ANNUAL REVIEW 2019

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Notes from the Editors 2019

BREXIT, BREXIT Everywhere... and yet, uncertainty!

In this preparing this year's Annual Review, the IMQS Editorial committee were very aware of the significance of the months ahead and the impact that a potential "No Deal" Brexit may have on our members. Such is the level of uncertainty around Brexit that a number of articles in this year's review had to be edited in advance of publication due to changes in the political landscape, including the events surrounding a new Prime Minister in the UK. We, therefore, seek your forgiveness if there are any inaccuracies in the content of this year's review due to changes unforeseen at the time of going to print.

In keeping with a review of the potential impact of Brexit on the mining and quarrying industry, we are delighted that this year's Review includes updates and features from contributors from across the island of Ireland, which will provide the reader with a range of perspectives.

This year marks the 21st anniversary of the first edition of the Annual Review publication and includes a dedicated Foreword from the new Minister of State for Natural Resources, Mr. Seán Canney T.D. and a message to industry members from the IMQS President Mr. John Francis, who is now in his second year as President of the Society.

Industry organisations rely on each other for support and knowledge sharing and this Review reflects that collaboration with contributions from leading associations including the ICF, IGI, EIT Raw Materials, EFEE, IAEG and MPANI. Details on new and relevant educational and training courses and upcoming events are presented by Carlow IT, iCRAG, the Institute of Quarrying (IQ), the Irish Mine Rescue Committee (IMRC) and INQUA.

Individual articles featuring case studies and industry updates have been prepared by contributors on behalf of the British Irish Chamber of Commerce (BICC), Irish Cement, Farrans Construction, Geoscience Ireland, Boliden Tara Mines, Gyproc Saint-Gobain, M. Keane Consulting, GSI, GSNI, LKAB, Sandvik, Tellus, LTMS Ltd., McCabe Durney Barnes, Kilkenny Limestone Quarries Ltd., Close Brothers and Dalradian.

There is also a feature on the value of Corporate Membership of the IMQS, a review of the 2018 Annual IMQS Golf Competition and Dinner Dance (K Club) and a chance for some of our younger readers to win some much-coveted construction-themed Lego!

A noteworthy feature focusing on a selection of "industry leaders" highlights the varied and interesting careers of two very impressive members of the extractive industry in Ireland – Dr. John Ashton and Mr. Mick Flynn.

We are honoured to include a previously unpublished paper from the archives of Mr. Tony Killian R.I.P. (former Editor of the Annual Review) and are sad to include an Obituary this year to honour the memory of Mr. Herb Stanley R.I.P.

As always, we thank our advertisers for their continued support for the Irish Mining and Quarrying Society; all our feature writers and regular contributors and our publisher 4 Square Media. Without the commitment and assistance of these parties, this publication would not be possible.

We hope you enjoy the IMQS Annual Review 2019. Remember – you are welcome to contribute to next year's edition!

We look forward to hosting our Mining Ireland conference on October 8th in Dublin which you will see information on in this review

the Editorial Team


Siobhán Tinnelly (Chairperson)


Sean Finlay


Keith McGrath


Ronan Griffin


Andrew Gaynor

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Minister's Foreword

by Seán Canney TD, Minister for Community Development, Natural Resources, and Digital Development.

I am delighted to provide the foreword to the Irish Mining and Quarrying Society 2018 Annual Review and I have been fortunate to have met a number of IMQS members already and am aware of the progressive work carried out by the organisation.

The exploration and extractive industries have continued to be active during 2018/2019. This is reflected in their expenditure and output. The construction sector continues to be strong and metal prices particularly for zinc have remained buoyant. The minerals sector is important to Ireland and to Europe as it provides the raw materials for society's needs and going forward for green energy and the circular economy. I recognise its importance as a regional employer, bringing well paid jobs to rural areas.

Two underground mines operated in Ireland in 2018. Ireland produced 12.1% of European zinc mine output and 3.8% of European lead mine, ranking Ireland 3rd and 7th in Europe, respectively. According to data published by the International Lead and Zinc Study Group, in 2018, Ireland ranked 15th and 24th in the world for zinc and lead mine production, respectively. Ireland did rank as Europe's number 1 producer of zinc concentrates and I am hopeful that new mineral deposits currently being investigated will lead to their development which will once again place Ireland as Europe's premier producer of zinc.

The Navan Mine, operated by Boliden Tara Mines, is still the largest zinc mine in Europe. In 2018, Tara milled 2.2Mt of ore grading 6.28% Zn and 1.20% Pb. Since mining operations commenced in 1977, up until 31 December 2018, total production at Navan has amounted to 94.76Mt grading 7.61% Zn and 1.74% Pb. At the end of 2018, the mine's JORC classified ore reserves (proven and probable) stood at 19Mt grading 5.7% Zn and 1.5% Pb, whilst mineral resources (measured, indicated and inferred) were 23Mt at 7.2% Zn and 1.7% Pb and the company continues to delineate the new satellite deposit – 'Tara deep'. In addition, the company has obtained planning permission for the extension to the Tailings Storage Facility which is now well advanced in construction.

Irish Gypsum Ltd., a subsidiary of the French multi-national Saint-Gobain, produced approximately 200kt of gypsum in 2018 from its underground mine at Drummond, Co. Monaghan and open pit at Knocknacran. The gypsum is crushed and blended on site, before being transported by road to a production facility at the nearby town of Kingscourt for manufacturing plaster and plasterboard. This industry has been operating in the Kingscourt area since the 1930s.

2018 saw some changes introduced in respect of mineral exploration drilling. Following legal advice it was considered that EIA screening should be carried out in respect of mineral exploration drilling. My Department moved swiftly and introduced three Statutory Instruments (SI) to provide for the screening of mineral exploration deep drilling. The exploration sector was kept informed during this process. I am aware that there was a period of a number of months in which my Department could not approve exploration drilling. The situation is now resolved and I am pleased to note that expenditure on drilling in 2018 slightly exceeded that of 2017. My Department is currently working on the full transposition of this legislation.

At the end of 2018 there were **576 active licences and 45 mineral exploration companies operating in Ireland**. The total exploration expenditure in 2018 amounted to €20.94 up €1.44 from the previous year. The amount of drilling was of the same order as that of 2017, with approximately 60,000m drilled in total.

This year the Joint Research Committee of the European Commission published the "Best Available Techniques (BAT) Reference Document for the Management of Waste from Extractive Industries". I am aware that my Department through the Exploration and Mining Division were active in contributing to this significant document.

Ireland has demonstrated best practice in the procedures for the closure and remediation of mine sites. This has been further demonstrated by the Green Apple award which Lundin was awarded for the remediation of the Galmoy Tailings Management Facility.

While my Department does not have responsibility for the aggregates sector, I am aware how important it is for the construction industry. I am pleased that output from the quarry sector continued to increase in 2018 in response to ongoing increases in construction activity throughout Ireland. While much of

Sean Canney TD with the Intergovernmental Forum and Team Ireland at PDAC 2019.

construction is still confined to the Dublin area, there are now clear indications that activity is picking up in rural areas. This trend is likely to continue as Government progresses with the ambitious targets for capital investment identified in Project Ireland 2040, many of which will require substantial access to aggregate raw materials. According to the Irish Concrete Federation, output from the **quarrying and concrete sector increased by approximately 7%** in 2018, with the current annual demand for aggregates and aggregate based products estimated at over 10 tonnes per capita compared to an average of 6 tonnes across the EU 28.

My Department continues to publicize Ireland as an attractive country in which to explore for and develop mineral deposits. This year, I attended Prospectors and Developers Association of Canada's Convention and Trade Show held in Toronto in March and was impressed at the size and energy of the convention. Almost 26,000 delegates attended.

My Department has been attending the event since 1989 and has had an impressive joint stand with the Geological Survey of Northern Ireland and the Department for Economy in Northern Ireland since 1999. I had a busy schedule which included attending and presenting at the International Mines Ministers Summit (IMMS), an event co-hosted by the PDAC and the World Economic Forum. The Exploration and Mining Division and I had a number of productive meetings with company executives. I was delighted to sign the agreement between Ireland and the **Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF)** and for Ireland to become the 71st member. The IGF forum provides a valuable opportunity to engage with over 70 fellow member countries on a broad range of important policy issues such as development, environment, gender issues, mine closure and responsible supply chains. Through its membership, Ireland hopes to be able to share its own best practice policies and learn from the experience of others as we work together on ensuring that mining contributes fully in the achievement of the UN Sustainable Development Goals. In addition, a half day presentation on "Ireland – **Open for Business**", organised by Geoscience Ireland, took place.

Ireland's overall ranking in the Fraser Institute's, annual survey dropped when compared to previous years. It nonetheless was ranked in the top 20 for overall investment attractiveness (coming 19th) and in the top 10 for Policy Perception (4th position).

My Department continued to support **Geoscience Ireland (GI)**, a business cluster of 39 Member Companies, delivering integrated expertise in water, minerals, environmental and infrastructure development to clients in over 50 countries. GI is supported by Geological Survey Ireland (a division of my Department), Enterprise Ireland and Department Foreign Affairs and Trade.

The TELLUS Programme, continued surveying and has now mapped approximately 50% of the country. The data from this programme is available to a range of end users including the mineral exploration, environmental management, agriculture, human health and research sectors across Ireland.

As Minister of State at the Department of Communications, Climate Action and Environment, I wish to confirm my support and commitment to maintain an active mineral exploration and development industry in Ireland. The Government will continue to facilitate the responsible, environmentally sustainable exploration for and extraction of mineral resources.

I wish the IMQS and the extractive industry the very best for 2019.

Message from the President

by John Francis, Customer Account Manager, Finning Ireland Ltd.

Welcome to the 2019 Annual Review

It hardly seems like 12 months since we put together the last edition of this publication, what a busy year we've had!

There were a couple of position changes at our AGM earlier this year, due to work commitments Mike Lowther has made the difficult decision to step down as Vice President, this role has been filled by Nicola Nixon of Tara Mines, in addition, Les Sanderson took the decision to step down as Treasurer and has been replaced by Jennifer Craig of ICrag, I know both ladies have big plans for the society going forward and I wish them the very best of luck.

On behalf of all our members I want to thank Les for his many years of service as Treasurer and Mike for his assistance in the Vice President position, both will continue to work with us as council members.

Brexit

This time last year we were all gearing up for the Brexit deadline of March 29th, 2019, it came, it went, and we're all still none the wiser as to what the final outcome will be. As Teresa May steps aside, the change of UK Prime Minister is a cause for concern, who will take over and what will be the impact?

The Economic and Social Research Institute recently reported that the economic impact of Brexit on Ireland will be considerable in either a deal or no-deal scenario, with a cost to output this year of between €1.8bn and €7.5bn.

It says the economic shock of Brexit will have negative effects for Irish households, businesses, jobs and government finances. The latest ESRI assessment of Brexit's impact on the Irish economy looks at three scenarios - a deal, a no deal and a disorderly no deal.

Ten years after Brexit, the study says output in the economy would be 2.6%, 4.8% or 5% lower than if Britain had stayed in the EU. In today's money terms, that would mean a Brexit cost to the economy of between €8bn and €15bn.

So now as we look towards the new date of October 31st we are still in the same position as we were this time last year and wondering will they stay, or will they go? And as the EU leaders insist there is no more room for negotiation, will it be Deal or No Deal?

Drilling Apprenticeship

Working with Carlow IT and Geoscience Ireland the IMQS have been involved in the development of a new Geo-Driller course which has recently been approved by the Apprenticeship Board through SOLAS.

The course, set at FETAC Level 6. The course will focus on drilling and related skills in key areas of Mining/Quarrying, Geotechnical, Exploration, Directional and Water. The course length will be either two or three years and will have an allowance to fast track drillers with significant proven practical experience.

It is hoped that it will start by January 2019 and more information can be found on our website. A special word of thanks must go to Brendan Morris and Sean Finlay who have worked tirelessly for over 2 years to get this course up and running.

PDAC

As covered later in this edition, Ireland & IMQS were once again well represented at the Prospectors and Developers Association of Canada earlier this year, along with their respective organisations IMQS was represented by Sean Finlay, Jennifer Craig and Andrew Gaynor.

Unfortunately, this year's results of the Fraser Institute's Survey of Mining Companies are not as complimentary to the Irish mining sector as we have been used to over the last number of years and we have seen our rankings slip significantly against our international competitors from 4th to 19th for Investment Attractiveness, this combined with drop from 1st to 4th for Policy Perception gives us some cause for concern.

One can only assume, this is partially because of some legislative changes late last year with regard to planning requirements for exploration drilling.

Thankfully this matter has now been resolved but we cannot afford to lose sight of how these changes can impact our industry, I appeal to our legislators to liaise with the industry bodies in advance of making changes which may have detrimental effects on our sector.

Membership

With the economy growing and strengthening so too does our membership, in particular our corporate membership, which has seen 110% increase in the last 12 months and now totals 38, this, along with our general membership represents an impressive cross section of people and organisations involved in the extractive industries from the four corners of the island. We appreciate your continued support and the council will continue to work diligently to offer our members a society to represent the entire industry and one you can be proud of.

Once again I ask you the members to get involved with the various activities and trips we arrange, your input is greatly apricated.

Health and Safety

We continue to focus on Health and Safety and both Ciaran Greenan and Brendan Morris continue to work with the Quarry Safety Partnership on our behalf, the newly published Safe Quarry Guide for Quarry Workers has been well received and the All-Island health and safety conference held in Blessington in October 2018 was a massive success and very well supported, the combined conference and exhibition was a new venture for us and took quite a bit of organising and I want to take this opportunity to thank the hard working committee who pulled it all together, Ciaran Greenan, Nicola Nixon and Andrew Gaynor along with Jim Holmes of the Health and Safety Authority and Joanne Boylan of the Irish Concrete Federation. I also want to thank Roadstone for allowing us to use their premises.

Website

Where can you find UpToDate industry news, free advertising, free job posting and a target audience?

The IMQS website that's where!

Since the relaunch of our website we have had an ever-increasing number of visitors from around the world and we continue to engage with local business to help promote their brands and offerings, if you have a success story that you'd like to share please let us know.

Make sure to stop by and see for yourself, you'll also find us on Linkedin and Twitter.

www.IMQS.ie

Dinner Dance

Last years Dinner Dance saw us back at the KClub for the second year, the day started off with the golf tournament which proved very popular and congratulations to Gordon Best who came out on top after a more than slightly competitive morning!

A few slight changes to the running format made for a very enjoyable evening with dancing and fun had well into the wee hours. I'm already looking forward to returning to the KClub again this year and I look forward to meeting you all on November 9th.

EFEE

Almost two years ago, through his work with the European Federation of Explosive Engineers, IMQS secretary Alan Dolan highlighted to the council the possibility of hosting the EFEE world conference in Ireland, after some discussion internally and with Failte Ireland we have recently submitted our expression of interest to host the 2023 conference in Dublin, in September, an IMQS delegation in conjunction with the Dublin Convention Bureau will travel to Helsinki to meet with the EFEE council and present our bid to host the event.

If successful, this will be the first time that the conference will be held in Ireland and it will not only offer the local industry a chance to participate and engage with industry leaders from around the world but will also provide a massive boost to Dublin tourism.

Field trips

This year we have combined two site visits to provide what I'm sure will be a very interesting day on June 6th, firstly a visit to the new CDE Global Headquarters in Cookstown, followed by a visit to Dalradian Gold, the trip is fully booked well in advance which is a very positive sign, I want to thank both companies for accommodating our members and I hope everyone enjoys the day.

With the demand so high hopefully we can arrange another field trip later in the year or very early in 2020, if you are interested in hosting a visit please let us know.

