500 MW of wind energy projects have been installed to date. However, further projects will need to be delivered in advance of December 2017 (when the existing government subsidy for wind expires) to ensure Ireland meets her 2020 targets. The ability to continue to develop windfarms throughout Ireland has been hampered by prolonged planning consents for both windfarms and large grid infrastructure. Consequently, the Department of Energy are looking at alternatives to ensure we meet our targets and avoid expensive European fines.

SOLAR TECHNOLOGY

Solar PV panels use the energy from the sun and convert it into electricity using the photovoltaic effect. This form of technology has been utilised for decades however the large scale deployment over the past number of years across the world has resulted in the technology becoming more affordable to install in northerly climates such as Ireland. This technology can play a major part in helping Ireland meet not only its 2020 renewable energy targets but also the future 2030 European targets and also eventually contribute to the complete decarbonising of the European electricity market by 2050.

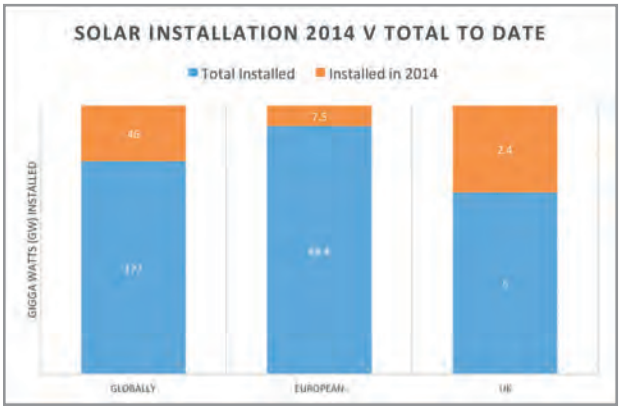
Solar PV installations have increased throughout the world with Europe leading the way. In recent years more developing nations are now deploying solar energy as a means of reducing their reliance on costly imported fossil fuels. Solar installations have increased 13,500% since 2000 and 400% since 2010. This rapid increase in the use of solar energy is primarily attributed to the lowering cost of the units and the ability to install the technology quickly.

Solar PV farms are now frequent in the UK countryside which has a similar climate and landscape to Ireland. Solar PV is proving to be an adaptable technology that can be deployed throughout Ireland. The advent of floating solar (as used at the Thames Water 6MW installation) will be of particular relevance to the extractive industry where there is an abundance of flooded quarries and settling ponds.

SOLAR MARKET WORLDWIDE

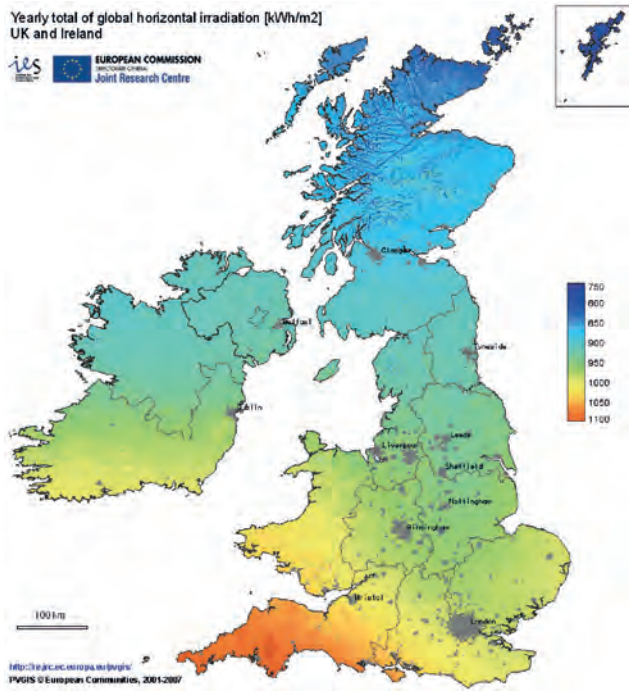
The total installed capacity globally stood 177GW at the end of 2014 up from 1.2GW in the year 2000 . The graph below shows the phenomenal increase in Solar PV installations worldwide in the last decade and especially in the last 5 years. Many European countries including Germany and the UK have led the way in the deployment of this technology with the UK installing 2.4GW in 2014 alone. The total installed capacity in Europe at the end of 2014 stood at 88.4 GW and this amount is set to grow year on year for the foreseeable future.

Many countries throughout Europe and the world are now benefiting from solar technology as a result of incentivising its installation which has helped increase the market and effectively reduced the price per unit of installation.



SOLAR IN IRELAND

Installations of Solar PV in Ireland have been limited to date to small scale domestic installations with only a small number of medium sized installations located around the country. With a suitable feed-in tariff rate, Ireland can accommodate 1500MW of solar in advance of 2020. This will amount to 5% of the total energy consumed in 2013.



Ireland has set a target of 40% of all electricity consumed by end of 2020 must be met by renewable sources. The Commission for Energy Regulation (CER) directed ESB and EirGrid in 2009 to issue 4000MW of connections to windfarm applications. Many of these connections will now not be realised due to planning restrictions and also the lack of transmission infrastructure in place to transport the energy to the east coast where the electricity demand exists. Solar energy projects connect to local substations and can therefore be deployed across the country utilising the existing network and without significant upgrades to the electricity system and associated costs to the end user.

SOLAR RESOURCE THROUGHOUT IRELAND

County	Location	Solar Resource kwh/m2
Kildare	Athy	1110
Cork	Midleton	1160
Leitrim	Carrick on Shannon	1040
Berlin	Germany	1140
Bristol	UK	1170

GOVERNMENT SUBSIDY

It is expected that the Irish Government will announce a support structure for all future renewable energy projects in late 2016 following the Department of Energy's consultation process on a future support structure which commenced in September 2015. A second round of consultation is expected in the summer of 2016 which will help clarify the structure of support and also which renewable energy projects will be eligible. Strong statements by government ministers in support of solar energy in the recent White Paper on Energy released last December suggest that solar will garner support.

CONNECTION TO THE IRISH ELECTRICITY GRID

Connection of solar PV projects to the electricity network may provide problems to the successful deployment of solar technology. Currently the ESB requires direct connections to the local 38 or 110kV substations (unlike our UK neighbours which allows connections to 11 & 33kV overhead lines). This requirement has two direct impacts on the viability of solar in Ireland, cost and location which are interlinked. The cost of connection into a substation is far in excess of that to connect directly into an overhead line. Solar farms must consequently locate in close proximity to existing substations creating a hub effect in every county for solar development. Substations are typically sited near such as towns and cities which are centres of electricity demand. This creates the conflicting requirements of locating sites close to substations and yet remote from communities.

OPPORTUNITIES

As policy for connection is likely to change to a planning consents based approach in 2018, sites that are secluded from communities will be best placed to achieve consents and subsequently receive a grid offer. The extractive industry have played their part over the past number of years playing host to windfarms such as the one in Lisheen and on the face of it, it seems like a perfect fit as long as there is access to a viable grid network. **With many sites in the extractive industry across the country currently underutilised, solar PV may prove to be the unlikely next chapter.**

About Author: *Michael Moore is a project manager for Elgin Energy, an Irish based solar development company with experience in developing 200MW of solar pv projects in the UK. Elgin Energy is the leading solar development company in Ireland with proposals to develop in excess of 700 MW across the island of Ireland.*

Round-table series 2016

by the European Economic and Social Committee

The round-table series 2016 is organised by the EESC's Consultative Commission on Industrial Change (CCMI) in partnership with relevant European and national organizations: Euromines, Euracoal, IndustriAll Europe, the European Commission and numerous national high level partners from academia, geological surveys, NGOs and civil society.

The objective of the round-table debates is to link the Member States' economic and industrial policy along the value chain from raw materials to end-products and to develop strategies and overcome obstacles to maintain a well-functioning European industrial fabric by improving investment conditions and creating new jobs.

Summary of the EESC Irish Roundtable

1. Mining activities in Ireland

Since the 1970s mining in Ireland has made significant advances. Increasingly, sustainability and corporate responsibility aspects have become part of both the management of mines and mining legislation. In the past some mining sites were left with major problems with tailings and contaminated rivers, although these were different times when employment was a priority and prior to an understanding of potential environmental effects. In a country where mining is not a major industry, every bad example has had a significant impact and Avoca (former copper mine), Silvermines and Tynagh (former polymetallic deposit: lead, zinc and copper) have all left their marks on the environment and on the public perception.

In more recent times, Navan, Galmoy and Lisheen zinc mines have all set good examples of the benefits that responsible mining can bring to a region and to the country. Navan, the home town of Tara mines, and the more rural areas around the recently closed Galmoy and Lisheen mines have all benefitted economically and socially from mining and between the three mines, have created approximately 3,000 jobs economy wide in 2011. At all three operations, mine owners have worked with government, its agencies and local communities in a positive way and have operated in a very responsible manner. They are good examples of how social, economic and environmental responsibility is now an integral part of this industry.

The new reality of the 21st century is that China consumes nearly half of all base metals and for many materials produces more than 50% indeed for many minerals more than 90%. Europe consumes about 30% of world's annual zinc production, but produces only 4%. Ireland has been Europe's number 1 producer of zinc metal in concentrate and 10th in the world. In 2015 Ireland slipped to 2nd place in Europe and 11th in the world. Ireland is a mature terrain but there are promising projects such as Glencore's Pallas Green although it would take maybe seven years at the earliest to be in production. But market conditions do change and therefore potential mines such as Pallas Green in Limerick, Conroy Gold's Clontibret project in Co. Monaghan, and Blackstairs lithium projects in Co. Carlow and Wicklow will benefit from continued support.

There have been very positive changes in how former mining sites are managed in Ireland, with some very good examples evident.

2. Relevant institutions for mining industry & raw materials policies

The Department of Communications, Climate Action and Environment responsibility for the regulation of exploration for and development of all minerals, other than stone, clay, sand and gravel.

The Exploration and Mining Division (EMD) of the Department of Communications, Climate Action and Environment functions include formulation and implementation of minerals policy, regulation and the administration of the State prospecting licence and mining facility system and the active promotion of mineral exploration and development.

EMD provides a "one-stop-shop" for mineral exploration licences in Ireland, providing an efficient and timely response to applications received. There are currently 500 active prospecting licences in place. A Prospecting Licence (PL) provides the holder with security of tenure as it is only the holder of the valid PL who can apply for a State Mining Facility (SMF).

To develop a mine three licences/permits are required from three statutory bodies. The three statutory bodies are EMD, EPA and the Local Authority. EMD grants an SMF, EPA grants an IPC licence and the Local Authority grants planning permission. EMD has established a close working relationship with the EPA and the relevant Local Authorities to ensure the process is streamlined with minimal regulatory duplication. This strong cooperation between the statutory bodies has worked well for mining operations to date.

The Division provides a full support service on all regulatory matters, as well as a large range of free datasets:

- Reference Data on Prospecting Licence Areas and status through online geographic information system (GIS).
- Quarterly publications including current ground holdings.
- Significant exploration data holdings including geology, geochemistry, geophysics (airborne and ground) and drilling is made available online and free of charge (websites mineralsireland.ie and http://www.dcenr.gov.ie/natural-resources/en-ie/Minerals-Exploration-Mining/Pages/home.aspx). This vast amount of data and interpretations consists of company reports, including drill logs.
- Information on environmentally sensitive areas and constraints.

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- Technical advice and field-based contact during exploration programmes.
- General advice on requirements to bring a deposit to the development stage.
- Advice on applications for State Mining Facilities.
- EMD is represents Ireland on mineral matters at EU level.

The Geological Survey of Ireland (GSI), a division of the Department of Communications, Climate Action and Environment and is responsible for providing geological advice and information, and for the acquisition of data for this purpose. GSI produces a range of products including maps, reports and databases and acts as a knowledge centre, research funder and project partner in all aspects of Irish geology. Among the data provided by GSI in support of mineral exploration is historical exploration reports (Open File Data) and Mine Records of historic mining activity, as well as modern digital geological mapping and a drill core library. GSI also act as a project partner in several EU Raw Materials initiatives, such as Minerals4EU, often in collaboration with EuroGeoSurveys, The Tellus programme is a major initiative of modern geological and environmental baseline mapping, comprising airborne geophysics (magnetics, radiometrics and EM) and soil, stream sediment and water geochemistry, which is due to be completed cross the entire island by 2023. GSI data is made available online for free.

Geoscience Ireland (GI) is a network of 25 companies, delivering integrated expertise in water, minerals, environmental and infrastructure development to clients in over 50 countries. GI is supported by the Geological Survey of Ireland and Enterprise Ireland as a business cluster. The GI network provides design, consultancy and contracting services to multilateral agencies, governments and the private sector.

Universities provide graduates and leaders for the sector for the future. Ireland is already good at this and provides at universities excellent leaders and graduates on an international scale, covering mainly geology, geometallurgy and some areas of minerals processing. A major new initiative is the Irish Centre for Research in Applied Geoscience (iCRAG), which has specific clusters of research around both minerals and social licence to operate. University sector will support the EIP-RM and economic development in Ireland:

- Diversify the palette of mineral deposits being sought in Ireland.
- Developing more efficient methods and systems of exploration.
- Identifying added value elements in Irish mineral deposits.

Several support institutions are now in place to support exploration and mining companies who wish to become established in Ireland.

3. Mineral exploration in Ireland

The Fraser Institute 2015 rankings place Ireland as the 4th jurisdiction in the world for mining and 1st for policy perception from 109 jurisdictions. The high quality data provided by the Exploration and Mining Division and the Geological Survey of Ireland and the Tellus and iCRAG programmes are great examples of how collaboration between industry and government helps to provide exploration companies momentum and encouragement in order to kick start the circular economy with respect to raw materials.

EMD provide a transparent and equitable exploration licensing regime. Prospecting Licences are normally issued within four months of an application being submitted. Ireland is a mature terrain and in terms of exploration for base metals deposits, companies recognise that future discoveries will be deep and "blind". Exploration companies working in Ireland have risen to this challenge and adopted exploration techniques such as seismics to provide the necessary information to understand the deep geology, structure and mineral potential. This combined with deep drilling is providing a step change in our understanding of Ireland's mineral potential. It is also recognised that new discoveries are directly related to drilling. A robust regulatory system has supported Ireland's continued exploration activities.

At the same time there are a number of companies carrying out exploration for a range of other commodities. In general, more shallow exploration techniques are applied to these properties.

Ireland has a long history in exploration and mining. This has resulted in the development of home grown exploration expertise which is internationally transferrable. Many of Ireland's exploration professionals export their expertise worldwide.

Tellus and iCRAG are great initiatives to assist explorers in generating compelling new targets in Ireland's world class zinc district. Promotion of research, support of teaching institutions and involvement in forums and societies are effective means of developing key ideas. Geoscience Ireland is an excellent network of mining, minerals and environmental companies who collaborate with government and the private sector.

Ireland is considered to be a very positive environment for exploration and mining and this is verified by the continued high ratings from the Fraser Institute surveys.

4. Conditions for sustainable mining in Ireland

Mining companies must ensure that they operate in a safe and sustainable way. This includes the introduction of best practice in all aspects of the operation, with safety and wellbeing of the workforce a top priority.

Mining activities must generate profit, which is a primary function of any mining company and this will generate spending, taxes, boosting local economy and promoting industrial growth. Where possible, the mining sector must and does create employment by hiring local people and investing in their on-going training and development.

Skills developed in serving a mining industry are transferrable to international markets. Thus enabling the preservation of jobs and economic capacity notwithstanding reduced activity in the domestic mining sector. Fostering of indigenous skills is provided by creation and support of local and European geoscience clusters.

Regarding community and social responsibility, mining and exploration companies must create, maintain and nurture relationships with community, local government, trade unions and other stakeholders to ensure that all voices are heard in both support and objection. Community fora are becoming popular and can be very productive.

Mining a certain mineral deposit is finite, so mining companies should put in place arrangements for the future of their employees, the local community and the local environment. This may include local funding, redundancy packages, training for life after mining and community involvement in the rehabilitation and use of the closed site.

In some cases, development of industrial zones around a mining operation is possible, as infrastructure is in place. Lisheen is currently working to establish a green energy hub at its site and recently received EU status as a Model Demonstrator Site with the assistance of politicians, government and state bodies.

The good examples must be shared wherever possible in Ireland and throughout Europe.

Where possible, create environments for renewable resources. There are two good examples:

- The Lisheen wind-farm set up by the Lisheen team in 2009 now produces up to 60MW of power, which is between 1 and 2% of the Irelands average power demand.
- The Silvermines Hydro Electric Power Station Project proposal plans to use the existing disused open-pit at Ballynoe, aiming to turn a negative environmental mining legacy into a positive, long term one with local and national benefits.

The Irish Environmental Protection Agency's view was that mineral extraction (mining and associated primary processing) should be covered by the Industrial Emissions Directive permitting system (formerly IPPC). This could resolve many issues around the social pillar, participation in IED decision making, access to information and access to justice. This directive would include BAT standards which harmonise the quality of operations across the EU. Environmental liability, energy efficiency, and continuous improvements would be considered as part of this process and not just waste storage. Most importantly aftercare and closure is standardised under IED. This would improve the clarity of process and (usually) single permitting – i.e. reduce the potential for complex multiple permits. A second point made was the need to use a strong trusted and real communicator for the activities, who would ideally be local or regional and understands the impacted community. Local communication offices around the activity should be established and monitoring and inspection/performance files open to the public. A community monitoring committee could be essential.

At the end there must be community gain – where the mining activity contributes to the improvement in social and environmental infrastructure of the community.

IRL Round-table May 2016

While a certain mineral deposit is finite, Ireland is now developing sustainable industry on closed mining sites and it is important that communities continue to benefit from exploration and mining activities.

5. European and national policies to facilitate investments in mining

Decisions to invest in countries are based on a whole host of metrics: prospectivity and availability of ground, regulatory system, permitting, sovereign risk, infrastructure, fiscal regime and mining law, cost of services and of holding ground, security of tenure, quality of in-country geologists and engineers.

Ireland and the EU compete for limited exploration dollars. Government and European policies must be in place and balanced between mineral extraction, the environment and communities.

The trust triangle between mining companies, government and its agencies, and the local community is a key component to the success of any mine. This needs to be established at the exploration stage and become a high priority during the feasibility and planning stage, and continue in the construction, operation, closure and after closure phases.

Metals and minerals sustain the infrastructure for our civilization. Therefore taxation should also be adequate.

In Ireland corporation tax for mining is at 25% whereas for other sectors it is 12.5% or 6% for IT start-ups. There are no incentives for exploration and none are foreseen. Canada is seen as an example for incentivising exploration spending.

Corporate taxation for mining may need to be reviewed in order to continue to attract exploration and mining companies to Ireland.

6. Public Perception of Mining and Geoscience activities. Tackling societal challenges

In late 2015 GSI commissioned a systematic review of the public perception of geoscience in Ireland: "Review of Key Issues around Social Acceptance of Geoscience Activities & Earth Resources in Ireland. FINAL REPORT". The aim was to better understand how the public perceive geoscience activities (e.g. extractive industries) and how industry and government can gain more social acceptance for their activities from the relevant stakeholders.

- A comprehensive minerals policy in line with the Aarhus Convention was enhanced with additional processes put in place following the ratification of the Aarhus Convention in 2012.
- Distributions of benefits to the communities in which the resources are located should be investigated. The concept already exists within the electricity generation business, with electricity bill reductions for those living within a certain distance of wind-farms.
- Longer term benefits, such as significant infrastructural investment, should also be considered.

The clear national benefits should also be outlined, and these include:

- Security of supply.
- Financial benefits.
- Ethical behaviour – it is not reasonable to expect other countries or jurisdictions to supply the raw materials you need, when those materials are available in your own area.

The 2015 white paper on energy introduces the concept of an 'energy citizen' perhaps this could also be extended to a 'resource citizen'. Ireland has shown in the past that an outwardly controversial policy with clear national benefits can be accepted if benefits are explained properly.

The recently published report by the GSI shows continued interest in evaluating and improving public perception of geoscience activities. Consideration should be given to the development of a 'resource citizen' to help the development of policy.

The report was made based on the information provided by the following persons:

- *Mr. John Barry, Independent geologist and entrepreneur*
- *Mr. Seamus Boland, Member of the European Economic and Social Committee*
- *Dr. Aoife Braiden, GSI Research Manager*
- *Prof. Richard Conroy, Chairman, Conroy Gold*
- *Dr. Eibhlin Doyle, Department of Communications, Energy and Natural Resources, Ireland*
- *Dr. Jonathan Derham, Environmental Protection Agency*
- *Mrs. Renata Eisenvortová, Representative Euracoal & Delegate CCMI*
- *Mr. Sean Finlay, Director, Geoscience Ireland*
- *Mr. Dumitru Fornea, Member of the European Economic and Social Committee*
- *Mr. Paul Gordon, SLR Consulting*
- *Mr. Linas Lasiauskas, Member of the European Economic and Social Committee*
- *Mr. Brendan Morris, Irish Mining and Quarrying Society*
- *Mr. Mark Rachovides, President Euromines*
- *Mrs. Veronika Sochorová, Communication Manager Euromines*
- *Mr. Slavko Šolar, European Commission, DG for Internal Market, Industry, Entrepreneurship and SMEs, GROW Unit G4 Raw Materials, Metals, Minerals and Forest-based industries*
- *Mr. Gerry Stanley, Geological Survey of Ireland*
- *Ms. Lucie Studnicná, President of Consultative Commission on Industrial Change (CCMI) of European Economic and Social Committee (EESC) president of EESC*
- *Mr. Koen Verbruggen, EurGeol PGeo, Director of Geological Survey of Ireland*
- *Mr. John Walsh, Director of iCRAG (Irish Centre for Research in Applied Geosciences)*

1 *Tellus is a ground and airborne geoscience mapping programme, collecting chemical and geophysical data that will inform the management of Ireland's environment and natural resources. Tellus is undertaken by the Geological Survey of Ireland and is funded by the Department of Communications, Energy and Natural Resources. All data from Tellus are made available free of charge online.*

2 *The Irish Centre for Research in Applied Geosciences (iCRAG) performs a broad range of raw materials research, which is designed to improve understanding of associated minerals deposits and develop related exploration models. Research projects are conducted on the public understanding and perception of geosciences with a complementary public outreach programme. Funding €30m Total; People 54 PhD, 8 MSc, 43 Post-Doc, 6 Ops Staff; Term 1st January 2015 for 6 Years*

3 *http://www.gsi.ie/Research/Public+Perception+of+Geoscience.htm*

New liquid screed solution
From McGraths Quarries (Cong).

McGraths have teamed up with Cemexa Technologies of France to develop a new product for the production of cement based liquid screeds. Cemfloor is simply mixed with cement, water and a suitable sand to create a high performance screed which complies with EN 13813.

During its 20 years of existence, Cemexa Technologies has placed itself as a key player on the European market and one of the main active leaders of cement screed development.

When Cemfloor is applied to cement based screeds it creates an exceptional screed with the following key features & benefits:

- Thinner sections compared to traditional screeds. 25mm above underfloor heating pipes.
- Minimal Drying Shrinkage (<0.1%).
- Larger floor area without joints (up to 150m2).
- Foot traffic after 24 hours.
- Exceptional Thermal Conductivity(up to 2.9W/m.k).
- Can be applied in wet areas.
- Reduced drying times of 10-15 days compared with traditional screeds on non-heated floors. (Surface finishes can be applied at 5% MC).
- Can be forced dried after 7 days.
- Self-compacting – no voids around under floor heating pipes.
- No risk of contamination at concrete mixing plants.
- Easier to transport by mixer truck and can bring more volume compared to some screeds.
- No Surface Laitance (Dust) after curing.
- More thermal insulation can be used in floors, compared to traditional sand cement screed which leads to a better u value for your building.

- Easy Installation; up to 1000m2 per day (Reduces time & costs).
- Lower running cost for underfloor heating system, due to exceptional thermal conductivity of cemfloor up to 2.9Wm.k compared with traditional screed at 1.1Wm.k and other liquid screeds at 1.8Wm.k which can lead to a saving of 8% per annum on heating costs.

Cemfloor screeds are very responsive to underfloor heating; due to the fact that they can be laid in very thin sections and have a high thermal conductivity.

Since Cemfloor is a cement based screed; coverings can be applied when the screed has dried to a final moisture content of 5%; this is achieved in a much shorter time than some other liquid screeds that need to be force dried with underfloor heating to a final moisture content of 0.5% before some coverings can be applied.

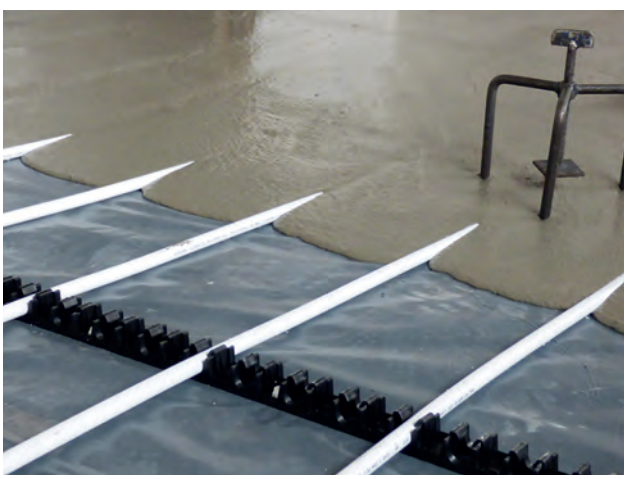
Cemfloor screeds can be used where underfloor heating isn't installed as it dries naturally to a final moisture content of 5% like traditional sand/cement screeds.

Based on the requirements of customers; three types of Cemfloor screeds can be produced C16-F3, C20-F4, & C25-F5.

> ***Note about the Author:*** *McGraths will be selling cemfloor as a blended binder delivered in bulk tankers to concrete producers around Ireland and the UK and will also produce the cemfloor screed in-house at the Cong quarry for delivery to the local market.*

Cemfloor
liquid screed solutions

McG McGRATHS CONG



Ireland at PDAC 2016


Toronto

by Sean Finlay, Geoscience Ireland

The Prospectors and Developers Association of Canada (PDAC) hosts a Convention each year in Toronto, Canada. Attendance in recent years has exceeded 25,000 delegates from the global minerals industry. PDAC has been an important platform for countries seeking to attract investment in mineral exploration and mining.

Ireland has had a presence at PDAC for 50 years since the birth of a modern mining sector led by the Northgate – Tara companies. This presence initially involved company presentations and trade stands.

The island of Ireland has had a significant presence at PDAC for approximately 25 years, via a trade stand jointly sponsored by the Exploration and Mining Division of DCENR, the Geological Survey of Ireland, the Geological Survey of Northern Ireland and DETI. This stand has been a successful showcase for attracting inward investment to Ireland. It has also been a focus for companies with Irish links attending PDAC- many of whom have had stands and/ or presented papers at the Convention. Examples include Conroy, Minco, Celtic Resources, Ennex, Aurum Exploration, CSA, SLR, Moydow, PW Mining, Intersocial, QME and ATS.

National & Regional Presentations

Several countries' trade organisations provide support by way of national pavilions for companies at PDAC and other Conventions e.g. UKTI, Australia, RSA, India.

A more recent trend at PDAC has been national or regional Presentations, usually half day seminars and networking. Germany hosted a half day presentation in 2015, which comprised presentations by the German Ambassador, the Federal Institute for Geosciences (BGR), the German Mineral Resources Agency, all of whom outlined Germany's prospectivity and attractions as a destination for FDI. In addition, German companies (e.g. Siemens, DMT) and financial institutions outlined services which are offered to international markets.

The Ireland Presentation 2016

Ireland's offering to PDAC in 2016 was expanded to include an afternoon session and networking reception to reflect Ireland's offering to the minerals sector.