Planning Seminar

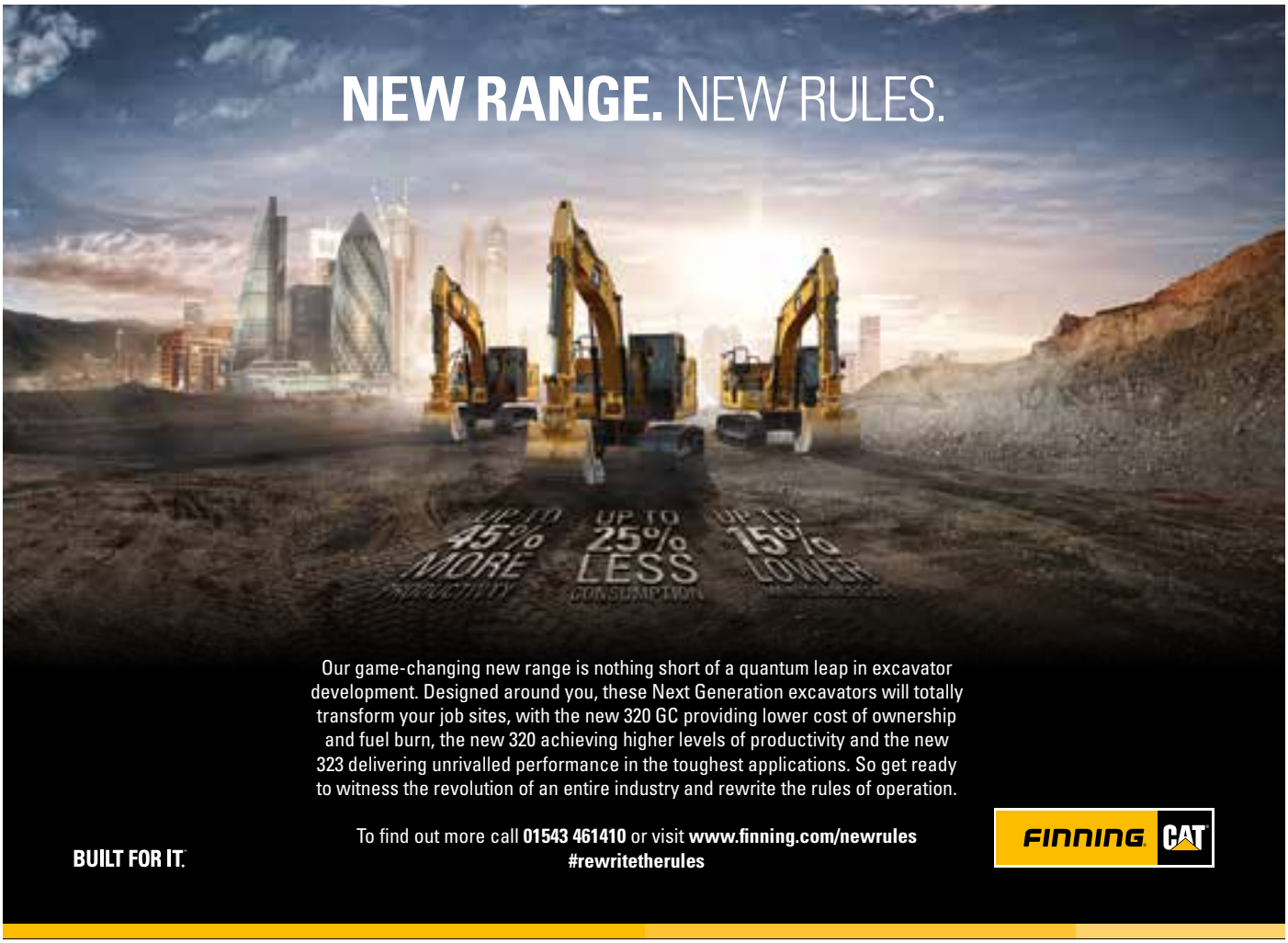
In February we held a Planning, Regulatory and Environmental Law Seminar and once again there was a full house for what proved to be a very informative day with an excellent line-up of speakers and presenters. There was excellent audience participation and plenty of open discussion on what clearly is a very complex and important topic to all our members.

Following on from the success of this event and a survey conducted by Geoscience Ireland after PDAC there appears to be a definite appetite for more of these types of events and I'm glad to say planning is well under way for our next event in October, I'm sure this will be another sell out so be sure to make your bookings early.

It's hard to believe that by the time you're reading this I will be almost halfway through my second year as President. I have thoroughly enjoyed my time as President and have had the pleasure to meet and work alongside so many wonderful and interesting people since taking up the role.

I'd like to take this opportunity to thank my fellow council members for all their hard work and assistance, there is a genuine team spirit amongst the council and a great willingness to get stuck in and make things happen and long may it continue.

On a personal note I want to thank my employer Finning for their continued support in allowing me the flexibility required during my time as President.



Activities of the Society
May 2018 to May 2019

by Alan Dolan, IMQS Honorary Secretary

The following are the main activities of the society in 2018 and some of the upcoming events for 2019.

Further details can be found at www.imqs.ie.

Council Meetings

- 2018 - September 11th, October 16th.
- 2019 - January 8th, February 19th (AGM), March 16th, April 16th, May 8th.

Representations in 2018

Council members represented the IMQS at the following events/committees during 2018.

- Council of the European Federation of Explosives Engineers
- Prospectors and Developers Conference in Toronto
- Geoscience Ireland
- Sinn Fein Motion 68 on mining (by correspondence)
- Quarry Skills Certification Scheme meetings (QSCS)
- Quarry Safety Partnership (QSP)

IMQS Planning & Environmental Law Forum

As part of its 60th Anniversary Celebrations, IMQS held a Forum on Planning and Environmental Law in The Louis Fitzgerald Hotel Dublin on May 22nd 2018.

The speakers included

Yvonne Scannell, Professor of Environmental Law, Arthur Cox (Moderator)

Rory Mulcahy SC

Oisin Collins BL

Jarlath Fitzsimmons SC

Joe Heron (Murray)

Liam Smyth,Senior Manager (Regulatory Compliance), Irish Concrete Federation

Gordon Best (MPANI)

Siobhán Tinnelly (TOBIN Consulting Engineers)

Paul Lynam (BICC)

Gerry Farrell (ICF)

Stephen Walsh, (Geoscience Ireland, Panacea Research)

L-R: Yvonne Scannell (Arthur Cox), Liam Smyth (Irish Concrete Federation), Tom Moore (SLR Consulting), Brendan Slattery (McCann Fitzgerald), Sybil Berne (MacCabe Durney Barnes), Eoin McGrath (Geological Survey Ireland) Oisin Collins (BL).

All-Island Health & Safety Conference and Exhibition

The Irish Mining and Quarrying Society (IMQS), in conjunction with the Health and Safety Authority, the Irish Concrete Federation and the Health and Safety Executive NI, held this event on on 26th Sept 2018 at Doran's Pit, Blessington, Co Wicklow. Over 250 delegates, exhibitors and speakers attended the conference which focused on health and safety, and automation and technology in the extractive industries. Thirty-six companies exhibited at the event. For more detail see www.imqs.ie.

Annual Review 2018

The Annual Review 2018 as well as reviews from previous years, can be viewed at www.imqs.ie.

Annual Dinner Dance 2018

The 2018 annual dinner dance was held at the K-Club, in Straffan, Co. Kildare. The event took place on November 10th and was attended by nearly 300 people. It is likely that the 2019 Dinner Dance will be held again at the K-Club. Minister Sean Canney TD presented the keynote speech. This is always a great opportunity to re-connect with people from the industry and to make new acquaintances. A golf tournament was held on the same day on the Smurfit course.

Institute of Quarrying – Northern Ireland, Stone Crushers Ball

The annual Institute of Quarrying (Northern Ireland) Stone Crushers Ball took place in the Europa Hotel, Belfast on October 19th, 2018. John Francis & Brendan Morris joined our colleagues from Northern Ireland and the UK, at the event.

Annual Field Trips

There were two field trips in 2018. The first on June 18th to Aughey Screens, Killyconigan, Monaghan, and the second on September 6th to Kilkenny Limestone, Kellymount, Paulstown, Co. Kilkenny. Both excellent trips that were well supported.

Mine Rescue 2018

Regular mutual training continued in 2018 between Boliden Tara Mines, Irish Salt Mining and Exploration, Dalradian Gold and Gyproc.

In June 2018 Boliden Tara Mines competed in the 69th Ontario Mine Rescue Provincial Competition, hosted by Almos Gold Young Davidson Mine in Matachewan, Ontario. Tara were highly commended, especially for their performance in both the Search and Rescue and First-Aid.

The PSNI emergency planning group invited IMRC to participate in a multi-agency exercise at the Marble Arch

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Caves in September 2018. The object of the exercise was to test the JESIP (Joint Emergency Services Interoperability Principles). The IMRC were represented by Dalradian Gold and Boliden Tara Mines.

Irish Salt Mining and Exploration are planning to host the 2019 All Ireland and UK Mine Rescue Competition in early summer.

A full summary of Mine Rescue activities can be found in the 2019 review.

Geo-Driller Course

Geoscience Ireland, in collaboration with the Institute of Technology Carlow, is developing a Geo Drilling Apprenticeship.

Due to commence in September 2019, the Geo Drilling Apprenticeship will deliver a Level 6 qualification for drillers in the mineral exploration, mining, quarrying, water well drilling, site investigation and directional drilling disciplines. IMQS is represented on the Apprenticeship Steering Committee by Brendan Morris.

Events in 2019

1. Our AGM was held in the Spa Hotel in Lucan on Tuesday, February 19th 2019. The meeting was followed by the IMQS Planning, Regulatory & Environmental Law Seminar.

   The speakers were;

   John Francis, President IMQS

   Eoin McGrath, Head of Minerals GSI

   Tom Moore, Principal Engineering Geologist, SLR Consulting

   Liam Smyth, Senior Manager (Regulatory Compliance), Irish Concrete Federation

   Brendan Slattery, Partner, McCann Fitzgerald

   Sybil Berne, Planning Consultant, McCabe Durney Barnes

   Panel on Recent Case Law;

   Yvonne Scannell, Professor of Environmental Law, Arthur Cox (Moderator)

   Oisín Collins BL

   Aoife Carroll BL

   Brendan Slattery, Partner, McCann Fitzgerald

2. The annual Prospectors and Developers Association of Canada (PDAC) Convention was held in Toronto, March 3rd- 6th 2019. The IMQS was represented by Sean Finlay (Past President) and Andrew Gaynor (Executive Secretary).

3. The Annual Field Trip for 2019 to CDE Global (ww.cdeglobal.com) and Dalradian Gold Mine (www.dalradian.com) took place on 6th June 2019.

4. Irish Salt Mining and Exploration are planning to host the 2019 All Ireland and UK Mine Rescue Competition in early summer 2019

We also have a very active LinkedIn page available for members and non-members and all activities of the society are kept up to date.

We have increased our Corporate Membership number significantly in the last two years. With benefits such as free advertising on the IMQS web site, free job postings, IMQS support, BIK reduction for individual members and regular information updates, being a corporate member is an excellent investment for any company - large or small. membership details available at www.imqs.ie/imqs-membership-2/#corporate.

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

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

View from the North

by Gordon Best, Regional Director MPANI

As always I am honoured to be asked to pen this short article for the IQMS Journal and its great to see IMQS going from strength to strength. This is my first article as Director of the Mineral Products Association NI having rebranded on the 1st January this year. The move to MPANI comes after.

With the current Brexit uncertainty and toxic political atmosphere in Britain plus the unacceptable failure of re-establishing our local Executive and Assembly it would be very easy to get angry and despondent about the immediate future. Over the past three years the NI Business Community has united and come together like never before to inform and encourage decision makers so that the decisions that are taken have Northern Irelands interests at their core. The message to our Political Parties and Politicians is "Get back to work and get it sorted by putting people before politics"

Make no mistake a No deal would immediately put Northern Irish jobs and businesses at risk and jeopardise years of positive economic development and integration across the island.

I believe in the tenacity, innovation and adaptability of NI Business. I've said before that when you look around these islands and further afield the presence, professionalism and skills of NI business people is ever present. Whether it is the Agri-food sector exporting around the world, our materials handling sector from Mid Ulster continuing to grow markets all over the world, our precast concrete suppliers leading the way across the UK, our construction contractors winning work in all parts of the UK, road safety across the UK still dependent on our supply of high PSV stone from Co Down, our manufactured products and IT skills in demand all around the world the future is definitely bright. Of course the common denominator in all of this is the skills, personality of our people and the experience of what we have come through and had to overcome. That is why I have every confidence for the future!!

That confidence has been particularly reinforced by listening to our MPANI Young Leaders and seeing their enthusiasm for our Industry, my engagement with GCSE Construction Students and their tutors during our initial presentations to schools. I can honestly say that the conversations we have had in our Highway Maintenance and Construction Group and our Concrete Development Group together with all of our Professional Bodies like IoQ, CIHT, IAT and Concrete Society highlight a real hunger and desire to raise the bar within our Industry in developing skills, career paths and significantly improving diversity across all the disciplines we represent. You will see in our MPANI objectives for 2019 below a core commitment to focus on training, skills development and promoting our Industry as a worthwhile, diverse and rewarding career opportunity.

MPANI Young Leaders Group visit to CDE GLOBAL HQ in Cookstown earlier this year.

MPANI Focus Areas and Objectives for 2019

Role – Facilitator to/from Government influence

Objective 1 - Continue to work with the Department of the Economy, GSNI, Strategic Planning Division and local Council Planning staff to establish a Northern Ireland Minerals Forum. If and when the Assembly returns work to establish a All Party Group on Minerals.

Objective 2 - Continue to build the knowledge and capacity of local planning officers to ensure their understanding of the industry results in a fast and efficient service to QPANI members.

Objective 3 - Respond to the local development plan policy statements to ensure that the long term sustainability and its right to operate are protected. Encourage the Industry to supply the relevant aggregate resource and production information to enable Councils' to develop local mineral plans.

Objective 4 - Work with regulatory authorities within Northern Ireland to ensure a level playing field for industry and clear recognition for responsible operators.

Objective 5 - Respond to Consultation Papers on issues that affect our Members.

Objective 6 - Continue to work with Northern Ireland Construction Group (NICG) partners to improve the communication of the pipeline of infrastructure work, improve skills within construction and see increased public and private investment in our infrastructure.

Role - Education internal/external

Objective 1 - To advise and inform the industry on its legal obligations under health and safety to ensure that improving performance on reducing incidents of harm continues. Key focus areas this year will be the " The Fatal Six" identified by MPA.

- Isolation of Energy
- Struck by Vehicle/Plant
- Work at Height
- RTA
- Struck by Falling Moving Object
- RCS

Objective 2 - To develop and deliver training and competence assessment in partnership with IoQ, IAT, CIHT, MPQC, CITBNI and others to raise skill levels across all sectors that QPANI represent and with customers who use our members products.

Objective 3 - To engage with, present to and assist schools in the delivery of the GCSE in Construction, particularly

covering the areas of the sustainable and responsible supply of construction materials.

Objective 4 - To work with NIEA and others through our Biodiversity / Geodiversity to improve environmental awareness and communicate our new Nature with Aggregates Guidance to create strategic partnerships at a local level between QPANI Members and local stakeholders.

Objective 5 - To take every opportunity too engage with political decision makers to highlight the essential contribution the construction materials sector makes to the local economy.

Objective 6 - Work with key stakeholders and our Young Leaders Group to promote diversity and the important role of women within the Construction Materials Industry.

Role - Protect & expand market

Objective 1 - Continue to work with Public Sector Agencies, including local Councils, and other construction representative bodies to promote the use of quality assured materials and responsibly sourced construction materials.

Objective 2 - Stage a Concrete and Masonry seminar in the Spring of 2019 and attend the annual Building Control Fire Safety Conference.

Objective 3 - Continue to develop an effective Concrete Built IS Better Built promotion campaign.

Objective 4 - Sustain and Increase the QPANI Membership.

Health and safety is and will continue to be our key priority in 2019 and our Health and Safety Committee will be focusing its, along with the rest of the MPA family, attention on the Fatal 6! As highlighted above.

Following the news that the British Aggregates Association (BAA) had dropped all Aggregates Levy litigation both in Europe and the High Court in London the Government announced it intends to carry out a comprehensive review of the Levy.

The Aggregates Levy has been largely unchanged since its introduction in 2002. The Government is conducting this review of the levy over the next year, working closely with the devolved Governments throughout. The review will be comprehensive, looking at the latest evidence about the objectives of the levy, its effectiveness in meeting that objective, and the design of the levy, including the impact of devolution. The Terms of Reference for the review have been published and an expert working group will be established to inform it. The review will aim to conclude by the end of 2019.

An expert working group, comprising of Industry Representatives and other Stakeholders, has been established to work with Government. Treasury has already published a Terms of Reference and set dates for meetings of the Expert Panel later this year. I am delighted that MPANI will be an important participant on the expert panel. Treasury and HMRC officials visited Northern Ireland in May to visit a number of our Members operations to hear about the impact of the Aggregates Levy first hand.

Our visit to Erne Integrated College to speak to GCSE Construction Students.