The Presentation was chaired by Gerry Stanley, Head of Minerals at GSI. Topics covered were;

1. An attractive location for Foreign Direct Investment (FDI), based on political stability, successful exploration, an established and significant mining sector, stable fiscal and regulatory systems. Speakers form EMD (Dr Eibhlin Doyle) GSNI (Kieran Parker) outlined the continuing success in attracting FDI.
2. Koen Verbruggen of GSI outlined the success and ambitions of the TELLUS surveys; started in Northern Ireland, TELLUS is now being rolled out across the island.
3. Sean Finlay from Geoscience Ireland outlined the international work of Irish consultants, contractors and professionals.
4. A major national applied Research and Development project (iCRAG) led by Professor John Walsh of UCD focussed on developing new technologies and methodologies in minerals and hydrocarbons development, including public perception and understanding issues.
5. Three speakers from the private sector outlined progress on advanced projects in ireland; Normand Dupras on the Pallas Green zinc lead project; Kevin McNulty of Conroy Gold on the Clontibret gold project and Patrick Anderson of Dalradian on the Curraghinalt gold project.

Enterprise Ireland (EI) supported the event from its Toronto office and EI's Senior Development Advisor Dermot Reidy summed up the proceedings.

Outcomes

The Ireland Presentation - a collaborative effort from a range of agencies from the island of Ireland - was attended by over 90 persons. The response from attendees was overwhelmingly positive as the event provided a comprehensive update on the minerals sector in Ireland and its international reach.

IMQS President Brendan Morris of Lisheen Technical and Mining Services attended; among other Irish companies present were BRG, Minco, QME, SLR, Aurum Exploration, Golder Associates and Boliden Tara Mines.

Preliminary discussions have been held since PDAC with Enterprise Ireland and the Ambassador Designate to Canada, Jim Kelly. Interestingly, Jim's public service career included a spell in the administration section of GSI in his younger days.

It is hoped to hold a similar event at PDAC 2017.

Sean Finlay
Geoscience Ireland
July 2016

The Ireland Stand at PDAC 2016

Speaking at PDAC 2016 – Dr. Eibhlin Doyle (EMD) with Gerry Stanley (GSI) and Ambassador Ray Bassett

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FLUID HANDLING

An underground dewatering pumping system.

Moving the muck and the mire

by Robert Markoski, IMEC AU Engineering Manager

Cost and efficiency are king in every aspect of a mine's operation, and realising these goals quickly is a keen motivator for most operators. However, a long-term game plan may be the key to keeping costs down when it comes to the dreaded task of dewatering.

Mining engineering consultancy IMEC has reported recent success at some mine sites by pursuing a surface dewatering treatment program over an underground one, delivering longer term efficiencies which mitigate more frequent maintenance.

While the company acknowledges that the most effective option will differ from site to site, IMEC Senior Engineer Robert Markoski believes operators should at least entertain the idea of settling pumped water on the surface.

"The larger the surface area that you can use for settling, more effective settling can be achieved," Markoski explained.

"If you're on the surface you can build a large dam and you get a lot more settling, whereas if you do it underground, you're limited for space and every meter you develop is at a much greater cost."

While settling water underground spoils operators for choice in terms of the availability of various pumps capable of pumping clean water, the capital cost of excavating an underground area can be considerable.

Alternatively, surface settling areas are much cheaper and easier to construct, but the pumps available to transport water with a high solids content from underground to the surface are limited and can require large amounts of maintenance and power to operate, hence it's not a straight forward decision to choose one option or another.

"A lot of people state it will cost too much for the maintenance work on a dirty water system, but we've found with some of our clients that if you look at the long-term cost trade-off, even though you're replacing the internals of these pumps more often compared with a clean water pump, it is a lot cheaper to do this than the underground development for creating settling sumps and the maintenance to clean these," Markoski said.

"As stated above, there is not one design fits all but the option should be looked at and have a cost benefit analysis done."

According to Markoski, IMEC have had success using centrifugal slurry pumps to pump dirty water to the surface for settling.

IMEC has found that the robust and simple design of the pumps makes the more frequent maintenance needed, easier to conduct.

"By utilising these pumps, we are able to design very efficient pumping systems, which require little or no settling of solids matter underground," Markoski explained.

By comparison, Markoski said, clean water pumps often needed to be sent back to the supplier for maintenance, which could be costly and time-consuming where the supplier was not present domestically.

Another advantage of settling above ground is the availability of a wider range of equipment for maintaining a settling system.

In addition to this, using equipment above ground limits traffic underground.

By removing the need for vehicles to transport mud out of the underground settlement ponds to the surface, operators can free up valuable underground equipment & real estate, directly leading to revenue benefits.

"The issue is that when you're settling underground, all those solids and materials that do settle in sumps – you have to get that material out of there," Markoski said.

"So you're tying up equipment and it could potentially cause delays in your decline or access where other vehicles can't pass because you're cleaning out sumps."

IMEC co-director and senior engineer Martyn Abbott summed up the advantages of a surface settling program rather succinctly.

"By implementing a primary dewatering system that can pump unsettled mine water direct to surface, a significant operational and capital saving can be realised by the mine by eliminating the need for large underground excavations for settling sumps and utilising larger or more efficient earthmoving equipment for treatment on surface," he said.

An overground dewatering pumping system.

***IMEC** are a multi-disciplinry engineering consultancy specialising in providing EPC support services to the mining industry. With offices in Dunshaughlin Co.Meath and Perth, Western Australia IMEC are positioned to support projects worldwide.*

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INTERNATIONAL MINING ENGINEERING CONSULTANTS

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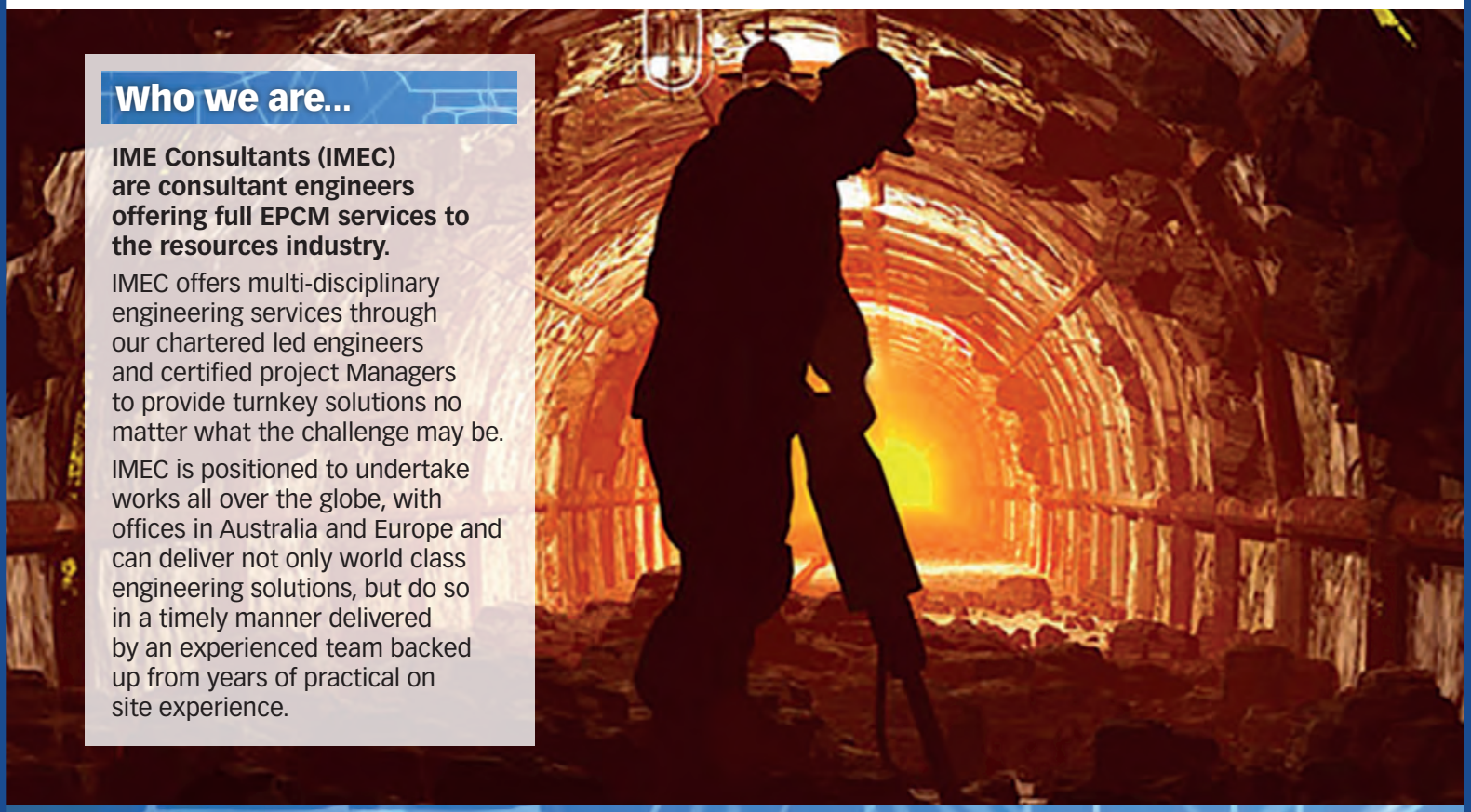

Who we are...

IME Consultants (IMEC) are consultant engineers offering full EPCM services to the resources industry.

IMEC offers multi-disciplinary engineering services through our chartered led engineers and certified project Managers to provide turnkey solutions no matter what the challenge may be.

IMEC is positioned to undertake works all over the globe, with offices in Australia and Europe and can deliver not only world class engineering solutions, but do so in a timely manner delivered by an experienced team backed up from years of practical on site experience.

How we work...

We at IMEC pride ourselves on having the strongest commitment to our client needs and do our best to not just meet expectations but exceed them!

Practical Solution

IMEC can provide designs that don't just look good on paper, but that can be achieved in the field and are fit for purpose.

Fixed Prices

Never again be scared of blowing the budget. Once we have agreed on a price and scope, IMEC offers fixed price for discrete packages of work. We also provide a range of commercial engagement options to suit the needs of our clients.

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Adventures in Australia and China

Irish Prospector and Journalist William J. Hernan

by Hilary Finlay (nee Heron): Travel Writer

Ireland has produced a host of successful entrepreneurial prospectors and miners who have discovered and developed mines across the world. William J. Hernan from Carlow was one of that inspired cohort; he differed from others by going on to develop a career as a distinguished journalist reporting on major events in the Far East.

Pilbara; Gold & Iron Ore

William Hernan was born in 1868 in Co. Carlow. Leaving rural Ireland as a young man, William's first adventures started in Australia. He started prospecting in the remote Pilbara region of Western Australia. In 1896 he discovered a rich gold reef in Weeriana, near Mount Welcome in the Western Pilbara and appropriately named it Hernan's Reward. Samples taken from shallow trenches were described in the "West Australian" newspaper as yielding between 10 and 15 ozs per ton (over 300 grams per tonne). The lode was said to range from 14 to 20 feet in width, densely copper stained and showing gold evenly distributed throughout. Hernan subsequently staked claims and sought leases in the area. As often happens with valuable mineral discoveries, boundary disputes arose; in this case Hernan v Roebourne Star; this was settled in favour of Hernan.

Despite some very high grades, the Weeriana area did not go on to be a major gold producer as the gold veins were limited in extent. Small scale operations, including one called Carlow Castle, were undertaken until 1938, long after Hernan departed the country for other adventures.

Gold mining was a key economic driver of Australia's development. Within 10 years of the first gold rushes to Bathurst, Ballarat and Bendigo, Australia's population trebled to more than one million people. Gold discoveries spurred the development of inland towns, communications, transport and foreign trade. Gold's importance declined during most of the 20th century as other minerals became of greater economic significance. Mining for gold underwent a resurgence in the 1980s and 1990s when the application of new technology allowed lower grade ores to be processed economically. Gold mines today are typically large open cast operations moving huge volumes of material to win gold in concentrations as low as 1 gram per tonne- a marked contrast to Hernan's day. Western Australia has about 3,000 tonnes of gold resources.

Remains of stamp at Weerianna Gold Mine, 2012.

The Pilbara District has gone on to become a mining powerhouse, accounting for over 40 billion tonnes of iron ore resources. Major operations are carried out by international companies such as BHP, Rio Tinto and Fortescue Mining who supplied almost 800 million tonnes of high grade iron ore for shipment to China, Korea and Japan in 2015.

Interior of Empressess's Palace, Pekin

In marked contracts to Weeriana, the Kalgoorlie district, discovered in 1893 by Paddy Hannon from Quin, Co. Clare, sparked a gold rush and remains Western Australia's main gold mining district. There is a plaque in memory of Paddy Hannon at Quin Abbey in Co Clare.

China Beckons-Turbulent Times

Press reports indicate that Hernan sold part of his Weeriana claims at an early stage-before they were devalued by further investigation! It is not clear exactly when he moved to journalism. He began by writing articles on mining for various mining journals and also undertook surveys of the mineral resources of various countries including Malay, South Africa and Ceylon for various

William Hernan, 1919

Aerial image of Weerianna Gold Mine.

London Mining Syndicates, before eventually arriving in China, where he based himself in the international port city of Shanghai. A lengthy piece in "The Nationalist and Leinster Times" in March 1900 coincided with a visit to Carlow by Hernan and showed that he was still involved in mining - this time in China. In this and subsequent articles during 1900 and 1901,The Leinster Times went on to report in detail on Hernan's exploits during the Boxer Rebellion in China.

By this time Hernan was writing pieces for various UK publications including "The Sphere", "The Sketch" and "The Daily Commercial" on the turmoil in China and how difficult it was becoming for foreigners doing business there during the Boxer Rebellion. In October 1900 he was appointed as Press Correspondent with the "New York Journal" to accompany US Forces on their rescue expeditions. Effectively this was almost a UN situation as troops from eight countries were involved; mostly there to protect their nationals who were trapped in the legation compounds in Pekin city. Hernan both witnessed and reported on some appalling atrocities during the Rebellion. He scaled the walls of Pekin along with the American troops. His articles indicated that contrary to some reports the English were not the first to enter the City; the first being the Russians followed by the Americans. However, Pekin was a complicated city to negotiate with three internal cities and it was the English troops who first arrived at the legations compounds. Hernan was present at the taking of the Taku forts and was very critical of the "American commander refusing to take part in the bombardment. If the allies had lost there it would have meant a massacre of all the foreigners in Tien Tsin and Pekin, along with native Christians. He was wounded twice but fortunately they were only flesh wounds. On one horrific occasion as he saw a mortally wounded man on the road being attacked by wild pigs and dogs he did the only humane thing he could by freeing him from his pain and which he described as "the most humane action of my life". No hospitals were open to these people and the fortunate ones were those who were killed outright and many wounded took their own lives to end their suffering.

Towards the end of the Boxer Rebellion Hernan was honoured to receive an invitation from General Baron de Ya-Magugi, Commandant-Chief of the 5th Division of the Japanese Army, to accompany him as he entered the private portions of the Palace, where he saw firsthand a tree in the harem gardens over nine hundred years old; but the harem itself was empty, "the charming beauties having fled with the Court before our arrival".

One has to wonder did his path cross with that of Herbert Hoover, probably the world's most famous Geologist, who was a prospector in Australia around the same time that Hernan was there and was working as a Mine Manager in China during the Boxer Rebellion. Unlike Hernan he did make his fortune from mining and eventually became President of the United States of America and the most powerful man in the world (definitely an article for the next issue).

Later Days; Home Rule and the USA

I am not clear on when W.J. Hernan returned to Europe. He became a member of the Mining Institute of Scotland in 1902. By 1907 he was in South America and whilst there he wrote a guide on "What you want to say and How to say it in Spanish".

He was in England from 1913 to 1915 and then in France. He visited Russia, Romania, Sweden, the USA and Canada between the years of 1916 to 1919. Whilst in England he was involved with the United Irish League of Great Britain, a strong supporter of the Irish Nationalist Party and of Home Rule. He shared platforms with Nationalist M.P's John Dillon and T.P. O Connor.

In the 1920's, Hernan was involved with a New York based news agency as General Manager of the Wireless Press Inc. He was also a columnist for the Westminster Gazette. Much less is known of his activities except that he received his American citizenship and US passport in 1930. He never married as far as we are aware but with such a nomadic life he was obviously not one to put down permanent roots although he never forgot his own strong nationalist identity.

He was clearly an inventive, curious and observant person with accomplishments in business, journalism and politics. He was a mineralogist, reporter; adventurer and of course a bon viveur. Such well rounded characters are scare enough in today's world of specialisation.

Author's Note: This article is based on a family scrap book which my late father Rory Heron gave me. William Hernan was a distant relative but my father was intrigued by his exploits. Unfortunately the records are indeed scrappy with many gaps but do offer a fascinating glimpse of adventurous times from another era. Further research beckons!

More recent Irish mining adventurers, scientists and engineers who prospered in Australia come to mind; Peter McAleer of the Northgate Group; Rupert Crowe, Gerry Fahey and Neal Reynolds who built the CSA Consultancy; Tony Poustie, Mike Donoghue and Adrian Black who developed gold and nickel mines and of course the many skilled craftsmen and miners who built the mines.

From small beginnings to the Cutting edge of the construction industry in Ireland

by Ronan Griffin, CRH Estates Ltd.

ROADSTONE HISTORY

The origins of Roadstone go back to the early 1930's when two young Dublin brothers Tom and Donal Roche started a sand and gravel haulage business with a Bedford truck operating from a small yard at Inchicore in the suburbs of West Dublin. Initially called Roche Brothers it later became the Castle Sand Company and developed steadily during the 30's and 40's.

The brothers launched a new company, Roadstone, on the Irish Stock Exchange in 1949. They were supported in this venture by John A. Wood who had his own sand, gravel and quarrying business in County Cork and which later joined with the Roadstone Company. In parallel to this story, the Irish cement industry, previously a state body was also developing rapidly. By the end of the 60's, Irish Cement had become the largest industrial Company quoted on the Irish Stock Exchange with Roadstone the third largest. In 1970 the two Companies merged to become Cement-Roadstone Holdings now known as CRH plc. CRH now operates in 31 countries and are the largest building materials company in North America, a regional leader in Europe, and we have strategic positions in Asia.

Today, Roadstone is the leading manufacturer and supplier of building materials in Ireland. Since the company's foundation in 1949, Roadstone has been at the cutting edge of the construction industry in Ireland and the commitment to core values remains steadfast. Today Roadstone we are as dedicated as ever to providing unrivalled product quality, reliability, innovation, choice, sustainability and customer service.

Roadstone's nationwide business includes the manufacture and distribution of a wide range of construction products including ready-mix concrete, aggregates, asphalt and macadam, mortar and plaster, concrete blocks and masonry, paving products, roof tiles and agricultural lime. They also provide an asphalt contracting service for commercial, domestic and local authority and infrastructural road projects. Infrastructural projects include the recently completed N7-N11Motorway Project, the M50 Motorway in Dublin. The contracts division has also recently commenced laying operations on the N17 N18 Gort to Tuam project in the West of Ireland.

VISION

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SUSTAINABILITY AND INNOVATION IN ASPHALT

Roadstone, as the leading manufacturer of Asphalt in Ireland, has placed innovation and sustainability at the heart of their strategy. Their aim is to develop and manufacture economical and durable products and to provide sustainable solutions and services to their customers. At the core of this innovation and solutions development is the Dublin based Product Research & Development Laboratory which is equipped with a range of the latest test equipment. Recent product developments include a range of Warm Mix Asphalts, Asphalt mixtures incorporating reclaimed asphalt and DuraflowTM Porous Asphalt system. DuraflowTM porous asphalt has been designed by Roadstone for Sustainable Urban Drainage System (SUDS) applications. DuraflowTM has been designed to soak up surface water which then percolates into a stone subbase layer, PermeabaseTM. The DuraflowTM Porous Asphalt system has been successfully installed on a number of projects including the recently completed (Red) Long Term Carpark in Dublin Airport.

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EUExcert project

by Alan Dolan, IMQS EUExcert Commitee Member

Since its inception in 2004, the EUExcert project has sought to establish a training and education programme aimed at restoring and maintaining the competence of workers engaged in the European explosive business.

This programme was necessary due to a loss of expertise as a result of retirements throughout the sector. A lack of a harmonised education and an information sharing framework within the EU also led to a loss of knowledge. The project also seeks to standardise explosives qualifications and make them transferable within EU member countries.

The 7th International Conference and Workshop on Explosive Education and Certification meeting was held in Telford, UK on 14th April 2016.

Johan Finsteen Gjodvad gave a presentation on the current status of EUExCERT and EUExImp (European Explosives Sector Implementation of Occupational Standards).

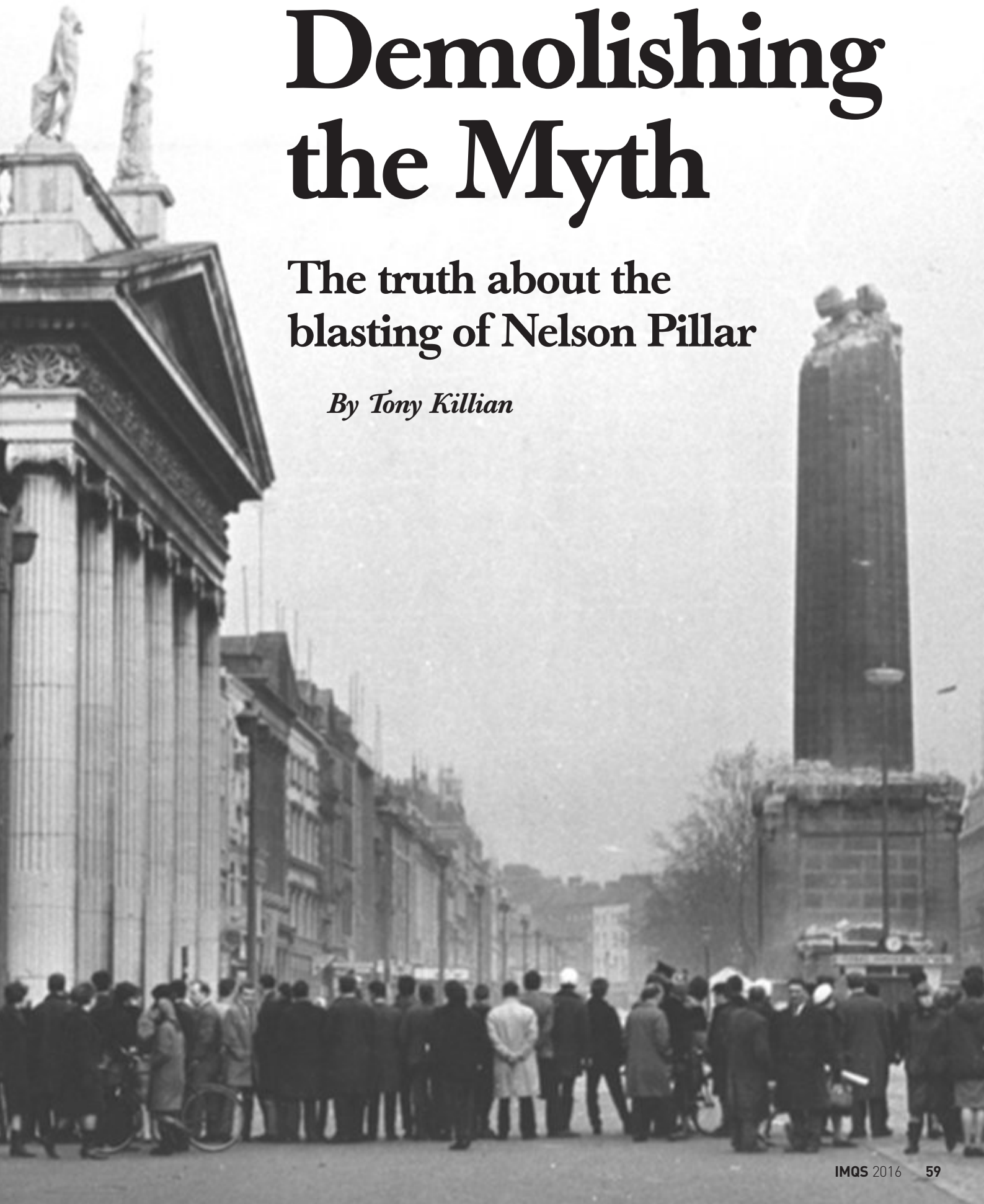
EU ExcErt
Certifying Expertise in European Explosives Sector

Details of these presentations and projects can be found at **http://www.euexcert.org/** and **http://iexpe.org/EUExImp-Project**

Demolishing the Myth

The truth about the blasting of Nelson Pillar

By Tony Killian



During night time, O'Connell Street in Dublin is rarely free of pedestrians or vehicular traffic, but this would tend to be lighter later as the night passes. Certainly at 1:30am on Tuesday, March 8th 1966, there was some traffic and quite a few people present (at night work or going home from dances in Clery's and the Metropole ballrooms, where the band were packing their equipment for transport) when a huge explosion blew up the top section of Nelson's Pillar and sent pieces of rock and stones flying in all directions and rising a cloud of dust over the entire area. Sixties Dublin had its first taste of terrorism.

Interviewed later in the morning by The Evening Herald, the following related their experiences:

Mrs. Elizabeth Rigney, **Bernard Forte**, His father, **Benedict Forte**, **Stephen Maugham** driving his taxi, **Michael Galvin** and his friend **Thomas Murray**, **Michael McManus**, who was knocked down by the force of the explosion, **Christopher Cullen**, who had been at a dance in Clery's ballroom, all were several yards away from the Pillar when it was blown up. **Kevin Dunne**, manager of Greenbeats Showband who had just left the Metropole Ballroom with his girlfriend, was about to drive off: said "I was about 10 yards away when I heard the bang, saw that we were covered with dust and the roadway in front of me was covered in rocks". **Charlie Donnelly** had just passed the Pillar on the GPO side said that he saw two girls crossing at the Pillar and he was convinced that they were under the rubble. They were not, fortunately, and later **Miss Breda Moore** and **Miss Angela Martin** told reporters that they were about 100 yards down Nth Earl St., when they heard a deafening explosion. They looked back and the Pillar was gone.

Eddie Gormley was bringing a passenger in his car down O'Connell St., he heard a deafening explosion, and saw rocks flying left, right and centre.

Any of these and no doubt many more could killed, severely injured or buried under tons of rock. The perpetrator of this moronic act, had obviously not played the slightest attention to ensuring their safety, in fact it was claimed afterwards that he was safely at home. It was fortunate, and in no way due to the so-called "expertise" of the perpetrator, that the blowing up of Nelson's Pillar is not now remembered in the same light as the atrocities of Enniskillen, Omagh and the Monaghan/Dublin explosions of 1974.

It was described at the time as "an outrage, an act of utter irresponsibility indicative of a warped idealism, and an inferiority complex which could be so outfaced by a stone monument that it must assert itself with violence".

Visiting the site

As Technical Representative with the main commercial explosives supplier at that time, during the forenoon of March 8th I attended a meeting with Senior Garda Special Branch officers, to discuss what methods and quantities of explosives might have been used for the operation. A newspaper report that "The Pillar was brought down by a deadly necklace of explosives" was deemed totally impractical.

A Garda Officer told me that 40 lbs of Plaster Gelatine had been stolen from a magazine in a quarry in Co. Dublin some time earlier. That was the most powerful NG explosive available commercially and would be more than adequate to demolish the Pillar.

I was driven down to O'Connell St., inspected the remains of the monument and climbed the stairs to within 10' of the top of the remaining section of the column.