On the health and safety front we are working with HSENI on plans to hold a series of workshops later this year focusing on Dust, vehicle maintenance and mental health. As many of you will be aware HSENI, supported by MPANI, are working with the Industry on promoting and implementing a Managing dust strategy. At our recent H&S Committee meeting Ken Logan reported that HSENI were pleased with the efforts of the Industry in working with them on implementing the Dust Strategy. A number of companies have submitted action plans and visits by HSENI are continuing. Ken added that a number of workshops will be held later this year that will focus on the managing dust and where best practice will be shared.

The 2019 "Stay Safe" campaign has commenced with the promotion of **'Managing Safety at Inland Waters'. (click link https://www.agg-net.com/news/managing-safety-at-inland-waters**

This RoSPA-produced publication from the Inland Water group of the National Water Safety Forum, of which MPA is a part, has been a collaborative exercise involving a wide range of stakeholders who are directly involved with the management of public safety on inland waters. We will promote the document amongst our members and beyond as it will help deliver the objectives of the National Drowning Prevention Strategy.

Planned local activity for this year will continue to follow the MPA strategy. MPANI will again team up with HSENI in our joint letter to all Headmasters of local schools. We will partner NI Water in a joint press statement warning of the dangers of swimming in cold quarry lakes and reservoirs. MPA will support and leverage off the drowning prevention campaigns of other major safety organisations such as RNLI, RoSPA and RLSS.

On the planning front MPANI are in the process of drafting a response to the Ards and North Down Council Preferred Options Paper. We also recently submitted a detailed response to the Mid Ulster Draft Plan Policy.

A number of meetings with Members were held with Mid Ulster Members prior to the submission and it was great to see that the vast majority did engage with the Council and submitted responses to the Draft Plan Policy. We continue our ongoing engagement with the Department for the Economy focusing on the need to gather as much information as possible as part of the annual quarry return and to improve the information gathering from our aggregates industry for local councils as part of the information input to their Local Development Plan process.

As an Association we are working very hard, and to be fair making steady progress, in encouraging our Members, (we don't represent everyone) to complete any information requests on aggregate production, permitted reserves and sales both locally and regionally. However there is still a long way to go!! In an effort to build relationships and understanding between our Industry and local Council planning departments we are organising a series of meeting with local planners and operators from each Council area, We have already met with planners in Ards and North Down and in Causeway Coast and Glens. The positive news is that a number of Councils have responded to our request and meeting dates are currently being agreed.

May I wish IMQS and all your members every success in 2019 and the coming years ahead.

mpa Northern Ireland
essential materials sustainable solutions

Irish Mine Rescue Committee 2018 – 2019
Continued Good Progress

by Mike Lowther, Chairman, Irish Mine Rescue Committee and
Aoife Tallon, Secretary, Irish Mine Rescue Committee

Mutual training sessions were held throughout the year, of particular note was the multi-agency exercise held at Marble Arch Caves in September 2018. The highlight of the year was Boliden Tara Mine's performance at the 69th Ontario Mine Rescue Competition in June 2018.

Boliden Tara Mines participate in 69th Ontario Mine Rescue Provincial Competition – June 2018

Ontario Mine Rescue operates a network of mine rescue stations across the province to ensure adequate emergency preparedness and response. Tara Mines has a long history with Ontario Mine Rescue which dates back to the 1970s when the two organisations worked together on a mine rescue standard for Tara Mines.

Today the mine rescue programme at Tara Mines is still based on Ontario principles. Although some techniques have been adapted to suit Irish Mining Legislation, common principles remain. Tara Mines previously competed in Ontario Provincial Competitions in 1999 and 2008.

2018's competition saw teams responding to a series of emergency incidents underground, including building a bulkhead and using high expansion foam to extinguish a fire; locating 6 missing persons and bringing them to safety and using rope rescue rigging to assist an injured miner approximately 80 feet down a mine shaft.

Advancing on ramp.

Throughout the competition Captain Paul Smith and his team put on a display of professionalism and technical ability that really impressed the judges. The team were unfazed by any differences in equipment or by the unfamiliar mining environment which is in part thanks to the IMRC's mutual training programme.

Preparing to assess casualties.

Rebuilding and field testing BG4s .

They managed to beat the average time for successfully completing the simulation by 20 minutes. The team were not eligible for awards but were highly commended for their performance. Their performance demonstrates the high standard of mine rescue across Ireland.

Mutual Training 2018

As part of the IMRC's Mutual Assistance Programme, a number of mutual training exercises took place throughout the year. Exercises were hosted by Dalradian Gold, ISME and Boliden Tara Mines.

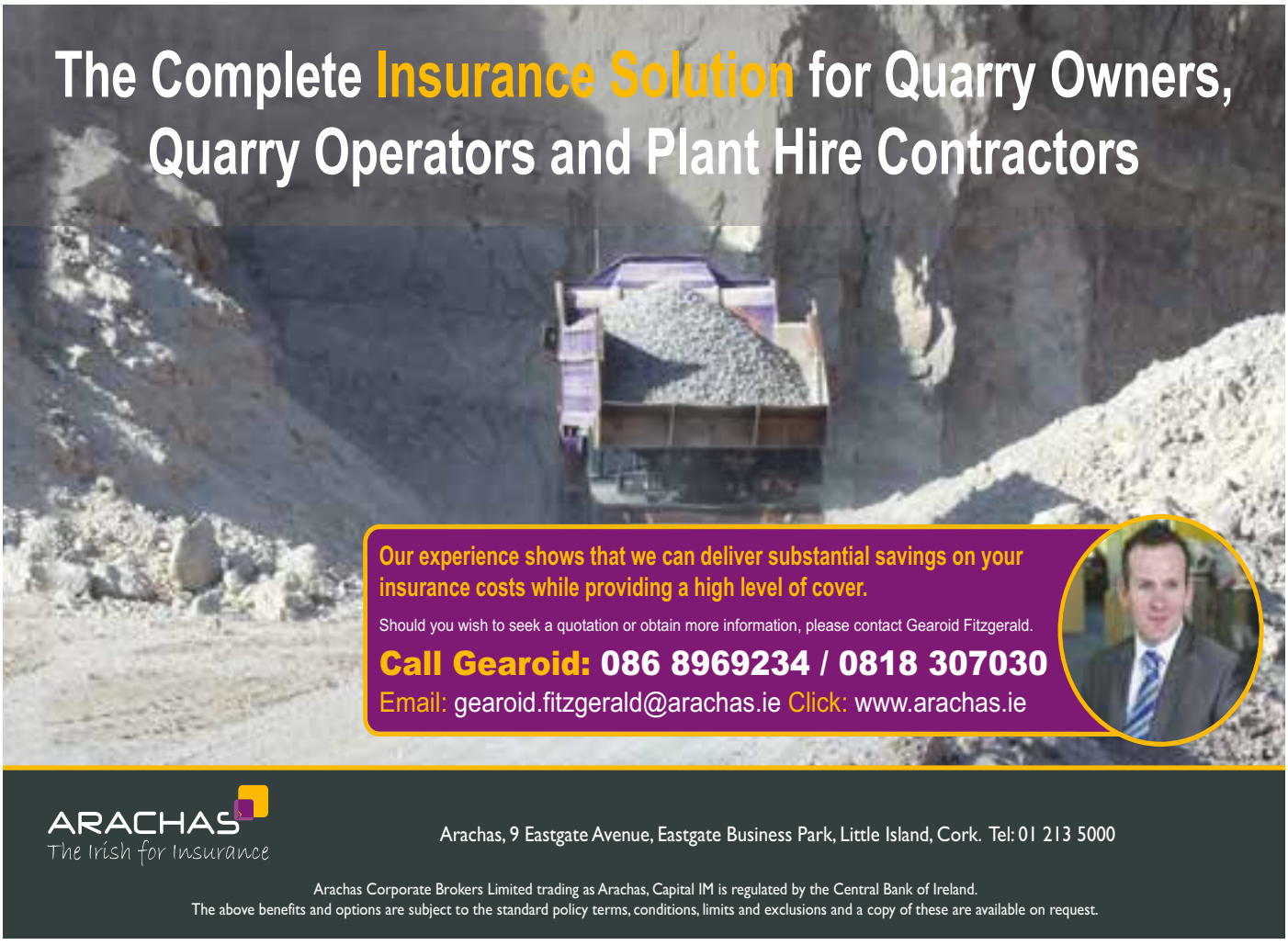
The Mutual Assistance Programme allows for all IMRC affiliated mines in Ireland to access mine rescue assistance from other IMRC affiliated mines.

Mutual training exercises serve to establish common mine rescue protocols and allow personnel to become familiar with the mining environments, mine rescue facilities and equipment utilised at the different mines.

The exercises test emergency preparedness, identify opportunities for improvement and allow for mine rescue personnel from different mines to be

CONTINUED ON NEXT PAGE

Combined team of Boliden Tara Mines, Dalradian and ISME in the field.



Captain Paul Smith receiving a presentation on behalf of the team from Ontario Mine Rescue Chief Mine Rescue Officer Shawn Rideout.

CONTINUED

integrated into one team which ensures personnel can co-operate effectively should mutual assistance be required during an emergency.

PSNI Multi-Agency Exercise at Marble Arch Caves – September 2018

The PSNI emergency planning group invited the IMRC to participate in a multi-agency exercise at the Marble Arch Caves, County Fermanagh. The aim of the exercise was to test JESIP (Joint Emergency Services Interoperability Principles).

The IMRC were represented by Dalradian Gold and Boliden Tara Mines.

The exercise involved the Search and Rescue of a missing casualty from the cave.

The multi-agency team was made up of members from IMRC, Police Search and Rescue and NI Ambulance (HART). HRH Duke of York attended the event and observed the various teams in operation.

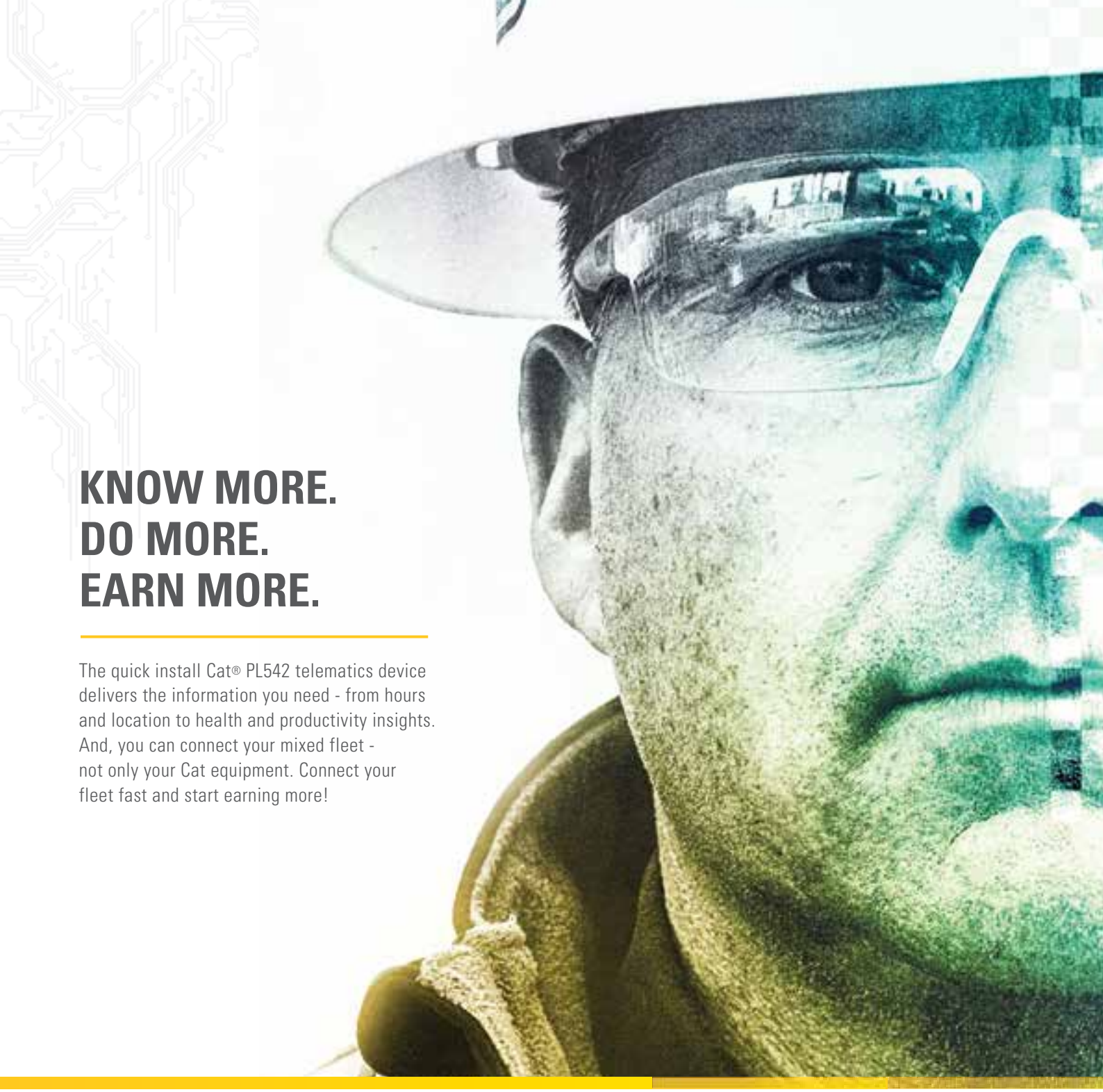
Summary

Although there was no All Ireland and UK Competition in 2018, the IMRC continued to co-ordinate mine rescue activities in Ireland, and to liaise closely with emergency services north and south.

2019 will see the return of the All Ireland Competition, hosted by ISME in June.

A combined team of ISME, Dalradian and Boliden Tara Mines returning to surface with a casualty after a mutual training exercise

L-R Anthony Moran (Dalradian), Richie Cahill (Boliden Tara Mines), Cloe Lam (Dalradian), Orla McKenna (Dalradian), Cian O'Meara (Dalradian), Ken Logan (HSENI).



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The saga of 'Brexit' this year

by Gerry Farrell, Chief Executive of the Irish Concrete Federation

I would like to thank the Irish Mining and Quarrying Society for their kind invitation to contribute to its Annual Review for 2019 and to wish the Society well in the current year and beyond. In particular, I would like to send best wishes to the current Executive Secretary of the Society, Mr Andrew Gaynor and current President, Mr John Francis, with whom we worked successfully in the organisation of last year's All-Island Quarry Safety Conference.

The Society's decision to feature the saga of 'Brexit' this year, while not unique, is certainly timely. At time of writing, the Tánaiste Simon Coveney has indicated that the risk of a 'no-deal Brexit' has never been higher as the administration of Prime Minister May nears its end and her replacement with a Prime Minister more aligned with the 'hard-Brexit' faction within the Conservative party becomes a likely reality.

It is clear that any deal agreed between the European Union (EU) and the United Kingdom (UK) requires compromise, a reality that unfortunately has still not dawned on many. In the absence of compromise, it is likely that the UK's exit from the EU in October will be on the basis of the dreaded 'no-deal Brexit', unless the House of Commons decides otherwise.

While speaking at the IMQS Planning Seminar in 2018, I expressed the view that a 'soft-Brexit' was damage limiting at best and a 'hard Brexit' was incompatible with a frictionless border on the island of Ireland and between the UK and mainland Europe. In the intervening period, much time has been invested in politics, as the 'art of the possible,' to find a workable solution to this conundrum. Unfortunately, in this case politics has simply crystallised the practical truths of 'Brexit' and deeply polarised opinion in the UK.

One can simply hope that the necessary leadership and compromise comes to the fore in the coming period to avoid a 'no-deal Brexit' and the negative implications that will flow from such a course of action. So what are the practical implications of 'Brexit' for the Irish aggregates and concrete products industry? On June 24th 2016, the date on which the result of the 'Brexit' referendum became known, the ICF was holding a regional meeting in Cork. It is fair to say that at the meeting there was a general lack of knowledge of what the implications of the 'leave' decision were. While the political future is little clearer three years on, knowledge of the likely practical implications for our industry has increased greatly.

While our industry is not as exposed as others in terms of trade with the UK market, the reality is that 'Brexit' and in particular **a 'no-deal Brexit', will have a negative impact on our industry**. The Irish aggregates and concrete products industry is highly dependent on a robust Irish economy. In March of this year the Minister for Finance estimated that a 'no-deal Brexit' could reduce growth in the Irish economy by 2% from its expected level. This contraction in growth will impact on demand for our industry's products as it is likely that public and private investment will be curtailed.

Government's infrastructural investment plans, as outlined in 'Project Ireland 2040' and which are highly dependent on a ready supply of construction materials is based on multi-annual funding from the exchequer which will undoubtedly come under close scrutiny in the event of a 'hard-Brexit'.