It was apparent that: The explosive had been placed at the top or within a short distance of the top of the "Column" section; Some form of timing device was probably used to arrange firing of the device at the chosen time; and a charge of only 20 lbs. of high strength explosives, strategically placed, would have been sufficient to disrupt the column section and cause the partial collapse. Judging by the wide spread of debris from the blast and the extent of visible damage, it was likely that a greater charge was used.

The entrance gate after the March 8th blast (1966)

I was further asked if the remainder of the Pillar could be felled using explosives. I advised that, although techniques existed to do so safely, as with all demolitions using explosives, essential precautions to prevent any damage to property could be prohibitively expensive.

In any event removal by mechanical should be the preferred option.

The Myth

A remark by a garda on duty in O'Connell St. after the blast to reporters:

"It was an expert job. They knew what they were doing", was mentioned in The Irish Independent and The Daily Telegraph of 8-3-66. His opinion, uninformed and ill-timed, may have in some way been the first indication of the general attitude pertaining to terrorist activity, and an early hint of how the "myth" gained common currency.

The Reality

Press and individual reports from the time describe large rocks flying in all directions, damage to shop fronts, advertising signs and windows broken in many premises. While waiting for the Army blast on March 14th. I spoke to a Garda Sergeant who had been walking towards the Pillar near the Carlton cinema when the March 8th explosion took place. He said that there was very serious flyrock from the blast and considerably more damage was done than generally believed. For instance, a rock some 2 foot across went flying past him and came to rest near the Gresham Hotel, and a rock "the size of a football" damaged a 12" brick wall on the roof of a building near Clery's.

"An expert job"?

An explosives engineer would deem it a very crude effort, needing only the most basic knowledge of explosive usage.

Proposed Further Demolition

Later that week, it was announced on the news that Army engineers were to demolish the remainder of the Pillar on the following Sunday night. It was stated that "The explosion will be a controlled one and will be heard as "a dull thud".

I was surprised at this development, considering the great difference between the requirements, facilities, and techniques available to military demolition personnel and civil demolition personnel respectively. I could not visualise the technique to be used, and intrigued by the statement that there would only be "a dull thud", I asked permission to attend the demolition which was scheduled for 3am on Monday March 15th.

Military Demolitions

The necessity for military demolition of a bridge or building, typically in a war situation, would probably be unexpected, urgent, and allow the very minimum of preparation and planning.

The military engineer would be faced with the necessity to ensure a completely successful demolition. Overuse of explosives would probably not be a problem. He would not be concerned with peripheral damage. To this end he would be highly trained to go in, assess the situation, and complete the demolition.

He would have no right of refusal to carry out the work under any circumstances.

His training will not necessarily help him to prepare for civil demolition.

Civil Demolitions

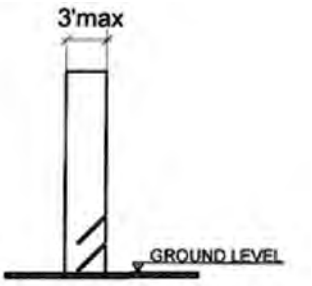
A brief description of the techniques employed in civil demolitions would give some the idea of the real problems faced by Comdt. James Seward, later Colonel Seward, Director Corps of Engineers, and Comdt. James Murphy, the engineers in charge of the demolition team, on the night.

The demolition by explosives of tall structures presents considerable risk, and requires very precise planning by experienced personnel. The amount and placing of the charges must be such that the demolition is totally successful. Where partial demolition does occur, the difficulties and hazards presented during the completion of the operation, would increase ten-fold. It is a "one chance only" scenario.

Buildings of Brick or Stone

Many stone or brick built structures have been demolished by drilling, charging and blasting the bottom 3' of all the walls, both inner and outer. This allows the entire building to drop to ground level and disintegrate. The "cellular" binding effect of the corners and internal walls cause the structure to fall under its own weight, maintaining its plan form up to the moment of impact. In this way the remains of the structure would take up an area of ground very little larger than the original floor plan, without unwanted spread of debris. Flying material from the charged section could be prevented by the erection of a "baffle" of sandbags, 3' to 5' thick, 2' away from the charged areas of wall, and to a height of 3' to 5' above the collars of the top row of holes.

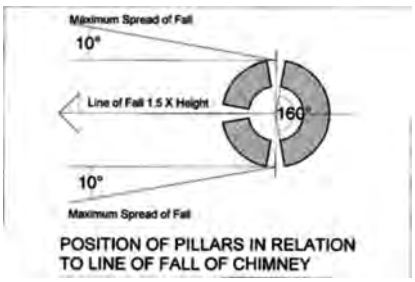
Demolition of a free-standing wall would present greater problems. Without the stabilising effect of the corners and internal walls, such a charged wall could remain intact during the fall to ground level, and topple in either direction to a distance equal or greater than its standing height. This i could be very dangerous.



HOLE PLACEMENT FOR WALLS, PIERS AND PILLARS

Chimneys

Chimney stacks are almost always "felled" in a particular direction.



POSITION OF PILLARS IN RELATION TO LINE OF FALL OF CHIMNEY

The technique normally used is to open three apertures in the structure by hand, leaving the chimney resting on a 160 degrees intact section directly opposite the proposed direction of fall, and two other supporting sectors of 45 to 60 degrees, each predrilled with a precise pattern of small diameter holes at 45 degrees from the vertical. The firing of carefully calculated charges in these holes would allow the chimney to fall in the required direction. The material from the chimney can be projected in this direction to a distance of 1.25 to 1.5 times the chimney height.

The method is described precisely in technical manuals, but experience has shown that often the structure, condition or position of a particular chimney can require the explosives engineer to vary his drilling and charging methods to suit the particular circumstances.

The technique described above for buildings could not be used. Like the single wall mentioned above, a chimney because of the proportion of its height to its maximum plan dimension could survive the short vertical drop, and topple with no control on the direction of fall. Any property near the demolition site could suffer damage.

Conversations with the army engineers charged with the demolition, showed me that they were aware of these facts.

This demolition in the centre of Dublin was certainly a task most unsuitable to a Military Engineer's training and experience, and it was grossly unfair that public misconception should reflect on the expertise or reputation of his team, or on the quality of his military training. In addition the unfortunate statement that the demolition blast would only be heard as a "dull thud" placed an impossible condition on any engineer, either military or civil.

Preparation for the Second Blast

I arrived on site at 9pm on Sunday March 14th and was introduced to Comdt. Seward of the Army Corps of Engineers, based in Cork. Nothing in his experience or in available military manuals was of any help. He had however a handbook on "The Use of Explosives in Demolitions" prepared by ICI Nobel Division. The technique recommended for chimney stack demolition was described in detail in the text and appeared to him to be the technique most suitable for the job in hand.

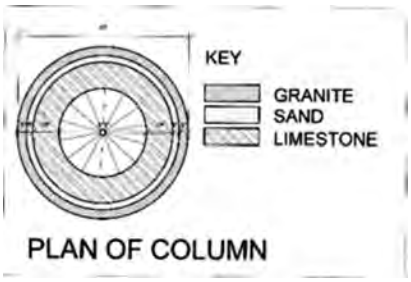
With this in mind he had decided to carry out the demolition by siting the explosive charge at the base of the "column" section, so as to "fell" the column northwards along the street. He asked that a "cushion" of sand be laid on the expected part of roadway where the column would fall. This was to protect the street surface and any underground services.

His decision was made in the belief that the walls of the column were solid.

Problems

When the drilling commenced Comdt. Seward found that the placing of the explosive charges as described in the handbook would be impossible.

Research for this article revealed that no original drawings of the Pillar exist. Drawings held at the Irish Architectural Archives in Merrion Square and elsewhere were produced from the best information available and showed the structure of the column walls as being solid from exterior to interior. It was only during the preparations for the second blast by the army engineers that it was discovered that the walls of the column consisted of approximately 8" of granite, 6" of loose sand and 2' of Limestone.



PLAN OF COLUMN

The fact that the structure had been subject to a previous blast meant that forming the three "apertures" could not be considered for safety reasons. In addition the presence of running sand in the centre of the walls rendered the drilling of angled holes impossible. Once an angled was drilled it filled up with fine sand and could not be charged with explosives. Indeed the drilling of horizontal holes was extremely difficult, with up to six holes being drilled it filled before one hole would remain open.

Comdt. Seward was then faced with the serious difficulty as described above. As the directional felling of the column section could not be controlled, it could fall in a direction which could seriously damage or demolish one or more of the surrounding properties. He had no alternative but to arrange the drilling of increased numbers and rows of horizontal holes with increased explosive charges in an effort to ensure full disintegration of the column, thus causing the resulting debris to fall around the base site without reaching the other properties.

All of this drilling and charging had been completed before I arrived on site. I was hoisted up to the working platform with Comdt. Seward. On inspection, with the prior decision to carry out the operation at the top of the "plinth" section and faced with the difficulties detailed above, I was certain that Comdt. Seward made the right decisions as regard the drilling and charging of the holes.

The material used was PE 852 plastic explosive, with perforated PETN primers. The charges had been connected with detonating cord, which contains a continuous core of explosive material. The linking of the charges with detonating cord would not have been my choice, due to the extra noise level that would be produced, but it was regular military practice, and the

firing of explosives in dead silence at night was bound to be very loud in any case.

A baffle of sandbags had been built around the charged section, but it was not truly vertical, and was about 4' away from the structure at the top. It was also at least 3' short of the ideal height. This left ample room for a considerable amount of debris material to be projected over the baffle. The re-building of this baffle could not be considered at this late stage. I suggested that sections of 8'x4' expanded metal reinforcing sheets be placed horizontally on top of the baffle and wedged tightly against the structure itself, with a number of tarpaulins draped liberally over the reinforcing plates and weighed down by sandbags to contain the potential "fly" material . This was duly carried out and was my sole contribution to the operation. Both Jim Seward and I felt that if the sand bag covering prevented the escape of the large amount of rock material, collateral damage could be kept to a minimum.

The Blast

A large number of the public who had attended patiently since late Sunday evening waited behind barriers at O'Connell Bridge, at the Parnell Monument or at a safe distance in all directions. I got permission to shelter in a doorway in North Earl Street, some 70 yards from the Pillar. The blast was initiated from a place of safety in Princes St.

The only persons nearer to the blast were a small number of press photographers who ignored all advice and sheltered behind lamp posts.

Despite my years of experience firing quarry production blasts, often containing up to ten tons of explosives, and my expectations on the night, in a condition of total absence of ambient noise, the level of noise from the blast still surprised me, and I am sure, the Army personnel involved. It delighted the general public who had been promised "a dull thud" and in typical Dublin fashion they raised a resounding cheer. This no doubt gave more ammunition to supporters of the "myth". The loud noise and spectacular sight of the explosion no doubt delighted the press, who had a spectacular film to show at home and abroad.

Effect of the Blast

Immediately after the blast, I walked back to the site noting that the only debris on Nth Earl Street th was a thick layer of dust. I walked right around the blast site. The column section had completed disintegrated and fell to the ground around the pedestal. I examined the area between the pedestal and the surrounding buildings. I did not see any large pieces of stone that had reached the GPO, or any of the three corner shops nearest the blast. The only "throw" of heavy material was southwards, but was limited to approximately 100 feet. Some panes of glass on the first storey of the GPO was broken, upstairs windows in Worth's jewellery store at the corner of Henry St. were broken and the burglar alarm was going off. A window in Burton's shop at the corner of Nth. Earl St., was also damaged. These breakages were possibly caused by small pieces of stone escaping from the charged section, or more likely, the level of air blast. I did not see any other broken windows, although it is possible more had been broken by air overpressure.

The considerable safety cover provided ensured that unlike in the previous blast, actual rock projection from the monument had been safely contained and serious damage to property was very unlikely. The covering material of sandbags itself meant that there was much scattering of sand and dust and the cleaning of the surrounding buildings could, coupled with the repair of any broken windows, be the main source of complaint.

From an explosives engineer's point of view, Comdt Jim Seward, (regrettably no longer with us), carried out his demolition in a very competent manner, despite the extreme difficulties which faced him.

- He successfully demolished the column section of the Pillar, containing all rock fly to a few pebbles and sand from the covering material which was so evident from the film recording the event.
- He did so without the slightest danger to any one of the many thousands who were present, and did minimal collateral damage.

The myth continues even to the present day. "An expert blew up Nelson Pillar causing no casualties and very little damage, while the Irish Army blew up most of O'Connell Street"

During research for this article, I was often corrected by the statement "Oh no it was the army that did all the Damage".

The Aftermath

During a programme on RTE 2 in February 2003, a man who said he was part of a breakaway group from the IRA, claimed to be responsible for the original blast. He "thought it would be a good idea". The sheer criminal callousness of a decision to cause an explosion which could so easily result in death or injury to innocent civilians, is difficult for a civilised person to comprehend.

Postscript

One of the most fascinating aspects of the whole incident was the lackadaisical attitude of the public, and dare we say it, the authorities, to an act of such utter irresponsibility and flagrant disregard for human life and property. Every article written over the last 50 years outlines the damage caused by the Army, without mentioning the criminally lunatic firing of explosives in a peaceful urban setting.

Pillar Damage Claims

Claims of damage caused by the first blast were handled by the courts under malicious injuries legislation, where all claims must be notified within 7 days of the occurrence.

Blast No.1

Information on claims for damage resulting from this seems reasonably straightforward. Extracts from Dail Eireann Official Reports of Debates, vol.222 No.4 for 24th April 1966. In a reply to Mr. O.J. Flanagan and Mr. M. J. O'Higgins, Mr J. Lynch reported 36 claims for damage totalling £18,864-19s-3d, with 2 other for unspecified amounts. (Source: National Archives, File 97/6/18)

The Irish Times of 8th November 1966, reported that at a City Council meeting on the evening before, Mr. Matthew Macken, City Manager, questioned by Alderman Sean Moore T.D., said 36 claims for malicious damage totalling £18,924-9s-10d had been received "in respect of the first explosion at Nelson's Pillar."