In addition, the Irish food sector and its farming supply base has been a very valuable market for our members throughout Ireland and given the Irish food sector's dependence on the UK market, it would be naive to assume that the introduction of WTO tariffs and duties on Irish exports would not have a negative impact on the agri-food sector throughout the country.

A major achievement of the concrete sector in Ireland during the recessionary years was the growth in **Irish precast concrete exports from zero in 2006 to over €130million in 2017**. While official export values for precast concrete have not yet been made available by Enterprise Ireland, it is likely that further export growth was achieved in 2018.

Brexit will impact directly on these exports primarily through an expected reduction in UK construction activity sector which will dampen demand. Additionally, the imposition of tariffs, while not as significant as those which apply to food exports, will reduce the competitiveness of Irish exporters as will the cost of new customs arrangements, necessary to facilitate trade even in the event of a 'soft-Brexit'.

However it is likely that the most immediate impact will be the predicted fall in the value of sterling which, despite some recovery in recent months, will more than likely see further depreciation in the event of a 'no-deal Brexit'. Such an outcome will certainly damage Irish exporters' competitive position relative to UK manufacturers in the marketplace.

While the magnitude of the previously mentioned impacts of 'Brexit' depend on the nature of the UK's exit from the European Union, there are a number of inevitable implications for domestic producers and exporters in the aggregates and concrete sector in the area of standards and certification. It is certainly positive to see that the UK is currently drafting legislation on product standards which is likely to be similar to equivalent legislation on EU standards in order to facilitate ongoing trade post 'Brexit'. It is therefore likely that, for the foreseeable future, **product standards in the UK will be similar to those within the EU**.

In addition, the British Standards Institution (BSI) has indicated that they intend to remain a member of CEN and that immediately post-Brexit the UK will continue to accept the CE mark for the placing of products on the UK market. However, it is likely that the UK will eventually introduce its own mark as an equivalent for the CE mark which will

inevitably means that exporters to the UK will be required to affix this new mark to products or supporting documentation, while also requiring the CE mark to place product on the domestic and EU marketplace.

In the area of product certification a 'no-deal Brexit' will mean that UK based notified bodies, of which there are 174, will cease to be EU notified bodies for the purpose of CE marking unless such notified bodies have established operations within the EU. Therefore all exporters who currently use UK notified bodies for the purposes of CE marking, should ensure that such notified bodies continue to be registered within the EU post-Brexit.

There will also be implications for notified laboratories which are required for the CE marking of certain precast concrete products. Similarly, importers of products will have to ensure that third party certifications of such products are by EU registered notified bodies, as they effectively become an importer from a third country and importers will assume additional obligations for placing products on the EU market.

Despite the political uncertainty, the

coming months must be used by companies to protect their business for the long term. Over the past year ICF has had extensive discussions with the National Standards Authority of Ireland (NSAI) in relation to standards and certification of products and has also taken advice on revenue and customs requirements on behalf of its members.

We have also engaged with Enterprise Ireland on supports available for our precast members to prepare for 'Brexit'. However, as long as the political road remains unclear, the ability of industry to prepare effectively remains difficult.

In the interim, **ICF has advised all its members to prepare for the worst** by identifying impacts and new requirements for supply chains, logistics, product certification and licensing and revenue and customs procedures for their own businesses. At this stage it would seem inevitable that these new requirements will eventually become a reality. The only question remaining unanswered is when.

While regrettable, it would seem highly likely that the UK will leave the EU and our nearest neighbour and largest trading partner and will assume third country status. As ever in business, certainty on the eventual outcome and time to prepare is what is needed to avoid the most negative impacts of the Brexit 'saga'.

The political representatives within the EU and the UK are charged with the responsibility of achieving compromise to facilitate citizens and business alike to prepare for new realities. To date there has been little sign of support for such agreement and compromise. If ever there was a time for politics to prove itself as 'the art of the possible' it is now.

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Uncertainty and Deadlines Make "no deal" Brexit Planning Crucial

by Katie Daughen, Head of Brexit Policy, British Irish Chamber of Commerce

The risk of a disruptive, "no deal" Brexit is now higher than it possibly has ever been throughout the Brexit process. So much so that in July the Irish Government published its updated Contingency Action Plan calling on businesses to prepare for this scenario.

The recent victory of Boris Johnson in the Conservative leadership contest and his appointment as Prime Minister of the United Kingdom has firmly put "no deal" back on the political agenda. His actions since taking up office firmly indicate that he is serious thus far, about carrying through the "do or die" exit promised during his leadership campaign.

The Prime Minister's stated intentions of renegotiating the Withdrawal Agreement and removing the Protocol on Ireland/ Northern Ireland (the "Backstop") has been rejected by the European Commission. So far, the line has remained that the current Withdrawal Agreement is the only deal on offer and while flexibility remains over the wording of the Political Declaration, negotiations on the Withdrawal text are now closed.

At present it seems unlikely that the European Council will meet again before their next scheduled meeting on 17-18 October. Without such a meeting there will be no mandate for the Commission's Taskforce to offer the UK Government any new terms on the Withdrawal Agreement.

There is also now much speculation that a snap general election may be called in the UK when parliamentarians return from their summer recess in early September. Should an election not be called, there is also the possibility that the opposition Labour Party could lay down a motion of no-confidence in the new Prime Minister potentially precipitating a general election.

While the majority of MPs remain firmly opposed to a "no deal" outcome and while the ability of the Prime Minister to prorogue (essentially suspend) Parliament to obtain such a result has been limited; without a ratified Withdrawal Agreement in place, a "no deal" exit remains the default outcome of the process.

With Brexit now less than 100 days away, the current political climate presents many challenges for businesses over the coming months.

Unfortunately, businesses have no control over how Brexit will be resolved, but they can control how prepared they are for all possible scenarios. In the immediate aftermath of the referendum vote, businesses were unprepared for the sudden depreciation of sterling and lessons must be learned from this painful experience to ensure the same mistakes aren't repeated.

Regardless of the outcome, the UK will remain an important trading partner for Ireland and vice versa. Our similar tastes, business outlook, cultural ties and geographic proximity make us natural business and trading allies. While Brexit might disrupt this relationship, those in business will find ways to overcome these hurdles and maintain these vital links.

There are practical steps that business can take now to offset any potential pain in the future. Many have no financial cost although they will take time and energy – something we know is difficult for SMEs, many of whom are already running on tight margins and with very little extra capacity.

The first thing businesses should do is register for an Economic Operators' Registration and Identification (EORI) number. Having an EORI will be a basic requirement for trading with the UK if there is no deal. Registration should be one of the first steps in any business' Brexit plan. There is no reason why businesses should not have already taken this step.

Other steps to take include:

reviewing your supply chain to identify any potential pinch points/regulatory issues;

preparing for further sterling fluctuation;

and learning how new customs/trade rules might impact your business.

It's not all negative though. There are opportunities for those willing to take them. Businesses should look at forming strategic partnerships with likeminded UK firms to secure market share and access. There is also an opportunity for Irish firms to take over international trading licences for the EU market held by UK firms. And finally, for those reliant on the UK market for their survival, now may be the time to put boots on the ground and to expand your business internationally.

Now is the time to prepare. Engage with State Agencies and avail of business supports. Go through the Government's Brexit Preparedness Checklist.

The British Irish Chamber of Commerce is also here to provide information and guidance. Our Brexit Toolkit is a free resource and a great place to start when it comes to thinking about what you might need to do to prepare.

British Irish Chamber of Commerce

About the British Irish Chamber of Commerce

The British Irish Chamber of Commerce is a private sector trade organisation, founded in 2011 to represent businesses and employers with interests in the two islands of Great Britain and Ireland. The Chamber's mission is to highlight, protect and grow the trade between Ireland, Northern Ireland, Scotland, Wales and England. That trade is worth over €1.3 billion a week or €70 billion a year and it supports 400,000 jobs, about evenly between the two islands.

advertorial

Keeping an eagle eye out for innovation

By Tom Verner, Founder and Group Managing Director of Momentum

Businesses throughout the plant and civil engineering sector in Ireland are missing out on thousands of euros of R&D Tax Credits every year.

They are failing to claim their full share of a specific pot of government money from the Office of the Revenue Commissioners aimed at rewarding them for pursuing research and development processes.

A lack of awareness of the scheme is part of the reason it remains underutilised, but more of an issue is the fact companies, or their accountants, don't fully understand which processes fall within the criteria set out by the Revenue Commissioners.

That criteria is complex and needs knowledge both of the R&D Tax Credit system and of the industry to successfully make a claim which sticks. That's where we at Momentum Group come in.

We have a team of R&D Tax Credit specialists which includes R&D technical analysts, chartered accountants and specialist business consultants with a deep understanding of R&D tax relief legislation and its application, particularly in the plant and civil sectors.

To date we have examined hundreds of companies, identifying R&D activities with associated expenditure for the purpose of R&D tax claims.

This is a complex and specialised area, and the Momentum team excels at managing the entire R&D Tax Credit application process on behalf of our clients.

In most cases we find many of the day-to-day processes which companies are carrying out are eligible, processes which may seem humdrum at first but in the Revenue Commissioners eyes are innovative and therefore fall under the research and development umbrella.

Working in partnership with businesses in the plant and civil engineering sector, our experts are able to quickly identify those processes and then, crucially, apply for R&D Tax Credits on client's behalf in a way which meets the strict ethical criteria.

By doing that we have successfully claimed hundreds of thousands of euros for our clients under the scheme, money which would otherwise have gone unclaimed.

This reflects not only our expert knowledge of tax legislation and our ability to research and write the best possible claim for your R&D tax relief, but also our strong and ethical working relationship with the Revenue Commissioners.

The clients themselves haven't had to alter their business practises in any way and haven't had to expend much effort in apply for the R&D Tax Credits given we at Momentum Group shoulder nearly all that burden.

For proof talk to our array of clients in the manufacturing and mineral products sectors, clients which have been able to plough claimed money back into their businesses to make them more innovative and ultimately more competitive.

Contact us and we will be able to quickly identify if any of your processes qualify for R&D tax credits and will then take the hard work of applying for them off your hands. We do this every day for companies of all sizes in all sectors and know how the process works.

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SMEs in the construction sector are cautiously optimistic about the future

by Adrian Madden, Head of Sales Ireland at Close Brothers Commercial Finance

Amid the uncertainty which continues to surround Brexit, construction SMEs across Ireland and the UK are showing cautious optimism about the future.

According to the most recent Close Brothers Business Barometer, a quarterly survey of around 900 business owners in the UK and Ireland, more than half of SMEs working in building and infrastructure believe that the economy is set to grow, and a further quarter believe that although the path to prosperity may be slow, the worst is behind us. In fact, just 7% of those we surveyed believe there will be a downturn in the economy.

It's encouraging that economic confidence remains even with ongoing negotiations and the risk of the UK having a disorderly exit from the EU. The upbeat construction sector has the most positive outlook on long-term prospects, suggesting they believe that the UK and Ireland will continue to be a strong place to trade and work.

Business sentiments are also good. Looking ahead to the next 12 months, 90% of construction companies said they are feeling positive about their own futures. Of these, 45% said they believe they will expand and 45% expect to stay the same.

It is clear that construction firms are sending a strong message to the market that they are still open for business and while our survey did not explore all of the reasons behind this progressive attitude, there are likely to be many factors involved.

For one, we have seen significant investment here in Ireland, with new infrastructure being built in Cork, Belfast and many other areas between. The new opportunities this has created in construction and related industries has boosted job prospects for many, allowing trade to remain steady.

Another is that these SMEs tend to be asset rich, giving them additional flexibility when it comes to cash flow as they can release funds against their assets, such as equipment, plant and machinery.

This can be reassuring when creating strategic plans and goes some way to explaining why funding options such as asset and invoice finance often gain traction during turbulent periods.

Either way, SMEs should bolster these sentiments by ensuring they are prepared for various Brexit outcomes. Putting sustainable finance, trade and other critical arrangements in place can inform decisions and enable companies to thrive over both the short and long term, despite wider geopolitical changes.

Our Managing Director at Close Brothers Commercial Finance, Ciaran McAreavey, recently shared a similar message about working with small and medium sized firms in Ireland. **"We're confident about the future and will adapt whatever the wider political and commercial outlook,"** he said. "It's important to remember that SMEs are the experts when it comes to their own work. These businesses underpin the Irish economy and deserve support and funding which matches their resilience."

Close Brothers is merchant banking group in the UK and Ireland which provides lending, deposit taking, wealth management services, and securities trading. Close Brothers Group plc is listed on the London Stock Exchange and is a member of the FTSE 250.

To find out more visit https: //www.closecommercialfinance.ie/

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Creating Future Leaders in the Quarrying Sector

by James Thorne, IQ's chief executive officer

Tackling an ageing workforce and developing competence fit for the future of quarrying remains at the forefront of challenges within the mineral extractives sector. With the average quarry worker aged 55, how is the sector developing the next generation of young talent and creating future leaders?

Membership association, the Institute of Quarrying (IQ) is proudly doing its bit to combat the issue with the launch of the 'Creating Future Leaders' strategy. Launched at the IQ Fellows Lunch in the Tower of London, the strategy is a roadmap for future success.

It distils IQ's aspirations to become a leading international membership organisation, representing the interests and professional development of all people working in the mineral extractives sector.

Phil Redmond is President of IQ UK. He says: "The pace of change within the mineral extractives industry is accelerating and our vision is to be at the forefront of these changes. The way in which information and data are being consumed is changing the very foundations of the way we work. IQ's strengths are in attracting and developing the leadership talent that the industry needs now and in the future. We also recognise that in an increasingly globalised sector, IQ can be the beacon for professionals in mineral extractives across the globe."

"Our new strategy has evolved over the last couple of years into an inspirational opportunity to make the Institute more valued than ever for the future. Achieving that, and making it both relevant and meaningful internationally, is the result of close collaboration with our global IQ partners in Australia, Malaysia, Hong Kong, South Africa and New Zealand."

The four cornerstones of IQ's new strategy include becoming the global leader in standards for the sector, driving innovation and operational best practice, supporting the industry in driving healthy, sustainable workplaces and promoting the positive impact of the industry and profession.

Through the IQ Skills Wheel and partnership collaborations, IQ will establish a benchmark for competency that is widely recognised, whilst signposting individuals to relevant professional development from all parts of the industry.

Hollowford April 2019

Developing Leadership Skills at Hollowford

Working in partnership with the University of Derby Centre for Mineral Products, developing and supporting technical and leadership skills for the world of work is a core part of the Higher Apprenticeship programme. The compelling partnership between IQ and the University delivers tailored learning programmes for young people interested in developing their career in the industry, as well as supporting those already working in mineral extraction.

As part of the educational programme at the University, every year Higher Apprentices from the University of Derby's Centre for Mineral Products participate in a week of outdoor activities supported by the Lindley Educational Trust at its Hollowford Centre in the Peak District.

Year 1, 2 and 3 students complete a series of tailored programmes of hands-on challenges specifically designed to inspire future industry leaders and develop new skills. The apprentices are employed by independent operators and large multinationals from across the UK and range in age from their early 20s to late 40s.

Mark Osbaldeston MIQ is Head of Centre for Mineral Products at the University of Derby and a former apprentice himself. He says: "The week at Hollowford is an annual highlight for our apprentices and the programme grows each year. It provides a great opportunity to take learning scenarios out of the classroom and apply them in an inspiring setting. Plus apprentices get time to socialise and share experiences and ideas with colleagues from across the mineral products sector.

"It's also a great focal point for partner organisations, including our colleagues at the Institute of Quarrying. The Institute is an essential contributor to our higher

apprenticeship and degree level courses. Having them join us at Hollowford is a real bonus for the apprentices, particularly as this year they are taking a more hands-on role in the programme, applying their experience and expertise to a number of activities."

Celebrating excellence

The Institute of Quarrying has proudly launched its first ever industry-wide awards. The IQ Excellence Awards celebrate the personal and professional achievements of people working in the mineral extractives sector across five UK regions: Scotland, Northern Ireland, Wales, North England and South England.

Each regional award winner automatically goes forward to the national excellence awards to compete for the overall national title in each category.

James Thorne, IQ's chief executive officer, explains: "This is all about celebrating success, with a particular focus on recognising excellence at a local level and nationally. That's why the IQ Excellence Awards are two-tiered awards, with winners in each of the five regions, as well as a grand final.