Blast No.2

A letter dated 10-08-66, from the Principal Officer, Dublin Corporation to The Secretary, Dept. of Finance, requesting reimbursement of 23 no. claims of damage from the second blast to property in the vicinity of the Pillar, varying from £2-3s-11d to £160-2s-6d and totalling £1295-4s-2d.

(Source: Dublin Corporation Archives)

At the meeting of Dublin City council of 7th November 1966 detailed above The City Manager said that 33 claims had been received totalling £4180-9s-10d. This probably included a claim of £995-17s-10d from Scafco Ltd. for scaffolding demolished in the blast. This of course was no doubt a legitimate claim, but as this scaffolding was, with the sand bags, tarpaulins etc. deemed expendable in the blast, it could not be regarded as collateral damage. (Source: National Archives. File No. 97/6/18.)

Thus the claims for damage from the Army blast, even with the inclusion of the cost of the covering material amounted to about one quarter of the claims from the first blast. These figures were published on a number of occasions but ignored because they did not fit the fantasy.

The Myth

Remember it. "The first blast was an expert job which did no damage to property, but the Army blew up half of O'Connell St."

A great story. Should I apologise for spoiling it with facts?

Tony Killian

The author worked as a technical engineer with the explosive supply industry since 1951, specialising in the design and supervision of blasting operations in the Quarry and Civil Engineering fields.
He carried out a number of building and several chimney stack demolitions in Ireland and advised on a number of demolitions in Northern Ireland.
In 1989, he was invited to join the blasting team in the carrying out of a very successful demolition of a 22 storey high rise apartment block in Hackney, East London.

He was Hon. Secretary and Council Member with IMQS from 1979 until 2002, and represented the Irish Quarry Industry on CII (IBEC) environmental and EC safety committees.

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Jade

"The Stone of Heaven"

By Tony Killian

Jade – a gemstone of unique symbolic energy, and unique in the myths that surround it. With its beauty and wide–ranging expressiveness, jade has held a special attraction for mankind for some 7000 years.

Today, this gem is regarded as a symbol of the good, the beautiful and the precious. It embodies the Confucian virtues of wisdom, justice, compassion, modesty and courage.

Jade has its cultural roots in the smoke-dimmed caves and huts that sheltered prehistoric humans. Around the world, Stone Age workers shaped this toughest of gems into weapons, tools, ornaments, and ritual objects. Their carvings invoked the powers of heaven and earth and mystic forces of life and death.

What is Jade?

'Jade' is strictly speaking a generic term for two different gems, Nephrite and Jadeite. Jadeite and Nephrite are both regarded in China as genuine jade. It was not until the beginning of the 19th century that mineralogists and gemmologists started to differentiate between them, since they bear a considerable resemblance to each other in terms of their appearance, their hardness and the properties they exhibit when being processed. Both are tough, consisting of dense, close-grained, matted aggregates, but they differ from one another in their chemical composition and colours

Nephrite is a silicate of magnesium-fibrous, hard to fracture, almost soapy in appearance.

Jadeite is a silicate of aluminium, microcrystalline, much more readily broken, and, when polished, far more brilliant. Rarer, and somewhat tougher.

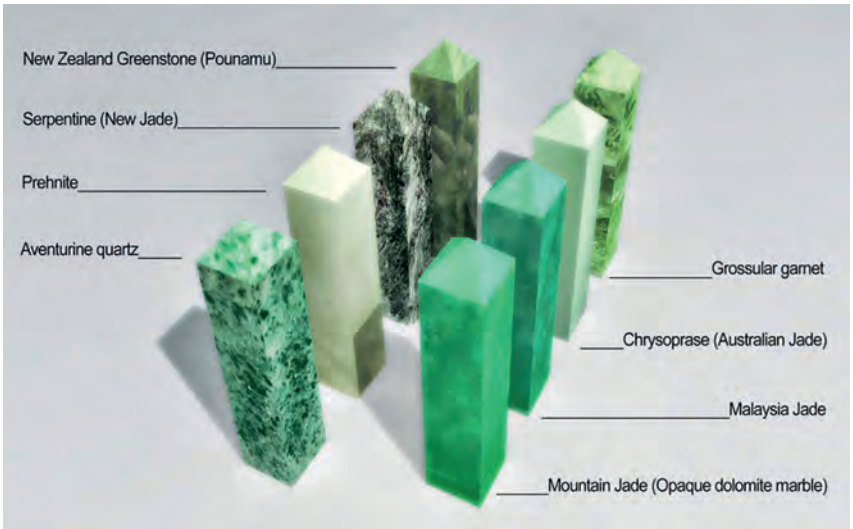
Jadeite (a pyroxene) is formed 20 to 30 miles below the surface of the earth under tremendous heat and pressure and only through violent upheavals and erosion is it brought up to the light, whereas Nephrite (an amphibole), though similar in many ways to Jadeite, is formed closer to the earth's surface.

Colours

Nephrite ranges mainly from mid to dark green or grey-green, but it can also be white, yellowish or reddish. Rarer, and somewhat tougher, Jadeite displays hues which include green, but also white or pink, and reds, blacks, browns and violets. In both minerals, the way the colour is distributed varies a great deal. Only in the very finest jade is the colour evenly distributed. Both nephrite and jadeite often have veins, blemishes and streaks running through them, some of which patterns are considered particularly valuable.

Sources

Nephrite deposits have been found in New Zealand, Russia, Guatemala and the Swiss Alps. Dark green jade, so-called Canada jade, is also found in Western Canada. Histories from the second century B.C. identify Kotan in Central Asia, as the chief source of China's jade for more than two thousand years. Though the use of jade is inseparably linked with the development of Chinese worship, court ceremonials, thought, Nephrite was not found China itself. It is believed that it



was mined there thousands of years ago, and as elsewhere in the world, the supply was in time exhausted. So the stone which determined, directed, and changed the course of Chinese history is, in so far as positive evidence goes, an import.

Jadeite is a comparatively young stone, in terms of carving, having been used in China to any great extent only since 1784. Jadeite is rarer than nephrite and is therefore regarded as more precious. It is found in Russia and Guatemala, but the best stones come from Burma, now known as Myanmar.

Burmese Jadeite

The year 1784 is one of the most important years the long history of jade production. That year marked the resumption of trade between China and neighbouring Burma, who had been feuding intermittently for nearly twenty years. This would be a relatively unimportant event historically had not one of the items Burma sent China been a large shipment of an unusually hard stone.

This stone, which made its way into the jade carving studios in many ways resembled nephrite. It was extremely tough, took a high polish, looked almost like nephrite, had to be carved in the same manner, and as nephrite, when carved and polished, had a bland surface, the new stone was brighter, shinier, and generally more crystalline (in contrast to the oilier, more wax-like appearance of nephrite). It was not until 1863, after extensive chemical tests, that the French scientist Damour announced that the Burmese stone was not nephrite at all and gave it the name by which we know it today.

Initially most of the stone came from the streams and banks of the Uru River. At first the traffic was confined to water-worn boulders, but it was not long until this supply had been exhausted. About 1880 jadeite in place was discovered on the Tawmaw Plateau, sixty-eight miles from Mogaung, Burma. This became the site of the "New Mines," deep quarries which have been the chief source of China's jadeite since that time.

Because of the rainy season, these quarries are workable only three months of the year, from March through May. To keep the mines open for even this brief time, the miners must work from November through February, pumping the veins clear of water. Occasional attempts to keep the mines open longer by building huge fires at the bottom of the mine shaft, were not successful. The military Government of Burma does not welcome outside visitors to the mining area, and there are rumours that thousands of miners are working in horrendous and dangerous conditions.

Though to our knowledge the natives of Burma never carved or used jadeite, there is no lack of native lore concerning it. Burmese tradition claims that far back in prehistory the stone was a mystic gift from Heaven.

The Worlds's greatest gamble

Jadeite is sold in the rough, in boulders varying in weight from one to hundreds of pounds, the outer skin so oxidized that the inside is almost totally hidden. Experienced merchants search the skin for tiny tell-tale spots of making a few "open eyes" or "windows" about one inch square. Often the boulder is sold with only this indication of its inner discovered the boulder's single patch of the precious but fickle uneven colour—may be completely worthless.

In the jade-cutting centres of Canton, Beijing and Hong Kong, the raw material is processed with carburundum and diamond powder. Since jade is, as a rule, not transparent, but has a fine lustre, the cabochon is the form best suited to it. Thin slivers, which can be worn as pendants, and jade bracelets are popular too. Round, cylindrical and flat shapes can be combined to make attractive necklaces. Traditionally, jade is processed into slender figures, filigree images or thin-walled vessels. Unwanted material is removed during the cutting process, and the stone is subsequently polished. Here once again one can see the subtle difference between nephrite and jadeite: whilst polished nephrite has a surface with a resinous lustre, the glassy lustre of jadeite after polishing seems to shine almost like that of a mirror.

What distinguishes good Jade?

For collectors as well as jewellery lovers, jade is a fascinating gemstone. In Asia, above all, it is collected as an antique. Besides the quality of the gem and its processing, religion and faith also play an important role.

In the West, many people prefer to collect jade in small jewellery, bowls or rings. Since each collector has his or her own taste and his or her own likings with regard to colour, style and shape, it is no easy matter giving definite advice on the purchase of jade objects.

However, jade is, at the same time, a wonderful gem, not only in its traditional guise, but also in more modern designs. Especially in recent years, creative jewellery and gemstone producers have

come up with some wonderful, up-to-date jewellery design, thus sprucing up the image of jade, which had had rather a traditional character for quite some time.

In general, the value of jade is determined according to its colour and the intensity of that colour, the vivacity and texture, and its clarity and transparency. Likings for particular colours vary very considerably from region to region and culture to culture. In green jade alone, the connoisseurs differentiate between seven main qualities, from the intense, even green of imperial jade, via apple green and spinach green, all the way to the lighter and to more heavily speckled shades of green. These special nuances often overlap and can hardly be recognised by the untrained eye. In the USA and Europe, emerald green, spinach green and apple green are regarded as particularly valuable. In the Far East, on the other hand, pure white or a fine yellow with a delicate pink undertone is highly esteemed. In the world of jewellery, the fine violet nuances of lavender jade are very popular. It is however the rare, emerald green of imperial jade, which shines through at the edges, a colour of incredible depth, which fetches the highest prices.

Unfortunately, since not only good and natural jade is offered for sale, but often fake or poor-quality products or stones which have been coloured or otherwise treated It is advisable to buy good jade only from reputable dealers and jewellers. Symbolic energy and beauty, the traditional and the modern are combined in jade in a particularly harmonious way. And in gemstone therapy it is said that jade stimulates creativity and mental agility on the one hand, while also having a balancing and harmonising effect.

So this beautiful gemstone brings us joy, vivacity and happiness all at the same time – and what, in our times, could we possibly need more?

BALTIC AMBER

Gold from the NORTH

By Tony Killian

With a scarcity value to match that of gold, Amber has been traded as a prized commodity since the 4th century BC.

Amber is one of the few precious substances on earth we consider a gem which is not of mineral origin, but is a wholly-organic material derived from the fossilized resin, of an extinct species of trees, which grew during the Cretaceous or Tertiary periods (approximately 30-90 million years ago). It appears that the resin was the tree's protection mechanism, produced to protect the tree from disease and injury inflicted by insects and fungi. Resin might also be exuded to heal a wound such as a broken branch.

When the trees died, the resin remained and becoming incorporated into sediments and soils, which in time could change into rock such as shale and sandstone. There the resins, devoid of oxygen, could be preserved over millions of years.

High pressures and temperatures provoked by overlaying sediment transform the resin into amber over time, an ongoing process that takes millions of years.

Where Amber is found

Manifestation of amber is confirmed almost in every region of the world but the majority of them have no industrial value. More than 200 deposits of amber and its manifestation are known today. The majority are based in Europe, North and South Americas, Asia and Oceania. Less known types are American, Japanese, Lebanese, African, Austrian, French, Portuguese, Romanian, Spanish, English amber and others.

The main deposits of World amber are concentrated in the Baltic basin in the territory of Russia, Lithuania, Poland, Germany and Ukraine.

Amber in history

Worked amber dating back to 11,000 B.C. has been found at archaeological sites in England.

We know that the breast ornament of the Egyptian pharaoh Tutankhamen (ca. 1333-1324 BC) contains large Baltic amber beads, and that the quantity of amber in the Royal Tomb of Qatna, Syria, is unparalleled for known second millennium BC sites in the Levant and the Ancient Near East. Amber was also sent from the North Sea to the temple Apollo at Delphi as an offering. The Roman historian, Pliny the Elder, wrote that amber was discussed as early as the 4th century BC, and also identified the area now described as the Baltic, was historically the richest sources of amber in Europe. Pliny also cites opinions that were well aware of its origin in tree resin.

The Amber Coast

The areas of the Baltic Sea where 98% of the world's amber is mined.

The Amber Road

In Roman times, due to the greatly increased demand for amber from the Mediterranean countries, amber was transported mostly over "The Amber Road", a route mostly over water, starting from the old Prussian towns of Kaup and Truso on the Baltic, down the Elbe River, and on to the Danube. From there roads led overland through the Brenner Pass into Italy, the heart of the Roman Empire. From the Black Sea, trade could continue to Asia along the Silk Road, another ancient trade route.

Colours

Amber occurs in a range of different colours. As well as the usual yellow-orange-brown that we all recognise, amber itself can range from a whitish colour through a pale lemon yellow, to brown and almost black. Other uncommon colours include red amber ("cherry amber"), green amber, and blue amber, which is highly sought after.

Cherry Amber was found only in Burma, has long been considered special. This

material was, and still is, extremely rare and expensive. It usually occurs in small pieces, and from very, very few localities. The rarest Dominican amber is blue amber. Only about 100 kg (220 lb) is found per year which makes that also, very expensive.

Amber of some 250 hues - from milky-white to yellow to black - is only mined in the Baltic Sea aria. Baltic amber is unique with each piece in various shades, forms and colours.