"The grand final itself will take place at Hillhead 2020. All of our regional winners will come together for a very special evening at which the national winners will be crowned. It promises to be an amazing evening so we're encouraging everyone to get involved."

Hollowford April 2019

Recognising the commitment to continuing professional development, the award categories are aligned to the different quadrants of the IQ Skills Wheel.

For more information about the Institute of Quarrying, visit its website: www.quarrying.org.

The Sustainable Underground Mining Project at LKAB

by Mike Lowther, Test-Mine Manager
and Tina Benson, Communications Officer

LKAB is an international high-tech mining and minerals group that mines and processes northern Sweden's unique iron ore for the global steel market. One of many challenges facing LKAB over the next few years is the development, planning and installation of a new mining system below the current main levels in Kiruna and Malmberget, at depths approaching 2,000 metres. We are aiming for a mine of the future that is carbon dioxide-free, digitalised and autonomous. We call it Sustainable Underground Mining.

Future Challenges must be Solved

LKAB is dependent on its ability to pursue technological and process development, and a number of future challenges have to be solved. In the next couple of years, ore must be mined at even greater depths on an even larger scale but at lower costs. New and more complex minerals will have to be processed to LKAB's exacting quality standards, and those of LKAB's customers. The impact on the environment and the climate must be reduced and LKAB is aiming for more efficient use of energy, and to phase out fossil fuels.

LKAB sources raw materials from the world's deepest underground iron ore mines in Kiruna and Malmberget, using a bulk mining method known as Sub-Level Caving. That is a technical and financial challenge in itself. LKAB has been driving technological innovation for more than 125 years and increasing awareness and ongoing product development are fundamental preconditions to maintaining competitiveness. We are now taking the next step.

View of the city and mining operations at Kiruna.

Location of LKAB's operations in northern Sweden.

Strategies for the Years after 2030

LKAB´s main strategic focus is a framework programme that describes where the company wants to be after 2030. The foundation for this development strategy is continuing to expand what is known about the ore deposits and designing an infrastructure for the future that can serve as the basis for a new production system.

An important part of LKAB´s framework programme is focusing on mining after 2030. This requires a significant evolutionary change in the design of mining, logistics and infrastructure, compared with the mines of today. Technology and methods both have to be more efficient than at present. The ore will have to be mined at even greater depths, which leads to challenges in terms of safety, efficiency, volume and costs.

New Mining System below Main Levels of Today

The current main levels are at 1,250 metres in Malmberget and 1,365 metres in Kiruna.

As the cost of mining ore increases with depth, there needs to be greater cost-effectiveness to enable LKAB to maintain its competitive edge.

LKAB has throughout its history gradually

increased the depth of mining, establishing new main levels at between 50 and 320 metres each time. Each new main level is then equipped with new systems for chutes, transport, crushing and hoisting.

The next generation of mining systems takes mining to literally a whole new level, and to maintain or increase the competitiveness of the operation ore has to be mined on an even larger scale.

This can be achieved with new technology for drilling and charging, automation and transport using driverless vehicles, 24-hour mining operations and real-time production management.

Increasing Seismic Activity

Increasing the depth of mining brings its own challenges. The word 'seismic' comes originally from Greek and means 'shaking'. Mining has an impact on the stress present in the rock. When the stress is redistributed, vibrations occur. This is called seismic activity and it is recorded by LKAB's seismic systems.

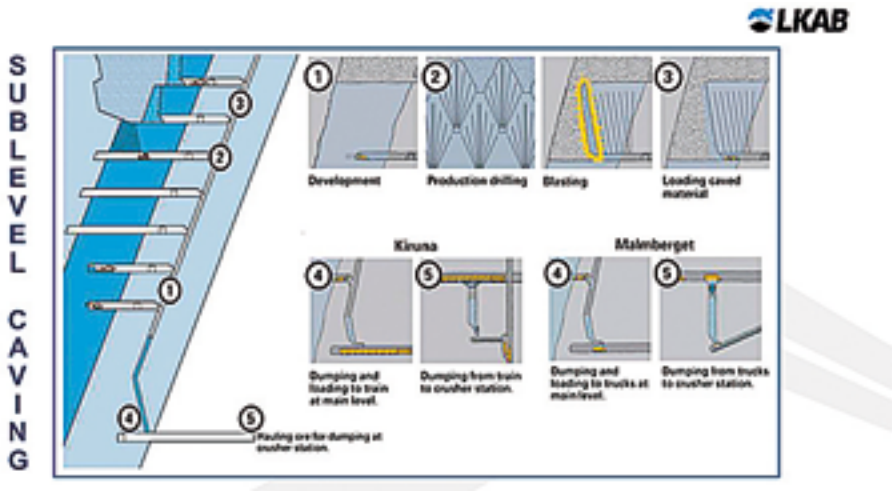
LKAB has devised different systems for rock reinforcement and major new systems for recording and analysing seismic activity have been installed over the years. The mine of the future will employ the latest real-time seismic monitoring technology, and more effective rock reinforcement systems are being developed.

New World Standard for Sustainable Mining

As part of LKAB ´s strategic focus a major industrial development project was initiated in 2018. This is called Sustainable Underground Mining (SUM), bringing together LKAB, ABB, Epiroc, Combitech and Volvo Group in one of Sweden's biggest ever industrial investments.

The mine of the future will be carbon-dioxide-free, digitalized and autonomous. Reaching that goal will demand a new type of collaboration, a digital ecosystem in which the partners' digital systems and operations are linked.

After 2030 LKAB must be ready to mine at greater depths in the Kiruna and Malmberget mines. For this, decisions will have to be taken in the mid-2020s. The sustainable mine of the future requires new control systems, new and improved mining equipment, as well as complex and efficient



management systems that meet future demands for a sustainable industry.

Virtual and Physical Test Mines

Together with the four partner companies, LKAB will create a unique testbed, in LKAB's underground mines in Kiruna and Malmberget. A physical test mine is already in operation in an old re-activated mining area called Konsuln, at the southern end of the Kiruna Mine.

A virtual test mine is also being set up to simulate data flows and scenarios, which cannot be tested in the physical test mine.

The goal of the collaboration is to find new methods and smarter solutions for future mining. Within the framework of the testbed the best means of building an efficient autonomous production system that has the highest conceivable level of safety and is carbon dioxide-free will be studied.

The SUM Project is now developing great momentum, and the team is taking shape. Project offices have been set up at the entrance to the Konsuln Test Mine, and a prototype control room and virtual mine laboratory are in construction.

Production from Konsuln is currently at c.900,000 tonnes per annum, and this will be ramped up to 3 million tonnes per annum during the test period.

On the first new level, 436L, slot drilling with an Epiroc Easer machine will commence in the late summer. Stopes on 436L will be 40m in height (compared to the current standard of 30m), and drilling, charging, blasting and operating these stopes will be the first of many tests to come.

About LKAB

LKAB's mines and refining plants are located in Malmfälten in the north of Sweden. Production operations are principally located in Kiruna, Malmberget and Svappavaara. LKAB is one of Sweden's oldest industrial companies and is wholly owned by the Swedish state.

The group had sales of about SEK 26 billion in 2018 and employs about 4,200 people in 12 countries. Other group business include industrial minerals, drilling systems, rail transport, rockwork services and property management.

LKAB manufactures and supplies highly processed iron ore products to the global steel market, with the majority of iron ore products sold to European steelworks. Products are transported to the ports of Narvik in Norway and Luleå on the Swedish east coast for shipment to customers all around the world.
Sustainability is the core of LKAB's business, and the company's ambition is to be one of the most innovative, resource-efficient and responsible mining companies in the sector.

www.lkab.com
www.sustainableundergroundmining.com

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Mining Ireland: Ireland - Open for Business

by Andrew Gaynor, Business Development Manager, Geoscience Ireland

Ireland's presence on the international mining stage continued to grow in 2019. Geoscience Ireland, in collaboration with the Irish Consulate in Vancouver, hosted an Irish networking breakfast at the annual Association for Mineral Exploration's (AME) Roundup Conference. The morning hosted 40 delegates and facilitated introductions between Irish mining executives based in Vancouver, Irish companies participating at the Roundup conference and the Geoscience Ireland member companies and networks based in British Columbia.

GI Member Companies that participated at the four-day conference included Mincon (and its recently acquired, Vancouver-based, Pacific Bit), Golder and ERM; GI was joined by IMQS corporate members including the Irish Centre for Research in Applied Geoscience (iCRAG), Boliden and Equity Exploration at Roundup.

Roundup is considered to be the world's premier technical mineral exploration conference and continues to grow in stature as it welcomed over 6,600 delegates last January; the conference is received as a lead up to Toronto's Prospectors and Developers Association of Canada (PDAC) annual conference in March which is the world's largest mining show.

Preceding PDAC was February's **Mining INDABA 2019** which marked the 25th anniversary of Africa's leading mining convention. GI member companies

Team Ireland at PDAC 2019.

PW Mining International and Mincon exhibited at the Cape Town conference; PW Nigeria, SLR Environmental and ERM also participated and joined GI in meeting with the African Development Bank outlining Ireland's capabilities and experience in delivering major mining and civil infrastructure projects and institutional capacity building programmes. INDABA was formally opened by the President of Ghana, HE Nana Akufo-Addo, and welcomed HE Cyril Ramaphosa, President of South Africa, who outlined in his keynote address that his government is to prioritise the restoration of a stable and predictable policy and regulatory environment to optimise exploration, production and beneficiation potential in the country.

Team Ireland maintained its strong presence at the PDAC Convention in March; the 2019 delegation was led by **Sean Canney TD, Minister for Natural Resources**. The Ireland Booth remained the focus for government departments from both the Republic of Ireland and Northern Ireland which promote the minerals industry across the island of Ireland. Minister Canney, on behalf of the Government of Ireland, agreed Ireland's commitment to responsible governance of the mining sector by **joining the Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF)**.

Mincon at PDAC 2019.

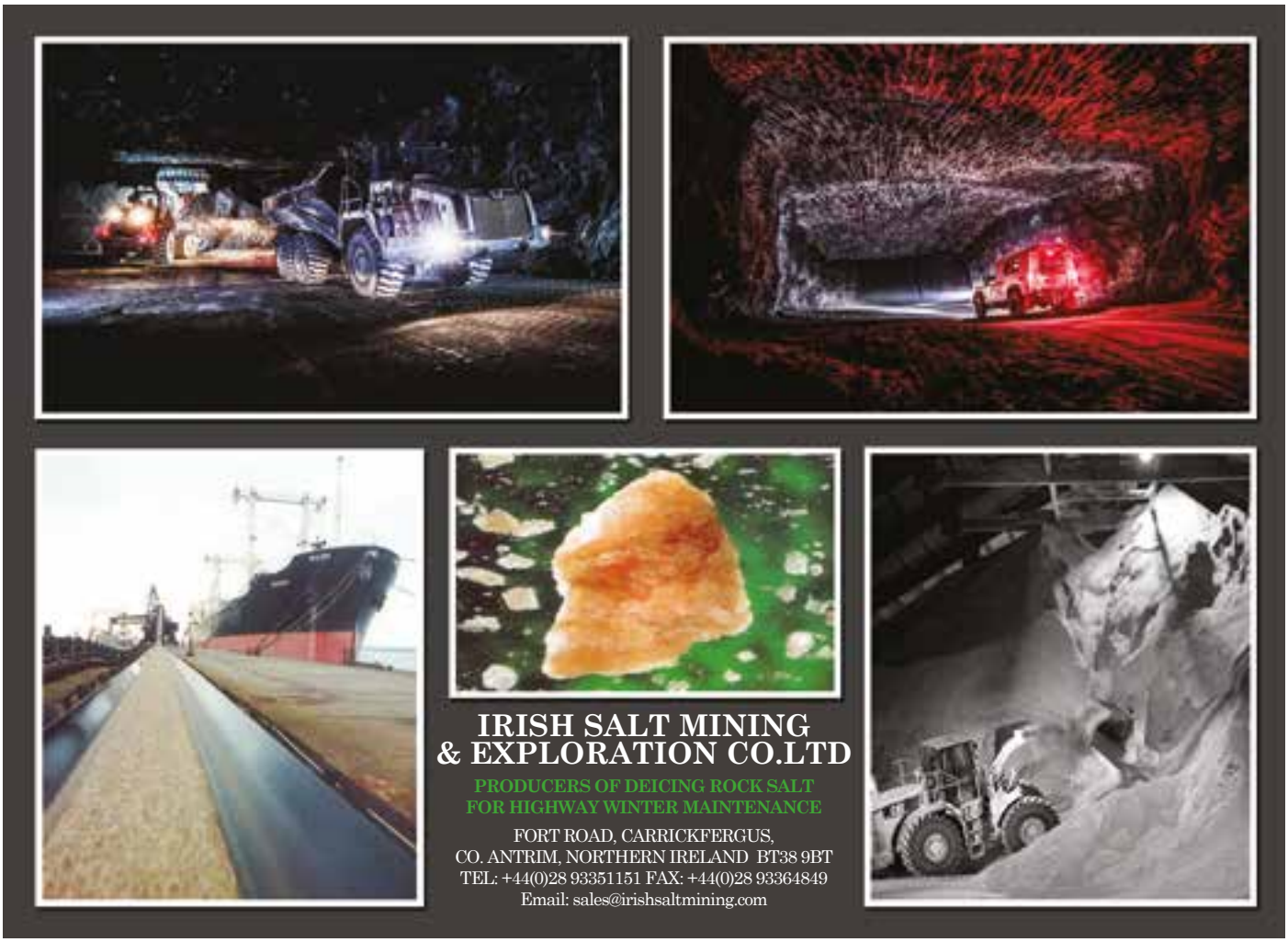
Sean Canney TD, Minister for Natural Resources signs IGF agreement at PDAC 2019.

Frank Flood, Consul General in Vancouver at AME round-up.

Team Ireland meet African Development Bank at INDABA 2019.

The **'Ireland - Open for Business' forum**, now in its fourth year, attracted upwards of 130 delegates from the sector and was opened by **HE Jim Kelly, Ireland's Ambassador to Canada**. The forum is delivered by Geoscience Ireland, in collaboration with **Enterprise Ireland**, and promotes both Ireland as a prominent destination for mineral exploration and as a location of geoscience expertise by way of its professional consulting and contracting offering, R&D and high quality open data acquisition. **Matt Collins, Assistant Secretary at the Department of Communications, Climate Action and Environment**, delivered the keynote address noting Ireland's strong north-south cooperation, his Department's implementation of two new Statutory Instruments to provide for environmental screening for exploration activities and the Department's continued support of the sector given the growing role of minerals and metals in a low-carbon world as recognised by both the World Bank and the World Economic Forum.

In its survey of delegates, Geoscience Ireland received strong feedback to deliver a reciprocal, commercially-focused, 'Ireland – Open for Business' conference in Dublin. GI, in collaboration with IMQS, will deliver **'Mining Ireland'** this October 8th.



Discovery of the Tara Deep Zn-Pb Prospect at Boliden Tara Mines, Navan

by John Ashton[1,2], Alastair Beach[2], Robert Blakeman[1], David Coller[2], Paul Henry[1], Rowan Lee[1], Murray Hitzman[3], Charles Hope[2], Simon Huleatt-James[1], Brendan O'Donovan[1] and Michael Philcox[2]

1 Boliden Tara Mines, 2 Independent Consultant, 3 Irish Centre for Research in Applied Geosciences

Boliden Tara Mines operates the largest Zn mine in Europe with annual production running up to 2.6 Mtpy at grades averaging 5 to 6% Zn and 1.5 to 2% Pb. The mine commenced production in 1977 and by end 2018 had milled 94.8 Mt grading 7.9% Zn, 1.8% Pb. Over the years, resources have been increased by surface and underground drilling, acquisition of adjoining areas and by increases in efficiency enabling lower grades to be mined economically (Fig. 1).

Over the period 2000 to 2010, annual resource additions averaged ca. 1.1 Mt but this was insufficient to meet the annual depletion rate thus potentially leading to mine closure before 2020.

In 2010, a meeting comprising a mix of internationally recognised geologists and Boliden staff, reviewed the large geological knowledge base at Navan with the aim of promoting further discovery. A key element involved the analysis of previous work by numerous geologists and consultants into the development of the major extensional fault systems at Navan. Target areas were identified north, west and south of the deposit and the use of seismic surveying, as used routinely by the oil industry, was strongly recommended.

Seismic reflection surveying involves sending artificially generated acoustic waves down into the crust. Rock layer interfaces exhibiting sufficient acoustic impedance contrast reflect some of these waves back to surface where their arrival times are recorded by geophones. Processing of these data enables images of the subsurface reflectors to be created and, given some insight to the geology, interpreted to give detailed stratigraphic and structural detail. In onshore surveys, Vibroseis trucks (Fig. 2) are often used to generate the vibrations and large arrays of geophones record the reflected signals - collectively the 'acquisition' phase. A single 'shot' (actually a complex 'sweep' of carefully controlled Vibroseis signals) generates many reflections whose arrival times along the geophone arrays are

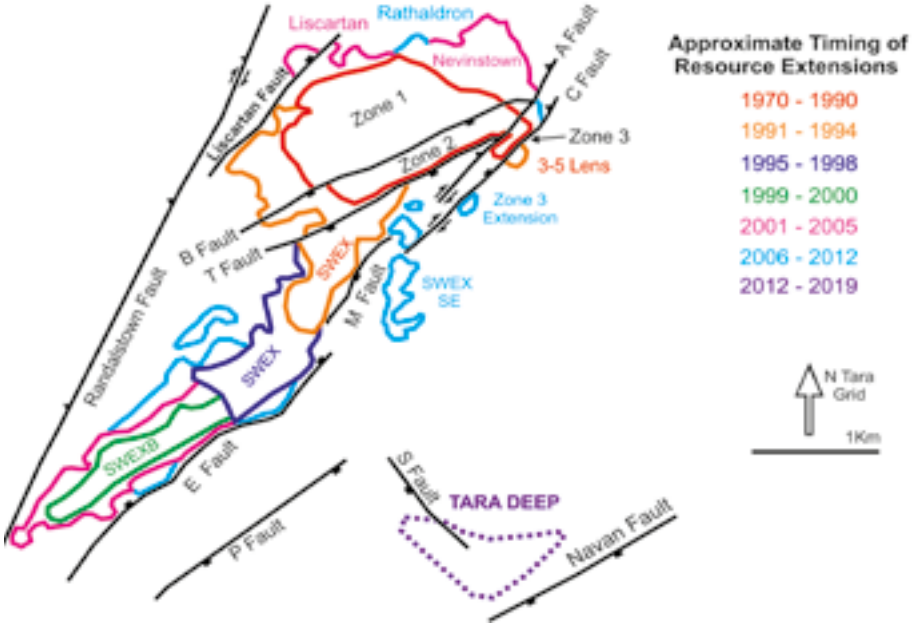


Figure 1. *Plan of the Navan deposit showing the location and approximate timing of resource extensions, major faults and the location of the Tara Deep prospect. SWEX – Southwest Extension.*

accurately recorded. For each shot it is possible to plot arrival times to identify the locations of various reflectors present. The shots are repeated as the vibrator truck moves along the seismic profile leading to progressively greater information on each reflector present and a 'stack' of reflector images is built up. The multiplicity involved in this process aids reinforcement of good reflectors and suppression of noise. Detailed processing involving a number of quite complex corrections is needed to provide accurate images for interpretation, which itself is a specialised exercise requiring some insights into the geology (ideally some suitable drill cores) and considerable experience of using seismic data.

Investigations into the practicality of using seismic surveying at Navan were finalised in 2011, culminating in the appointment of a seismic program manager who had extensive practical experience in specifying, tendering, negotiating and managing a seismic data acquisition program. Guided by this experience, together with, geological, permitting and social licence considerations, a 15km 2D survey was completed on a third class public road southwest of Navan in July 2011. The technique was succesful in producing structural profiles with significant geological detail and a further survey was completed along the M3 motorway for 24 km in November 2011. Subsequently five further surveys were completed in 2012 and an additional three in 2015.

Acquisition was completed by IMC-Tesla without significant incident although it involved a large road presence comprising three vibroseis units and control truck recording data from a geophone array of ca. 4 km each side of the source and a host of support staff and vehicles. Permitting, traffic management, vibration monitoring and control, security and equipment protection, and public information campaigns were key aspects to successful data acquisition. Seismic Image Processing

Figure 2. *Vibroseis units working on a road in the Navan area.*

were used for processing to produce pre-stack time migration images that were interpreted by Colin O'Brien of Count Geophysics and consultant Dave Coller.

Interpretation of the seismic data along the motorway profile revealed a wealth of geological information that matched existing drill hole interpretation, where available, and confirmed the presence of a major normal fault located south of Navan as predicted by Beach and Coller (unpublished data, the Navan Fault). A clear terrace area between the mine and the Navan Fault was evident with a target 2 km SE of the Southwest Extension at a depth of 1100m. This area had previously been considered too risky to drill, due to depth and the perceived likely absence of the Pale Beds host rocks.

Proximity of the M3 motorway and land access issues prevented drill set-up at the target center and the first hole (N02176) was located ca. 400m NW of the target. Drilling started in April 2012 and by July concern was growing that the hole was deeper than the interpreted target. However Upper Dark Limestone hangingwall rocks intersected in the core contained abundant laminated framboidal pyrite over thicker intervals than usual, normally a good indicator of the proximity of underlying mineralized zones at Navan, and therefore a clear incentive to continue drilling. On 12th September the hole intersected somewhat brecciated and pyritic Pale Beds at 1445 m. This material was drilled for 77 m before the drill hole entered strong 5 Lens style sulphides that gave an intersection of 32.5 m at 11.1% Zn and 3.0% Pb, in rocks dipping at approximately 45° (Fig. 3). A subsequent navi-deflection hole, N02195, gave a similar intersection and a second rig was mobilized to drill on the central target location. This hole, N02201, intersected similar geology but at a shallower depth closely comparable to the interpreted seismic target, but with lower zinc and lead grades than the preceding holes (Fig. 3). Drilling proceeded at both locations, locally at significantly deeper depths than had previously been carried out at Navan, or indeed Ireland, and the application of navi-technology at those depths was ground breaking for both Priority Drilling and Tara staff.

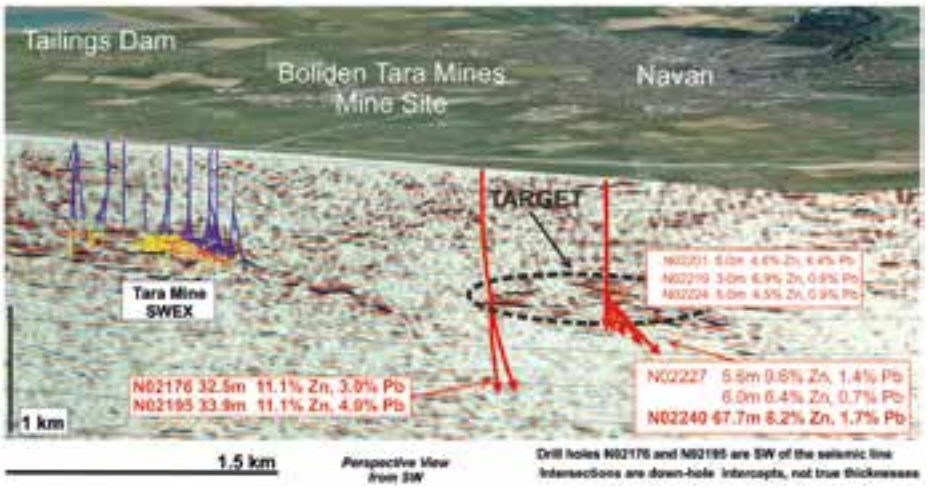


Figure 3. *Perspective view from the southwest showing the M3 motorway seismic image section, surface detail, mine site and the Southwest Extension (SWEX). The target area and initial drilling results are shown; N02176 was the discovery hole. Results for N02201, N02219 and N02204 refer to early drilling on the target area; N02227 and N02240 emphasise later, better grade navi-deflection drilling.*

On-going drilling near the discovery hole intersected further mineralization with evidence of steep westerly dips in the hanging wall of a significant fault that appeared to run subparallel to the seismic section (explaining discrepancies in the initial seismic interpretation). To the SE, drilling continued to intersect marginal grade mineralization and after 5 holes was suspended. Drilling resumed after about 6 months, with further navi-deflection holes yielding better grade intersections (e.g. N02240: 67.7 m @ 8.2% Zn, 1.7% Pb; Fig. 3). It was clear that the Tara Deep mineralization could represent a potentially economic deposit.

Since 2012 more than 100 holes have been drilled with an Inferred Resource, published in early 2017, of 10.2 Mt grading 8.5% Zn and 1.8% Pb (Boliden press release). In early 2018 a further update was released showing an increase in Inferrred Resources to 18.2 Mt grading 7.6% Zn and 1.6% Pb. Drilling continues to outline the resource which remains open in several directions. Underground access development to allow more detailed exploration and delineation was started in mid 2017 and is currently underway by QME mining contractors.

The Tara Deep discovery is the result of multi-disciplinary collaboration between earth science professionals with access to the high level of knowledge emanating from the many years of exploration, consultancy and research at Navan. The process required strong management support and a desire to extend the Navan mine life. Boliden's experiences in extending the Garpenberg mine in Sweden in the previous decade played a major role in exploration management strategy and provided confidence with leveraging near-mine exploration. The successful usage of seismic surveying was a key factor. Persistence during the drilling phase after some indifferent results and the ability to drill with navi-deflection technology, facilitated the drilling phase, as did continued support from management. Finally, there was a welcome amount of good fortune.

Boliden are thanked for permission to publish this contribution. For further details and acknowledgements the reader is referred to: Ashton, J.H., Beach, A., Blakeman, R.J., Coller, D., Henry, P., Lee, R., Hitzman, M., Hope, C., Huleatt-James, S., O'Donovan, B. and Philcox, M.E., 2018, Discovery of the Tara Deep Zn-Pb Mineralization at the Boliden Tara Mine, Navan, Ireland: Success With Modern Seismic Surveys. SEG Special Publications, 21, 365-381.

Dalradian Gold
Ten Years in Northern Ireland...

by Orla McKenna, Senior Geologist

The first mineralised veins at the Curraghinalt deposit were discovered in 1983 in Curraghinalt Burn triggering extensive exploration over the following 36 years. Over 3,000 metres of trenching and 30,000 metres of drilling were completed up to 2009. From 1987 to 1989, 710 metres of underground development were completed at the deposit.

Acquired by Dalradian Resources in 2009, major investment focused on developing the Curraghinalt deposit and expanding the regional exploration programme. Ten years and six updates have seen a 10-fold increase in the Curraghinalt resource from 0.6 Moz in ten veins to 6.1 Moz in 21 vein zones with an average width of 0.47 metres.

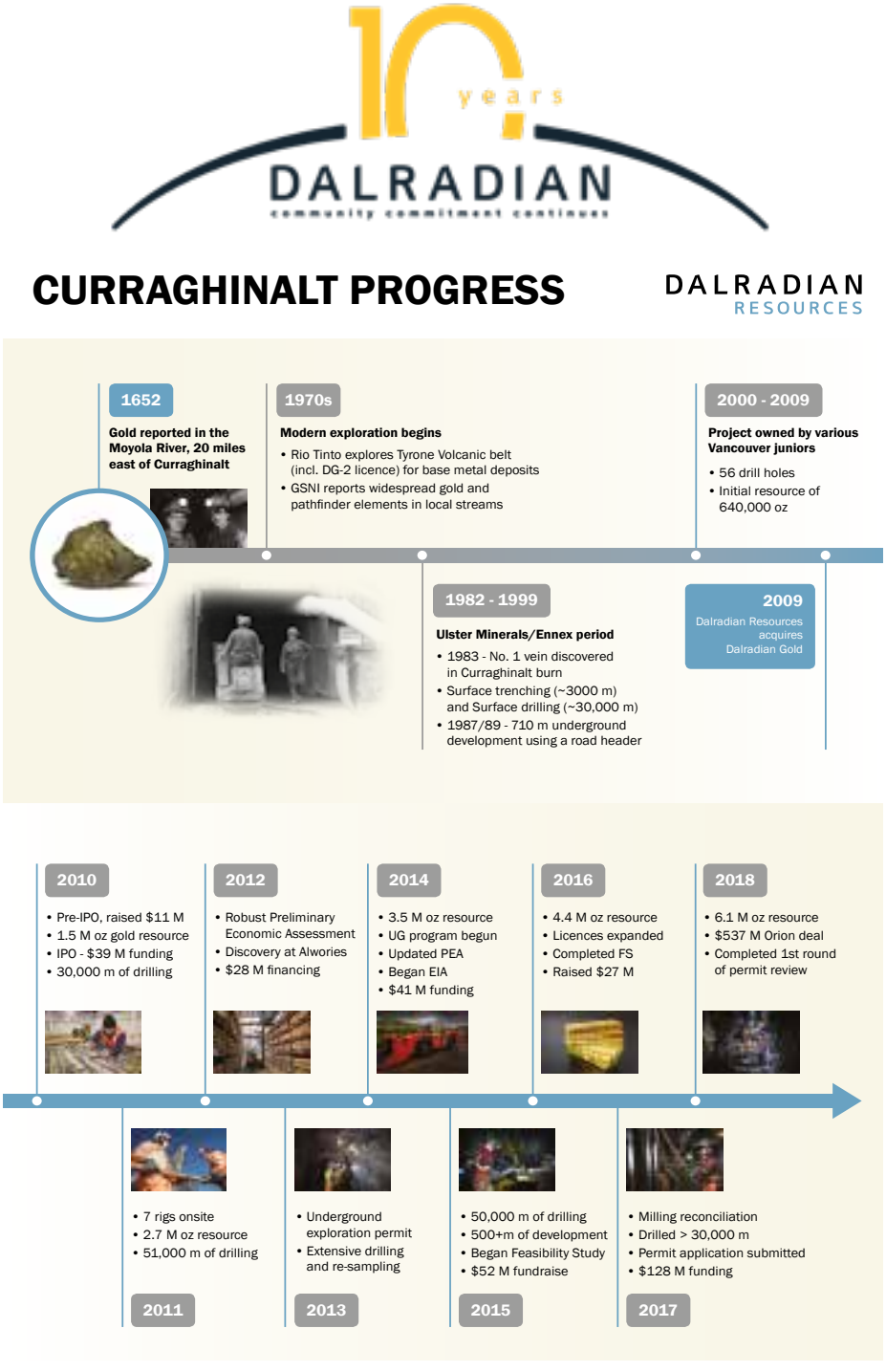
The current resource contains 0.04 Mt in the measured category at 26.04 g/t Au; 6.31 Mt in the indicated category at 14.95 g/t Au, and 7.72 Mt in the inferred category at 12.24 g/t Au.

Approximately 989 m of new development, including test stopes, was completed by the company throughout 2015 and 2016 as part of exploration works in support of a feasibility study with a reserve of 1.4 Moz released in 2016.

Since then, ore sorting tests have shown that tonnage to the mill can be decreased while increasing the grade. This will feed into an updated FS incorporating the 2018 mineral resource.

Over the past ten years the company has spent over £115M on exploration and development, drilled >178,000 metres in 615 holes, completed >900 metres of underground development, collected >19,000 regional samples, and submitted a planning application to the Department for Infrastructure.

Over the next ten years the company intends to establish a modern mine in West Tyrone using long-hole stoping, ore-sorting technology, and dry stack tailings. If you would like to support the planning application submitted in 2017, please visit dalradian.com and select 'Build a Letter of Support'.



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40

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Lithium
A lightweight metal with heavyweight power

by Brendan Morris C.Eng. Managing Director, LTMS

The lithium industry is expected to grow rapidly in the near future due to developments in batteries and aircraft alloys, both of which require large quantities of pure lithium metal.

This expansion will transform the lithium mining industry from its current state to a more technologically focussed state. While the mineral resources for lithium are abundant enough to satisfy world demand for many decades, however many of these resources have not yet been proven up to ensure that they are economical to mine.

New processes must also be developed to produce both high tonnages and high purity levels to sustain the growing demand. Toward this end, several new extractive processes have been established and others are currently being evaluated.

The deployment of renewables and electric vehicles is increasing rapidly as the world strives to reduce greenhouse gas emissions. Clean energy technologies rely on certain key metals which will be needed if they are to continue to expand. Two metals in particular, lithium and cobalt, have seen supply chain fears in recent years, although many other metals are used in the green revolution.

Lithium, a soft, silvery-white metal which is also the lightest in the periodic table, is a crucial ingredient of lithium-ion batteries. These are used in everything from smartphones to electric vehicles (EVs), now its biggest consumer. The lithium-ion battery is the battery of choice for most car makers.

Lithium brine deposits being mined.

Lithium

Lithium, derived from the Greek word lithos which means stone, is a chemical element with symbol Li and atomic number 3. It is a soft, silvery-white alkali metal and under standard conditions, it is the lightest metal and the lightest solid element. Lithium is highly reactive and flammable, and is normally stored in mineral oil.