Fresh, natural Baltic amber never occurs in a red colour, nor does it appear red by transmitted light. The demand for red amber can be met by treating Baltic amber. Altering the colour and clarity of Baltic amber is not a new idea… the Romans were treating amber to enhance it 2000 years ago. They could clarify opaque amber and darken its surface. To do this they boiled it in pig fat or rapeseed oil. Today more modern methods are used, which are closely guarded secrets.

The Uses of Amber

Amber, a wonderful accessory to wear as jewellery, was also valued as a traditional remedy for all sorts of ailments.

Amber bracelets were worn by those who suffered from bone diseases such as rheumatism and arthritis. It was thought to be beneficial also in reducing fatigue and general weariness. In some cases, fairly large pieces of amber would be rubbed on the body of the sick. This would have a calming effect and relieve the pain, and various creams and balms, and even amber infusions in alcohol, were made to cure pains and help the suffering, for example, amber is known as an excellent natural antibiotic. Over the years and through many centuries, amber has also been used for the kidneys, the nervous system and the heart, due to the fact that it had positive effects on internal organs and helped people relax by reducing anxiety. Europeans have been using it for centuries to cure the sick and ill.

Amber Oil

Amber oil is considered to be one of the most priceless possessions and one of the most valued extracts of pure natural Baltic amber. It is easy to prepare in a short period of time. Used on skin, it has a regenerating effect and is one of the earliest treatments used in anti-aging techniques.

Amber in powder form is used in Eastern European homes as an efficient anti-hangover treatment. A pinch of amber powder downed with a glass of beer is the most effective way to get past the after effects of excessive alcohol consumption.

Inclusions in Amber

One of the elements which makes Amber a scientific phenomenon are that some amber contains actual fossils of plants and insects that date back over 45 million years! As sticky resin was exuded by the trees, animals, minerals, and plant materials were trapped in it. As the resin hardened, these fossils—called inclusions—were perfectly preserved, providing modern scientists with invaluable information about extinct species, and giving them a unique window into the fascinating world of ecology in ancient times. Unlike other types of fossils, amber fossils are three-dimensional, with life-like colours and patterns. Even the internal structures of cells may be intact.

Previously unknown genera of fossilized insects have been discovered in amber. In August 2012, two mites preserved in amber were determined to be the oldest animals ever to have been found in the substance; the mites are 230 million years old and were discovered in north-eastern Italy. In some cases, deoxyribonucleic acid (DNA) can be extracted from the fossilized organisms and compared with that of its modern-day counterparts. In ongoing research into DNA, scientists will have trees... the timeless survivors of the ages, to thank for preserving a museum of the past. These amber pieces with inclusions are highly sought after in the amber world.

The Story Baltic of Amber

The earliest evidence that amber was known about, mined, and worked with in the Baltic Sea/Gdansk area dates from between 8000 - 4000 B.C. The locals produced amber amulets in the shape of animals, deities, and hero figurines for cult purposes, and believed it was imbued magical power.

During prehistoric times, wind and waves coming ashore from the Baltic Sea formed what is known as the Curonian Spit on Poland and Lithuania's famous "Amber Coast." Running southwest to northeast, the spit varies in width from 430 yards to 2 miles and is sixty miles long.

Amber recovery and processing

With a density slightly less than sea-water, some amber floats to the surface and the oldest and the most primitive method of obtaining amber was collecting it from sandy beaches where various size pieces were washed by the waves.

As the amber industry developed, more improved and efficient ways of obtaining amber were introduced. Fishermen in the shallower depths of the Curonian Lagoon collected amber using a kasele – a horseshoe shaped arc with the net attached to it. The kasele is fitted between two boats which are being rowed, carving amber from the bottom of the sea.

Modern Mining Methods

Modern Amber Mine (Photo: Public Domain)

In 1860, a very long and time consuming process of using custom ships with specialized machinery, diving and then dredging took place over the next 30 years that yielded 75 tons in excellent raw amber each year. More than 500 employees were needed to manage the operation. Now amber is mined from the bottom of the seas and from the earth by specialized machinery, and the amount of mined amber increased to 400 tons per year.

Cutting, Shaping and Polishing

For jewellery or carving, amber usually is worked by hand, with a jeweller's saw and fine-toothed files. Reshaping is done with various grades of sandpaper. Rough edges from the saw blade may be smoothed with 200- and 400-grit paper, by hand or with a belt sander equipped with a water cooling system, to remove dust and prevent overheating and fracturing or glazing. Amber for jewellery is polished with tin oxide or cerium oxide, using a leather buff, Jelt wheel or pad, or chamois board. Periodic polishing with a silicone-based wax restores shine and decreases evaporation and surface oxidation.

Ownership

During medieval times amber was the property of the finder. However, the Baltics eventually came under the rule of the Teutonic Knights, who exercised absolute control over all aspects of the amber trade, even prohibiting the unsupervised collection of amber on beaches under penalty of hanging. As late as the 17th century fishermen were obliged to swear the "amber oath," a denunciation of amber smugglers. As the Knight's power waned, guilds became increasingly important players in the amber trade. The guild established in Danzig in 1477 still exists today.

The end of the 19th century brought with it a huge demand for amber products in the

world marketplace. Before World War I up to 500 workers were engaged in the amber industry at Palanga, producing approximately 20,000 kg of Baltic raw amber, but the two world wars almost destroyed the amber mining industry in the area. The production level declined and all material mined went in various forms to assist the German war effort.

Post World War 2

After the end of hostilities, Poland, Lithuania, Latvia and Estonia became part of the USSR and there was merging of the various excavation sites and more efficient methods of producing amber. However all amber produced had to be sent to Russia for sale and further export. There was much resentment on the part of producers that all the profits from the sale ant export of the amber went to the Soviet government.

With the break-up of the Soviet Union in 1991, shops for processing amber were gradually re-opened and several hundred craftsmen were engaged in the work, processing up to 10,000 kg of raw amber annually. More than 500,000 kg of raw amber came from these mines every year, more than 90% of amber produced in the entire world.

Polish Amber

In Poland amber became an integral factor in the ethnographic identity of its people. Amber working became a means of living for the majority of the inhabitants of the region. Thus, amber gathering and working took its place alongside bee-keeping, hunting, and fishing, and became a common occupation.

Jewellery

Amber jewellery is made from less than 20% of that yield because of the quality that is required to produce excellent pieces. Less perfect samples – "pressed" amber are used for costume jewellery. The rest of the produce that is considered unsuitable often ends up in factories where it then becomes amber oil, amber acid, amber varnish and other amber products.

The City of Gdansk, the undisputed amber capitol of the world, and the International Amber Association are constantly striving to improve and increase the mining situation and the marketing of Baltic amber. As the supply of raw amber continues to shrink, Polish amber producers have become quite sophisticated with their designs and their marketing strategies.

Today's styles incorporate much more sterling silver than amber and rely on design, craftsmanship and quality amber as major selling points, and the Polish amber industry is experiencing a renaissance in craftsmanship and design.

Illegal Amber Mining

A boom in demand for amber sent prices up and redrew the world map of the amber "solar stone" trade. After the 1991 Soviet Union collapse, amber mining - like almost any other industry in Russia - was rife with corruption and crime. Corrupt mine guards turned a blind eye to illegal diggers - who could get away with a fine of 500 rubles ($13) if caught. Hundreds of tonnes of amber were smuggled to Poland and Lithuania. According to a 1996 estimate, annual losses due to illegal extraction and smuggling amount to $1 billion.

Chinese tourists look at a $10,000 amber necklace at a shop in Moscow [Denis Sinyakov/Al Jazeera]

During a digging season that lasts between April and November, a lucky and hard-working digger can earn enough to buy a house. The "black" diggers claim their illegal job is their only chance to earn a decent living in the Montenegro-sized region of one million, where competition with European farmers made agriculture unprofitable, Soviet-era plants had been shut down and rampant corruption stifles business.

Reform

Following Russian President Vladimir Putin's orders to "normalise" the extraction and sale of amber, and boost domestic craftsmanship, Black diggers now face hefty fines, confiscation of their pumps and cars and criminal charges. Craftsmen are prohibited from buying raw amber outside Combine. Law and order seems to have returned.

In modern times, amber has remained a valuable substance as ornamentation techniques have become more complicated and the creations of the masters more exquisite. As more value is added to the raw material, the new product becomes more expensive.

Fake Amber

As with other imitation gems, ways were found to synthesize precious natural materials into copies of varying inferior quality. Baltic amber was one of those precious materials that was replicated with worthless materials. Currently, there is a considerable amount of fake amber in the marketplace. Unless one really knows how to determine real amber from fake, it is easy to be deceived. It is recommend that all purchases of amber should be from the most reliable sources.

Amber-hungry China

With the ever increasing demand for amber in China, prices have risen almost tenfold since 2000, and a milk-white, fist-sized piece that weighs more than a kilogramme can now fetch tens-of-thousands of dollars. Amber figurines and jewellery have also become a luxury item among affluent Chinese. But the Middle Kingdom's tradition of craftsmanship is too different from those in Russia or Europe. In recent years, Chinese interest has been in raw amber for further working in their own design centres.

"They take our daily bread, our work" says Yelena Kochetkova, owner of the KTK jewellery workshop in Yantarny, who employed 280 workers in 2011 - and now has only 85. "But their product is superior to ours, honestly".

As in other fields, Chinese purchasing power, lower wage costs and technical expertise can affect even the long established amber business.

The Russian "Amber Room"

The original Amber Room, 1931

The Amber Room is a world famous chamber decorated in amber panels backed with gold leafs and mirrors, located in the Catherine Palace near Saint Petersburg. Originally constructed in 1701 in Prussia, The Amber Room was looted during World War II by a German troops and brought to Germany for reconstruction and display. Knowledge of its current whereabouts remains a mystery. Before the room was lost, it was considered an "Eighth Wonder of the World".

The 9/11 Memorial Plaza

Reflecting Absence

By Tony Killian

The 9/11 Memorial Plaza

In the shadow of the 1,776 feet high, One World Trade Centre, the tallest building in New York, the Plaza consists of two 1-acre pools with the largest man-made waterfalls in the United States in the footprints of the ill-fated Twin Towers, with almost 400 sweet gum and swamp white oak trees filling the remaining 6 acres, and an underground Museum, symbolizing the loss of life and the physical void left by the 9/11 attacks.

The waterfalls are intended to mute the sounds of the city, making the Memorial Plaza a contemplative sanctuary and enhancing the site's reflective nature.

Background

The original World Trade Centre was a large complex of seven buildings in Lower Manhattan, New York City, United States featuring the landmark 1,368 feet twin towers, which opened on April 4, 1973.

The most innovative part of the structure was The Slurry Wall. Built on reclaimed land landfill with the bedrock located 65 feet below ground level, it had been necessary to build a "bathtub" with a slurry wall around the West Street side of the site, to keep water from the Hudson River out. The slurry method selected involved digging a trench, and as excavation proceeded, filling the space with a "slurry" mixture composed of bentonite and water, which plugged holes and kept groundwater out. When the trench was dug out, a steel cage was inserted and concrete was poured in, forcing the "slurry" out. This formed the basic foundation for the Twin Towers.

Terrorist attacks

On February 26, 1993, a truck filled with 1,500 pounds of explosives, detonated in the underground garage of the North Tower. The blast opened a 100 foot hole through five sublevels with the greatest damage occurring on levels B1 and B2 and significant structural damage on level B3. Six people were killed and 1,042 others were injured.

On September 11, 2001 Terrorists crashed two airliners full of jet fuel into the towers and the resulting inferno, coupled with structural damage, caused both of the twin towers to collapse and disintegrate into a mound of smoking rubble. But amazingly, after the dust settled the slurry wall-- remained in place. Had it collapsed, the entire New York subway system might have flooded, and the loss of life could have been exponentially worse. The attacks of September 11, 2001, were the deadliest terrorist act in world history and the most devastating foreign attack on American soil since the attack by the Japanese on Pearl Harbour on December 7, 1941.

The second plane hits the Towers

Casualties

The September 11 attacks killed 2,996 people and injured more than 6,000. These immediate deaths included 265 on the four planes, 2,606 in the World Trade Centre and in the surrounding area, and 125 at the Pentagon.

2,974 victims were confirmed to have died during the initial attacks including "first responders", mainly firefighters, paramedics and security personnel. Heart-breaking stories by those using the stairs in a rush to the ground and safety, told of meeting the firefighters loaded with hoses and equipment climbing up - to oblivion!

In 2007, the New York City medical

examiner's office began to add people who died of illnesses caused by exposure to dust from the site to the official death toll. This raised the number of victims at the World Trade Centre site to 2,753 and the overall 9/11 victim death toll to 2,977.

Excavation

As workers excavated the 1.2 million tons of steel and rubble that remained of the collapsed buildings, they worked around the slurry wall with great care, carefully reinforcing the wall with steel cables to prevent its collapse. The engineers strove to keep the original wall in place, as a testament to the determination and resilience of a nation.

A portion of the slurry wall is preserved in the museum.

Planning the Memorial

A memorial was mooted in the immediate aftermath of the attacks. The urge to memorialise was accompanied by an equally powerful need to rebuild at the World Trade Centre. Most wanted a memorial, but how big it should be and how much of the World Trade Centre site constituted "hallowed ground" was hotly debated. Many thought the entire 16 acres should remain empty; community advocates asked for affordable housing, others wanted a garden, a school, a hospital, a library, a museum, a religious centre, a centre for world peace- each had its advocates.

The concepts were presented at a series of public forums. Hearing the clear call from the public, officials decided to launch a worldwide competition for a new master plan for the site.

The Theme

The winner of the World Trade Centre Site Memorial Competition was Israeli architect Michael Arad of Handel Architects, a New York- and San Francisco-based firm. Arad working with landscape-architecture firm Peter Walker and Partners on the design, proposed a forest of trees with two square reflecting pools in the centre where the Twin Towers stood, and a museum to be built below ground level.