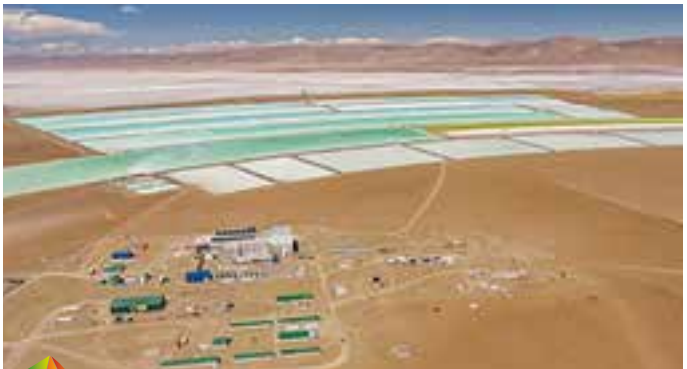
When cut, it exhibits a metallic lustre, but moist air corrodes it quickly to a dull silvery grey, and then a black tarnish. It never occurs freely in nature, but only in compounds, such as pegmatitic minerals, which were once the main source of lithium. Due to its solubility as an ion, it is present in ocean water and is commonly obtained from brines. Hydrogen, helium, and lithium, the first three elements in the periodic table, were all created in the Big Bang, and while the first two elements are abundant, lithium is not.

Lithium was first discovered 1817 by Swedish chemist Johan August Arfwedson, but he couldn't isolate the metal when he realized petalite contained an unknown element. It wasn't until 1855 that British chemist Augustus Matthiessen and German chemist Robert Bunsen were successful in separating it from the host rock.

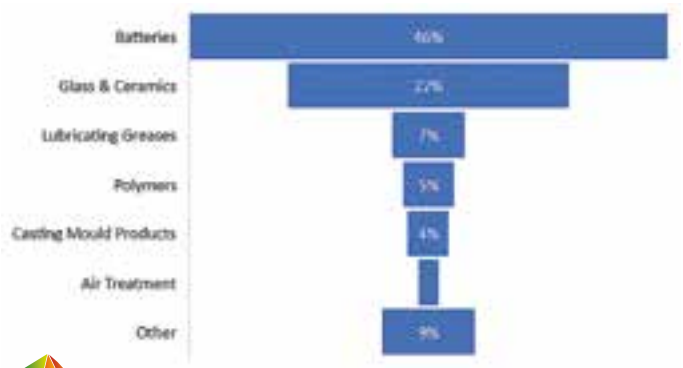
Lithium is one of the lightest and softest metals known to man. In fact, it can be cut with a knife. And because of its low density, lithium can even float in water.

Lithium Usage

Lithium production has greatly increased in the last few decades.



Salar brine deposit in South America.



Lithium Usage.

Salar brine deposit in South America.

Lithium Open Pit Mine in Australia.

The main uses are as follows:

- Lithium cobalt oxide is a chemical compound used in rechargeable Lithium-ion batteries that power smartphones, laptops, and electric cars.
- Lithium metal is used in the production of alloys with aluminium and magnesium, making them lighter and suitable for use in the manufacture of aircraft, high speed trains and bicycles.
- Lithium oxide is used in the production of glass and ceramics.
- Lithium chloride is used for air-conditioning systems and industrial drying systems.
- Lithium carbonate is used as a medical treatment for bipolar disorder. Lithium affects the flow of sodium through nerve and muscle cells in the body, and sodium affects excitation or mania. Lithium is used to treat the manic episodes of bipolar disorder (manic depression). Manic symptoms include hyperactivity, rushed speech, poor judgment, reduced need for sleep, aggression, and anger.

The graph below shows that batteries account for approximately 46% of lithium usage, followed by glass & ceramics.

Lithium has several advantages that make it popular for batteries:

- It is the lightest known metal, which means it can store power without adding a lot of weight to devices.
- Lithium-ion batteries have some of the highest energy densities of any current battery technology; they deliver three times the voltage of nickel-based batteries, according to the University of Washington's Clean Energy Institute.
- Lithium batteries do not experience the 'memory effect', meaning that they don't lose power capacity if charged continually before they are dead.

Lithium clay deposit in Mexico.

Lithium has been used for more than a century to treat bipolar disorder and other mental illnesses, including depression, schizophrenia, and eating disorders. It is also used to treat anaemia, headaches, alcoholism, epilepsy, and diabetes. But there's a narrow difference between the dose at which it is effective and the one at which it is lethal. Lithium's side effects include weight gain, nausea, and the exacerbation of heart and kidney disease.

Lithium Production

There are three main types of lithium production: brine pools, hard rock deposits and clay.

More than half of the world's lithium supply comes from high-altitude lakes and bright white salt flats in the "lithium triangle" of Bolivia, Chile, and Argentina, where it is mined in a grid of brine pools. Lithium is produced from salar brines pools, which are underground reservoirs that contain high concentrations of dissolved salts such as lithium, potassium and sodium. These are generally found below the surface of dried lakebeds known as salars.

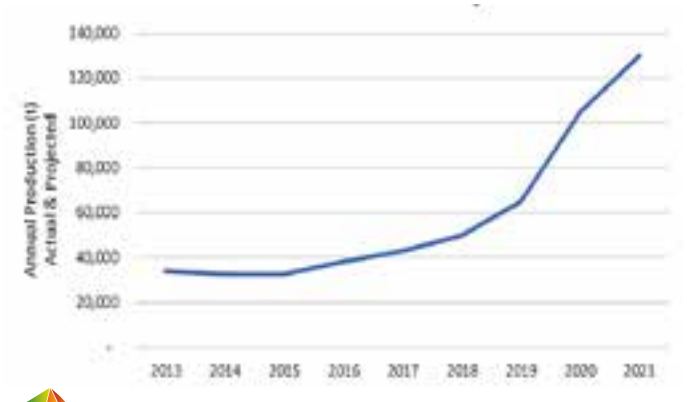
In other regions such as Australia, lithium is produced from hard rock mine deposits such as spodumene, petalite and lepidolite. Extracting lithium from hard rock is significantly more expensive than extracting the metal from brine pools.

Lithium is also found in clays but until recently was considered uneconomical to mine. There are several prospective projects in the U.S. and Mexico that may become productive in the near future.

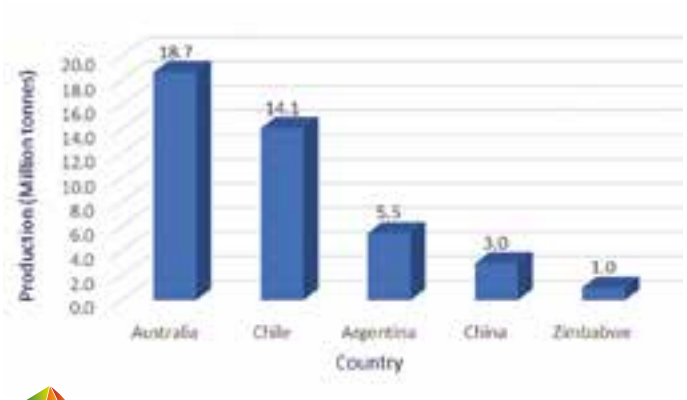
Lithium production has been increasing in recent years and this is expected to continue at least for the next few years. The graph below shows the actual production to 2017 and the projected production from 2018 to 2021.

Australia leads ore production at 18.7 million tonnes (Mt) in 2017, while Chile produced 14.1 Mt and Argentina was a distant third at 5.5 Mt. The graph below shows the top five lithium ore producers.

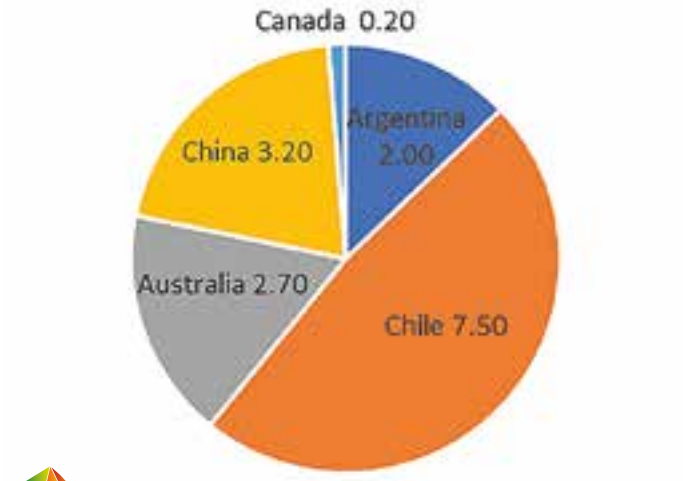
Current trends show a significant increase in electric cars with a requirement for nickel, cobalt and lithium and new mining projects are required for these metals to



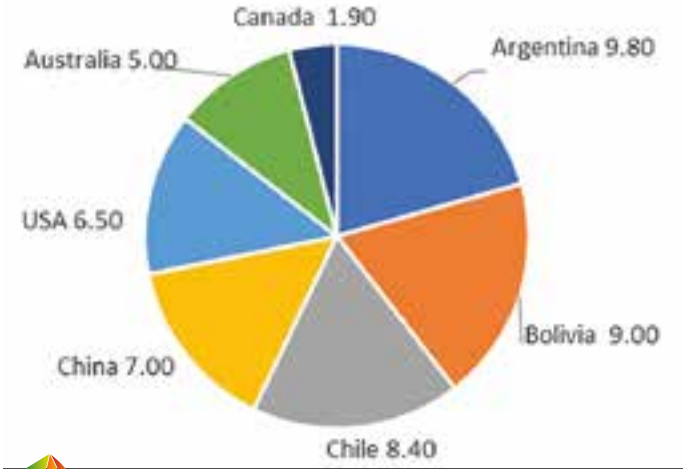
Global Lithium Production and Projection.



Global Lithium Ore Production.



Global Lithium Mineral Reserves (Million Tonnes).



Global Lithium Mineral Resources (Mt) for Countries >1Mt

prevent a deficit which will occur, if there is not a major increase in production.

Lithium Reserves and Resources

Worldwide reserves of lithium is estimated by the U.S. geological Survey at 16Mt, although it is difficult to estimate accurately as much of the reserve is in brine pools and estimation of the total lithium quantity from these sources is difficult to ascertain. Further, it is estimated that there are more than 65Mt of lithium resource available.

A **Mineral Resource** is a concentration or occurrence of solid material of economic interest in or on the Earth's crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction.

A Mineral Reserve is the economically mineable part of a **Mineral Resource** and includes diluting materials, allowances for losses and modifying factors, which may occur when the material is mined or extracted.

Chile currently leads the list of countries with mineral reserves in place and is followed by China, Australia and Argentina.

Argentina, Bolivia and Chile in the 'Lithium Triangle' all have significant resources, and these can potentially be moved into the reserve category with additional exploration work. China, USA and Australia also hold good levels of reserves.

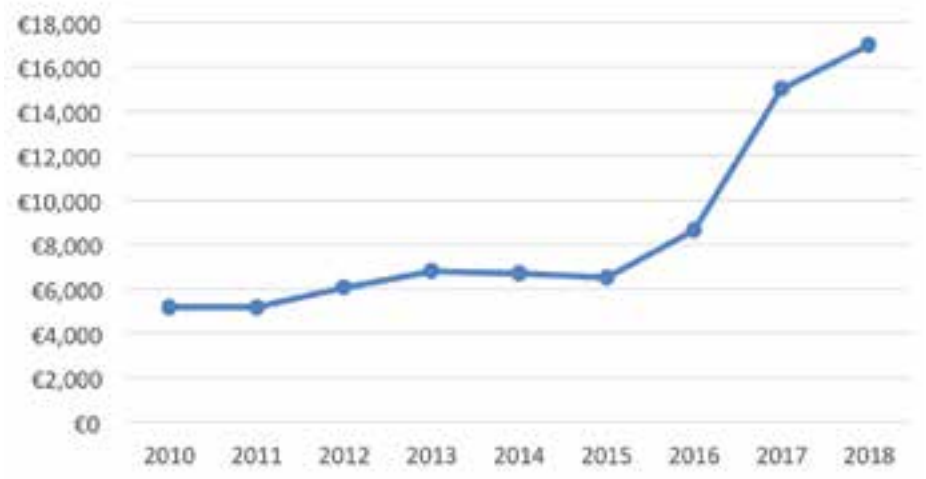
Southeast Ireland is the host to several lithium pegmatite occurrences. A project which includes eight prospecting licences, straddling the Carlow Wicklow borders is currently being explored.

Lithium Price

Like all other commodities, lithium price is dictated by supply and demand. Demand has been increasing significantly in the past few years but recently supply has started to catch up.

Currently, all eyes are on Australia, where key sources of new supply are due to come online, with help from the country's recent fast-tracking of spodumene operations. Lithium prices have been rising fast in recent years but are expected to soften during 2019, when supply is set to ramp up.

This graph below shows the annual average price per metric tonne of battery-grade lithium carbonate from 2010 to 2018.



Lithium Carbonate Average Prrice (battery grade).

Processing of Lithium

In order to extract lithium from brines, the salt-rich waters must first be pumped to the surface into a series of evaporation ponds where solar evaporation occurs over several months. Because salar brines occur naturally at high altitudes and in areas of low rainfall, solar evaporation is an ideal and cost-effective method for precipitating salts. Potassium is often first harvested from the early ponds, while the later ponds have increasingly high concentrations of lithium. Economical lithium brines normally contain anywhere from a few hundred parts per million (ppm) of lithium to upwards of 7,000 ppm. When the lithium chloride in the evaporation ponds reaches an optimum concentration, the solution is pumped to a recovery plant where extraction and filtering remove any unwanted boron or magnesium. It is then treated with sodium carbonate (soda ash), thereby precipitating lithium carbonate. The lithium carbonate is filtered, dried and ready for delivery. Lithium carbonate is a stable white powder which is a key intermediary in the lithium market because it can be converted into specific industrial salts and chemicals or processed into lithium metal.

In contrast to salar brine sources, extraction of lithium from spodumene and other minerals requires a wide range of hydrometallurgical processes, depending on the host rock type and lithium type and grade. New processes are currently being tested.

There are many options for extracting lithium from clays and the choices depend on the nature of the specific raw material being considered. However, despite the testing, clay-based lithium has not yet proven to be cost viable and is not currently being done commercially.

Extracting lithium from brine is cheap but slow, while extraction from spodumene is expensive but fast. Extraction from clay is not yet commercially proven at scale. There are also other new lithium extraction technologies being looked at including leaching, solvent extraction, geothermal extraction and electrolysis, but the

findings are too inconclusive to be used commercially.

Although they are not widely used, the following methods have also proven to lead to lithium production:

Seawater, as Lithium also exists in the world's oceans. There are currently processes in place to extract the metal from seawater including the co-precipitation extraction process, which involves separating lithium from other ions present in the water. But newer forms of technology are also being developed but not yet at an industrial level to make the process economically viable.

Recycled electronics. As this is not necessarily a form of extraction, it is an easy way to add to the world's lithium sources.

Converting lithium into metal is carried out in an electrolytic cell using lithium chloride. The chloride is mixed with potassium chloride and this produces a molten eutectic electrolyte. Potassium chloride acts to increase the conductivity of the lithium while lowering the fusion temperature. When fused and electrolyzed at approximately 450° C, chlorine gas is liberated and molten lithium rises to the surface of the electrolyte, collecting in cast-iron enclosures. The pure lithium produced is wrapped in paraffin wax to prevent oxidization. The conversion ratio of lithium carbonate to lithium metal is approximately 5.3 to 1.

Lithium Metal.

Interesting facts about Lithium

Lithium was once a key ingredient in 7UP. Before being branded as 7UP and when holiday party punchbowls were popular in the 1920s, 7UP, which debuted in 1929, was briefly called "Bib-Label Lithiated Lemon-Lime Soda," and its original ingredients included lithium citrate.

Federal Aviation Administration in the US grounded the entire Boeing 787 Dreamliner fleet in 2013 after one plane's lithium-ion battery shorted out and started a fire, shortly after passengers had disembarked in Boston.

Tesla Model S cars also saw fires in 2013 attributed to battery malfunctions. Then the Samsung Galaxy Note 7 phones started catching fire, prompting the aviation authorities to ban the phones from flights. Samsung had tried to boost battery capacity to accommodate consumers' increasing game-playing and video-streaming habits while also shrinking the phone. Tasked with doing more in a smaller size, it became prone to meltdowns.