Foundation Structure

The complexity of designing and constructing the museum pavilion on the World Trade Centre site was especially challenging. The majority of the pavilion is supported over the PATH train station, a rapid transit railroad connecting Lower Manhattan with Newark, and Jersey City. The long span underground station was unable to accommodate any additional load from the proposed Memorial. Even with considerable coordination, many columns required transfer girders below plaza level to align with columns over the train tracks. To provide support, a 22-foot-deep, full-story steel truss cantilevered from the pavilion core walls at level 3, providing a location to hang the floors below and effectively forming a portion of the Memorial structure over the PATH station.

The 9/11 Memorial Plaza

The Plaza, comprising the Pools, the Park, the Names on the walls and the Museum.

A tribute to the past and a place of hope for the future — the Plaza is alive with twin spirits of remembrance & renewal.

The Pools

The pools, set within the footprints of the original Twin Towers, with each pool approximately 1-acre in size, featured the largest manmade waterfalls in the United States.

Fully framed in steel, the pool had walls behind the fountains lined with black granite.

Visitors are greeted by sheets of water cascading 30 feet down into twin reflecting pools. To give the waterfalls an aesthetic look, a steady stream of water with a nice even flow is maintained. Turbulence is avoided, by a system to speed up or slow down the pumps on windy days.

Massive pumps collect all that water, treats it and sends it back to the top at a rate of 24,000 gallons per minute. The pumps are fitted with mechanical filters to take sediment out, and UV lights that take bacterial control. A heating system keeps the water from freezing in winter and the fountains are designed to filter out coins in the likely event that visitors toss them into the pools of water. LED lights at the base of the pools illuminate the water at night, with the fountains designed for continuous operation.

The soothing sound of the water pouring over the sides of the fountains is one of the most lasting impressions one take away.

Arrangement of the victims' names

The names are incised in a bronze parapet that rings each pit. The boxy parapet loo is cooled inside in the summer, to make sure that the dark bronze surface with the names does not get too hot to the touch, and heated in the winter to prevent ice from forming. In addition, lights illuminate the names from within the parapet.

A section of wall showing some of the victims' names

The names include 2,983 killed in the September 11 attacks and six killed in the 1993 World Trade Centre bombing, the employees and visitors in both tower, the passengers and crew of the planes which struck the towers, the employees, visitors, and bystanders in the immediate vicinity of the North and South Towers, the passengers and crew of United Airlines Flight 93 (which crashed in Pennsylvania) and American Airlines Flight 77 (which struck the Pentagon), and the employees at the Pentagon. The names are arranged according to an algorithm, creating "meaningful adjacencies" based on relationships—proximity at the time of the attacks, company or organization affiliations (for those working at the World Trade Centre or the Pentagon).

The names of passengers on the four flights are listed under their flight numbers, and first responders with their units. Company names are not included, but company employees and visitors are listed together.

"Your loved ones' names are surrounded by the names of those they sat with, those they worked with, those they lived with and, very

possibly, those they died with. The phrase "and her unborn child" follows the names of ten pregnant women who died on 9/11 and one who died in the 1993 attack.

The Park

The 8-acre park is a supremely contemplative sanctuary, with more than 400 white oak trees creating a green roof over the below-ground portion of the museum. The swamp white oaks can reach 60 to 80 feet at maturity, live from 300 to 350 years, and their autumn leaves are gold-coloured.

The Museum

The National 9/11 Memorial Museum is located within the archaeological heart of the original WTC site.

The Museum (background) and the North Pool in front of it

The Museum serves as the country's principal institution concerned with exploring the historic implications of that tragic date, through state-of-the-art multimedia exhibits, archives and monumental artefacts. Paying reverent homage to the nearly 3,000 victims of the attacks, the museum also recognizes the thousands who survived, and all who showed extraordinary courage & compassion in the catastrophe's aftermath.

It extends 70 feet below ground, accessible through a pavilion on ground level and encloses 110,000 square feet of publicly accessible space, in a series of cavernous, hangar-like rooms. Its galleries contain crushed fire trucks, mangled steel, multimedia displays, and a torn seatbelt from one of the airplanes that hit the towers, clothing and bicycles covered with ash from their collapse.

Included are recordings of survivors and first responders, pictures of all victims, photographs from the wreckage and other media detailing the destruction (including the crashes, collapse, fires, those who jumped and literally thousands of other pieces of memorabilia.

There are some large items displayed in the open space between the north and south galleries.

Slurry Wall

One of the museum's walls is an exposed side of the slurry wall retaining the Hudson River, which survived the September 11th attack.

The Survivors' Staircase

The Survivors' Staircase was the last visible remaining original structure above ground level at the World Trade Centre site. It was originally two outdoor flights of granite-clad stairs that connected Vesey Street to the Centre Plaza. During the September 11 attacks, the stairs served as an escape route for hundreds of evacuees from the 9-floor building adjacent to the 110-story towers. During construction of the Museum, the Staircase was lowered to bedrock, making it the first artefact to be included. It is placed between the escalator and stairway to the main Museum exhibition hall. The staircase, which is closed against use, is now an important feature of the Museum.

The survivor's staircase

The Iconic Last Column

(Photo: Jin Lee)

To thousands of Ground Zero recovery workers, the Last Column represents a symbol of resilience after 9/11. Standing at 36-feet tall, the Last Column is a 58-ton beam, which was the final piece of the World Trade Centre left standing. It was also the last artefact removed from ground zero, signalling the end of recovery efforts. During the recovery effort, it was adorned with messages written by firefighters from Squad 41, who, for months, couldn't reach the remains of their fallen comrades buried nearby. Others followed suit on the column, writing messages, taping pictures and turning it into a kind of grave marker. After removal, the beam was draped in the American flag - the same honour given to all the 9/11 victims who were recovered and wrapped in plastic, it was transported to an empty hangar at John F. Kennedy Airport where it underwent conservation. Over time, all the posters and pictures were removed and placed on archival backings for reattachment to the column.

In August 2009, the column returned to Ground Zero, where it was placed inside the then under-construction 9/11 Memorial Museum. It is now on view in the Museum's Foundation Hall. The column - which has become a kind of cornerstone for the museum - is so massive they couldn't bring it into the museum. The museum had to build around it. When the museum opened in the 2014, visitors could see and learn about every single item written or affixed to the column - even those that tower more than 30 feet above them because of four touch-screen panels that allow you to zoom in and see individual photos and messages anywhere on the column.

The Column with the Slurry wall on the right

Placement of unidentified remains

In an early-morning ceremony on May 10, 2014 the long-unidentified remains of 1,115 victims were transferred from the city medical examiner to Ground Zero, where they would be placed in a space in the bedrock 70 feet below ground as part of the 9/11 Museum. The ceremony was held early in the morning because of opposition to the decision. They are held in a private room open only to their families.

Emotions

There were emotional challenges of building a museum in a location where thousands of people were killed in an unprecedented event that altered the course of humanity. The memorial museum was erected in close proximity to the events it is charged to commemorate - events characterized by unimaginable collective loss. The information presented is both graphic in its violence and provocative in its implication.

At its core, the memorial museum carefully balances the act of commemoration - which has its own requirements of sensibility and reverence - with the imperatives of education, historical documentation, and fidelity to the emotionally resonant artefacts on display.

Personal impression

When I visited the site with some family members in September 2013, we found that the gentle noise of the falling water masked the city sounds of traffic and other movement. It also seemed to have a marked effect on those moving around the area-no loud voices, no loud phone calls-even the children seemed to be quiet and mannerly. The main impression was one of sincere reverence and respect.

(The Museum was not completed at that time)

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Irish Mining And Quarrying Society

Annual Dinner Dance 2015

The always enjoyable annual black-tie dinner took place in Dublin city centre on Saturday, the 28th of November 2015, at the Ballsbridge Hotel.

Sean Finlay (Director Geoscience Ireland), Siobhán Tinnelly (IMQS President), John Kearney (Guest Speaker), Katherina Kearney and Danesh K.Varma

Sandra Davies and Malcolm Morgan

Brendan Kieran, Siobhan Tinnelly, Carol Sanderson and Roy Sanderson

Céline Francois, Peter Lowther, Karen Lowther, Mike Lowther, Mary Griffin and Pat Griffin

Patricia Scanlon, Ray Scanlon, Professor Chris Bean and Dr. Aoife Braiden

Joan Morris, Brendan Morris (Incoming IMQS President) and Dr. Eibhlín Doyle

Olive Magee, Darryl Magee, Maurece Harrison, Gordon Best and Yvonne Best

Brendan Kieran, Frances Tinnelly, Siobhán Tinnelly, Pat Tinnelly, Roisin Tinnelly and Niall Martin

Jane Braniff, John Braniff, Siobhán Tinnelly and Robert Tobin

Roy Sanderson, Heather Sanderson and Les Sanderson

Gerry Stanley, Alan Forsyth, Marie Fleming (IGI President) and Brendan Kieran

Bernie Verbruggen, Koen Verbruggen (Director GSI), Stephen Robinson (IoQ Chairman) and Janet Robinson

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IRISH MINING & QUARRYING SOCIETY

Membership Application Form

IMQS, THE LUCAN CENTRE, PRIMROSE LANE, LUCAN, CO. DUBLIN
Web: **www.imqs.ie** Email: **info@imqs.ie** Tel: **08949 27942**

PERSONAL Details (PLEASE USE BLOCK CAPITALS THROUGHOUT)

Surname: ..... Forename(s): .....
Home Address: .....
.....
Telephone Number: .....
Mobile: .....
Home E-Mail Address: .....

EMPLOYER Details (PLEASE USE BLOCK CAPITALS THROUGHOUT)

Employer: .....
Address: .....
.....
Telephone Number: ..... Mobile: .....
Work E-Mail Address: .....

Correspondence Address (please tick both location to be sent to & by what means Home ❑ Work ❑ E-Mail (preferred by IMQS) ❑ Post ❑

Please state association with the Mining or Quarrying Industry: .....
Proposed by: ..... (Existing IMQS Member)

Note: Should the candidate be unable to obtain a proposer who is a member of the IMQS, the application will be assessed by the Council of the IMQS and membership is subject to the approval of the Council. Please send to address above enclosing payment of €50 (ordinary membership). (Membership fees are payable in January each year and are valid for that calendar year).

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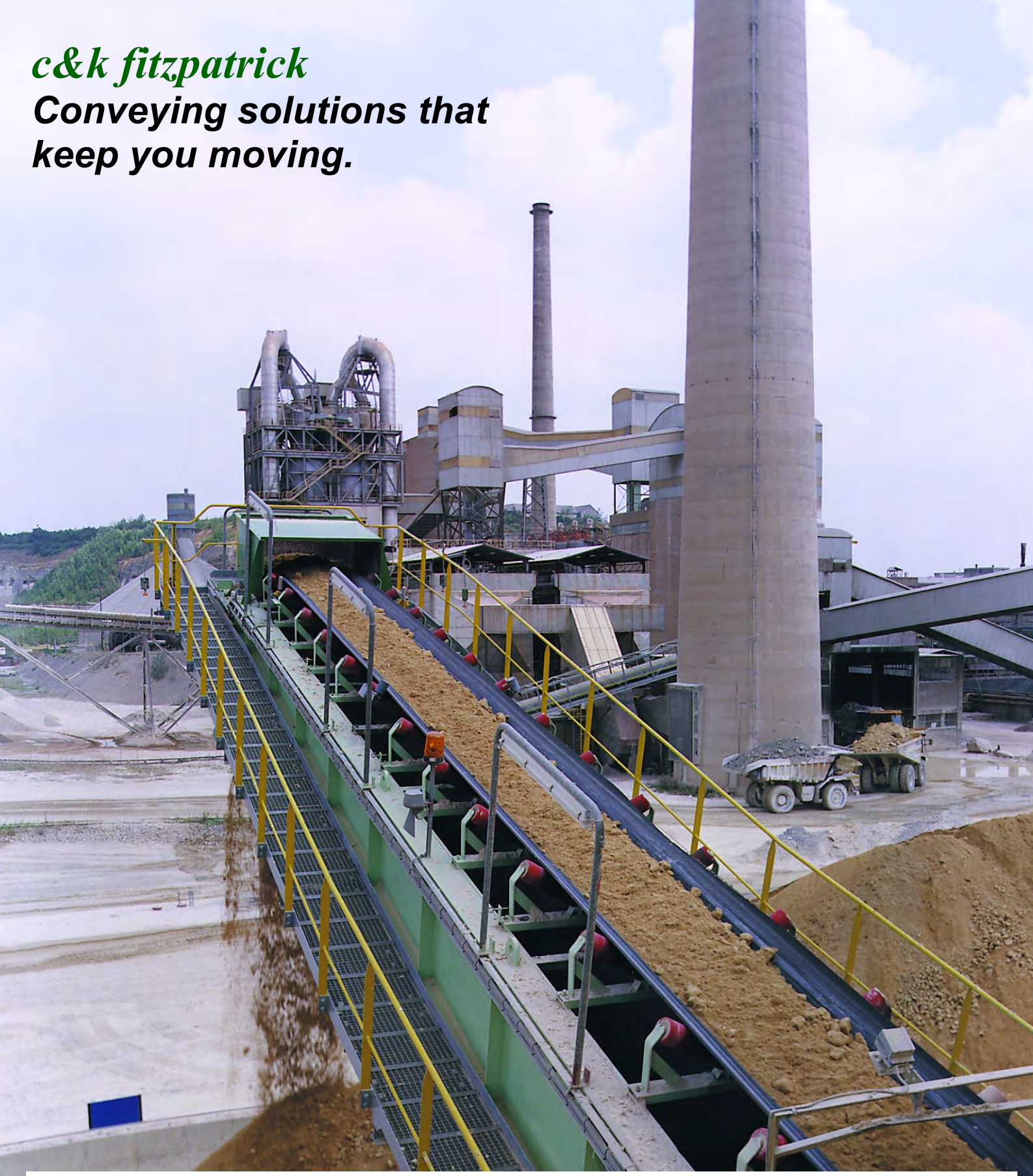

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