Summary

Lithium is considered to be a metal of the future as a part of the green revolution and while it is being mined at various locations across the globe, a major production increase is required to meet the new demand. Resources are available to satisfy the market demand for several decades to come, subject to resources being upgraded to reserves, but new technologies are required to enable production growth to stay abreast of the increasing rate of growth. This all brings a significant challenge to ensure that the environmental effect of lithium mining does not nullify the positive effect of the green revolution.

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Kevin Lonergan - k.lonergan@ltms.ie
Padraig Barrett - p.barrett@ltms.ie

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- Mining Method selection and analysis
- Geology, Geotechnical and Backfill

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- Special Projects such as rehabilitation and water management
- Contractor selection and management
- Preparation of mining documentation and procedures
- Provision of short term management and supervision

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- Mine Operators and Supervisors
- Technical personnel – Engineers, Geologists
- Maintenance personnel
- Safety for operators and management
- Mines Rescue

MAINTENANCE
- Fixed and mobile plant consulting
- Due diligence and Independent reviews

MINE CLOSURE
- Planning and design

iCRAG 2018/2019 update

by Dr Sean Johnson

2018 has been another busy and successful year for iCRAG with many changes taking place.

The Centre, comprising nearly 150 researchers across now eight different institutions with the addition of Dublin City University, continues to tackle key research challenges in Ireland and abroad in the areas of energy security, raw materials, groundwater, geohazards and safeguarding the geomarine environment.

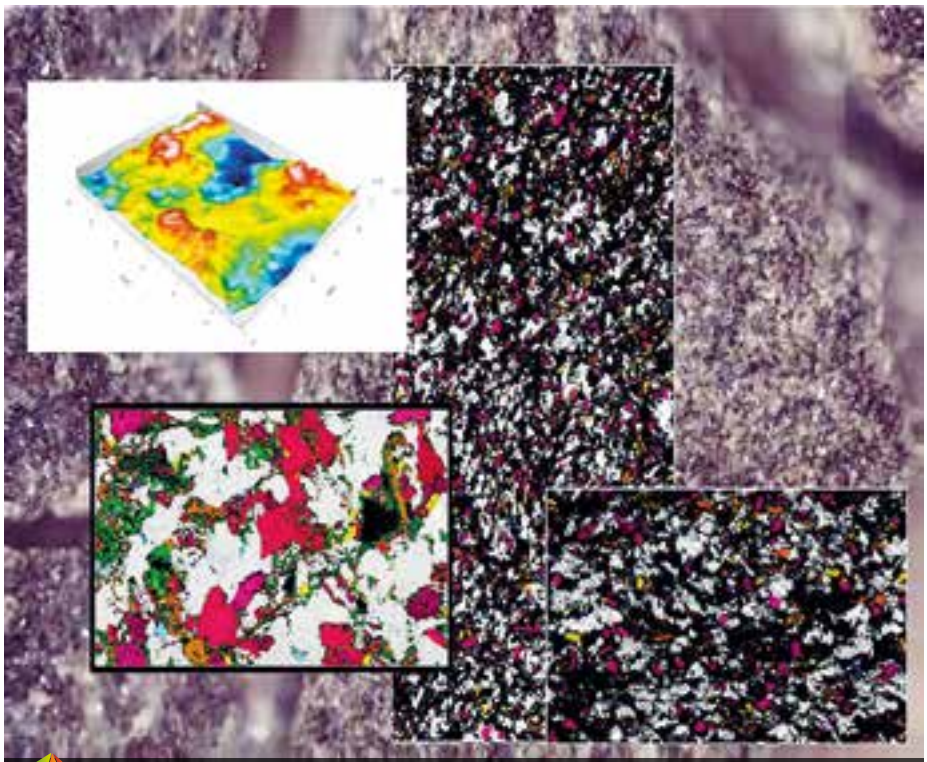
iCRAG's research group has also **expanded with new projects in the geohazards and geotechnical program** dealing with tunnelling in karstic environments and sediment stability for construction. Environmental geoscience is also expanding with 8 new PhD projects funded through the iCRAG-GSI Environmental Geosciences Postgraduate Programme.

In March of 2018, our Founding Director, Prof. John Walsh, who worked tirelessly to establish and grow the Centre for the past 3 years, stepped down from his post with the appointment of Prof. Murray Hitzman to a new SFI Professorship at UCD and the iCRAG Directorship.

Murray is no stranger to Ireland and brings a wealth of experience across the raw materials, hydrocarbons, and policy spectrum to his new role. Since Murray's appointment, he has concentrated on ensuring that iCRAG becomes more industry focussed and has made several key changes to the structure of the research themes across the Centre; for example, the appointment of John Güven, as Minerals Manager, Dr Sean Johnson as Geochemistry Manager and Dr Koen Torremans as 4D Ireland Manager.

Together with Prof. Hitzman, they will co-ordinate iCRAG's minerals research and ensure that our researchers better deliver excellent science in support of Ireland's raw materials sectors.

Raw materials research to expand the Irish explorer's toolkit is a focus. The Centre recently published structural and fluid models of Lisheen and Silvermines. Modelling work continues on Navan as well as mineralogical and geochemical work on the recent Tara Deep discovery.



3D metrology, 2D Raman superimposed on aggregate particle, 2D detailed Raman and 3D Raman.

iCRAG's deposit models are being extended into the regional scale through use of company seismic data as well as a range of geochemical and geophysical datasets including those from GSI's Tellus Programme and their Land Mapping Unit.

We strengthened contacts with our industry partners through technical meetings and researcher secondments / work placements. Such placements are invaluable as they allow iCRAG researchers to not only gain an understanding of the problems facing industry but to also contextualise their research, while allowing industry to benefit from direct knowledge transfer with our researchers.

iCRAG's world class in-situ analytical facilities are attracting new international industry partners particularly in the fields of metallurgy and mineral processing. The facilities are in the early stages of being utilised to characterise trace and ultra-trace metal distribution within waste streams thus helping to address the need for a circular economy.

The **lab facilities and a new RAMAN microscope at UCC** are helping to advance work on road and building aggregates. Current work looks to develop a new, multi-disciplinary approach to characterising aggregate sources and predicting aggregate behaviour with accelerated aging in laboratory tests.

An overarching goal is to quantify the attributes that make certain quarry products high value and thus of greater export interest, while being able to better understand and define suitable aggregate resources for future development.

We look forward to the new opportunities 2019 brings and hope to strengthen our partnerships with the varied partners in IMQS.

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Sandvik
A Journey to Automation in Ireland

by Brian Carroll (Parts, Service & Warranty Lead & Sales Manager Mining Ireland)

With the global mining industry continuing demand for safer, more efficient and productive operations in a period where operational costs are increasing, the demand for automation and optimization has never been more important for the customer. Since the early 2000's Sandvik have been developing our AutoMine and OptiMine product offerings to meet these customer demands.

Sandvik offers the industry's most advanced automation and teleoperation systems. These solutions significantly improve productivity and safety, while lowering the total cost of ownership. The software systems also help you to monitor your machines, giving you a full overview of your fleet and enabling you to control and optimize your operations.

Starting my career as an apprentice technician in Tamrock (now Sandvik) in Galmoy Mines, Kilkenny in 1999, the leap forward in ways of working from an operational and maintenance point of view but also in a health and safety perspective has been mind-blowing. Back then line-of-sight remote control loading was in its infancy in Galmoy. It was more of a standard practice in the Lisheen Mine, Tipperary and Tara Mines, Meath.

Galmoy operated a Room and Pillar mine, where most mucking was manual back then. Lisheen and Tara were line of sight radio remote mucking in Open Stopes. The leap forward in the Irish mining industry

Sandvik LH621i.

over the past 4 years with Boliden Tara Mines embracing Sandvik AutoMine loaders (and last year AutoMine trucks) has brought a whole new level of health and safety but all potential productivity and maintenance opportunities and benefits.

Tara Mines initially kicked off their automation project in 2015 with Sandvik AutoMine Lite and then moved toward Sandvik AutoMine Multi-Lite which I will explain the difference below.

During this period Tara implemented Sandvik OptiMine Monitoring which track equipment performance, productivity, utilisation, alarm log and data via their wireless underground Wi-Fi network.

Sandvik Automine Lite

AutoMine Lite is an automation system for a single Sandvik loader or truck. The solution provides a powerful way to take advantage of the full machine performance through automation, and offers substantial benefits of increased productivity, safety and cost efficiency in mining operations.

AutoMine® Lite is particularly suitable for mining operations requiring repeatable and constantly high performance, such as sub-level open stoping, sub-level caving, transfer levels or individual block caving drives.

AutoMine Lite offers staggering productivity through high-speed tramming, high availability as well as continuous and consistent operation. The solution can also be easily expanded to AutoMine Multi-Lite, which enables each system operator to simultaneously control multiple loaders or trucks.

Sandvik Automine Multilite

AutoMine Multi-Lite is an automation system which enables each system operator to remotely and simultaneously supervise multiple automated Sandvik underground loaders and trucks.

With AutoMine Multi-Lite each piece of equipment completes automated missions in its own dedicated production area. Again, the solution provides a powerful way to take advantage of the full machine performance through automation, and offers substantial benefits of increased productivity, safety and cost efficiency in mining operations.

Sandvik DD422i.

Sandvik TH663i with AutoMine Trucking.

AutoMine Multi-Lite is suitable for large mining operations with several production areas. It is an ideal package particularly for mining operations which require repeatable and consistently high performance as well as multi-machine control. Transparency of the loading and hauling process through fleet reporting capabilities of the system serve as an enabler to optimize operations.

Sandvik Optimine Monitoring

OptiMine Monitoring updates equipment information automatically in real time. This OptiMine module guarantees constant up-to-date awareness of the status and productivity of your Sandvik fleet. The information is presented clearly and intuitively to support fact-based decisions. Data can also be integrated with other mine IT systems.

OptiMine also has different applications in its offering which further optimises a customer's processes and operations.

- OptiMine Location Tracking
- OptiMine Task Management
- OptiMine Scheduler
- OptiMine Drill Plan Visualiser
- OptiMine 3D Mine Visualiser
- OptiMine Analytics

Further developments will be seen in the very near future on our underground and surface drilling equipment which will also join the Sandvik AutoMine family. This truly is tomorrow's technology today and it's an exciting prospect for customer and supplier on what we will come tomorrow with Artificial Intelligence and Virtual Reality to name but a few in our current R&D programs. From the advanced technology that I saw 1999 in Galmoy Mines, to the changes in the Irish and global mining industry that we see today, it has been quite a journey which has a bright, healthy, safe and productive future for all!!

Brian Carroll (Parts, Service & Warranty Lead & Sales Manager Mining Ireland).

Links

Tara Mines Automation Video - **https://www.youtube.com/watch?v=popyT09xh-Q**

Sandvik OptiMine - **https://www.youtube.com/watch?v=eB_BwmQBynk**

Sandvik AutoMine Trucking - **https://www.youtube.com/watch?v=difuW752jNU**

Sandvik AutoMine Glass Labyrinth - **https://www.youtube.com/watch?v=TdYpxF9-8Ec**

Sandvik AutoMine Lite, Multi-Lite & TeleRemote - **https://www.youtube.com/watch?v=kRCVs34-ZCk**

Sandvik Automation IOT IBM - **https://www.youtube.com/watch?v=mW0mL0QaMBQ**

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Delivering Kilkenny Limestone to a Global Market

by Laura Hally

LAURA HALLY discovers how the management at Kilkenny Limestone Quarries Ltd. have promoted and modernised their business to ensure that they continue their success in leading the way both nationally and internationally in the markets they trade in.

Formed some 340 million years ago, Irish Blue Limestone is one of the most beautiful indigenous materials in the country. It formed the walls of Neolithic burial chambers, ancient monasteries, castles and the homes of chieftains and lords.

For centuries, Irish Blue Limestone has been the elemental medium through which designers have expressed their unique vision. In an age of mass production and expandability, the excellence of Irish Stone endures.

Now, Kilkenny Limestone is the company bringing the product to the world stage of modern architecture.

Established in the 1930s, the company directly employs 115 employees across three quarries based in Old Leighlin, Kellymount and Holdensrath. These quarries produce limestone blocks, slabs, tiles and paving for internal and external applications and are supplied to prestigious projects across Ireland, UK, Europe and Worldwide. Clients are predominantly Building Contractors and Municipal Bodies, (such as the OPW, and Local Councils)

They also sell limestone slabs and finished standard products to distribution partners who sell direct to the end user.

There are three colour variations in the Kilkenny Limestone range;

Kellymount Quarry.

The **Classic Blue** is bright blue grey in appearance and is suitable for many types of finishes and is used predominantly in cladding.

The **Dark Selection** is darker than the classic blue and is more suitable to honed or polished applications for internal use.

Fossil material is an incomparable variety of Kilkenny Blue Limestone as it is a captivating dark shade which is extracted from special shell or fossil beds and features relics of ancient oysters which are a particular characteristic of this stone. These large oyster fossils are unique to Kilkenny Limestone and are only found in the Kilkenny/Carlow region of Ireland.

Projects

Kilkenny Limestone enjoys strong working relationships with most of Ireland's leading construction contractors, and their craftsmanship can be seen in prolific projects across Ireland including The

More London.

London City Hall.

Central Bank, The Lewis Glucksman Gallery, East Point Business Park and Kilmainham Gaol.

In 2001, the company were selected as suppliers to Norman Foster's flagship More London project on the River Thames. This site is home to London's iconic City Hall. The public space features 30,000 square meters of flame-textured Irish Blue Limestone paving and a dramatic, sunken limestone Amphitheatre, known as 'The Scoop'.

International Success

Phillip Maher, General Manager, Kilkenny Limestone, says that it's their excellent reputation and track record that has propelled them into international markets.

"We've built up a strong portfolio of work over the years. Positive client references have allowed us to grow our business from mainly Irish-based work to overseas contracts. Most notably in Brussels' city center where Kilkenny Limestone recently secured a contract where they are currently supplying 36,000sq m of paving and 5000 Linear meters of kerbing in a major Urban Regeneration of the City Center and surrounding areas.

Before the contract was awarded, there was a 2-year pre-qualification required to get Kilkenny Limestone selected.

The clients visited the quarries with their Designers and Building contractor Viabuild to check on the capabilities of the Quarries in terms of Quarry Extraction and outputs from Factories.

Our Limestone had to meet strict Belgian stone specifications and quality standards, therefore as we already held ATG certification, which is a quality standard required in Belgium for Natural Stone, we were already in a strong position.

This standard requires that finished products such as paving and kerbs can be traced back to the beds in the Quarries where they were extracted, and these Products can be followed through our Production and Quality system before delivery to site.

In addition to the above testing must be carried out on the material such as compressive strength flexural strength and slip resistance.

The client reserves the right to pick random samples from the delivered pallets and carry out their own independent tests during the Project Duration to ensure we are complying with the standard specified.

All our testing is carried out by an independent company Sandberg who are based in London.

Quality Focus

A corporate member of the Irish Mining and Quarrying Society, quality is of the utmost importance for Kilkenny Limestone and all its quarries are both ATG and ISO 9001 certified. More recently they also now have been accredited with the ISO 14001:2015 Environmental

Brussels.

Certification from NSAI assuring clients that the management of the quarries and the systems that support them comply with high standards of environmental management.

ATG is the strictest and most respected auditing and assessment system for blue limestone in Belgium. This guarantees Kilkenny Limestone's adherence to a technical base specification and operation of a rigorous quality control system.

The company's commitment to continuous improvement, quality and technology has enabled it to thrive and grow into an industry leader.

New Technologies

"Business has changed significantly since our quarries were established," explains Phillip Maher. "In the last construction boom, there was a massive influx of cheaper materials into the market. We invested significantly in technology to diversify our product, boost productivity and ultimately reduce the cost of processing the limestone for us to offer an Indigenous product at a competitive rate to the markets we trade in.

When I joined the company over 20 years ago, we had employees working in the quarry using hammers and drills to extract the limestone. Technology today has certainly advanced, and

computer-driven chain saws and wire saws cut into the quarry faces using diamond-edged wires driven by electro-hydraulic systems"

New Quarrying equipment including Sandvik drilling rigs and trim drills are used to drill the limestone. Caterpillar loaders which are specifically designed as Block Handlers have a capability to carry blocks up to 40 tons in weight from the quarry floors to the processing plant.

A highly skilled workforce operates a variety of saws including gang saws, wire saws, diamond wire and circular saws for cutting the blocks into slabs and texture lines to apply surface finishes to the slabs before they are sawn into paving by the Bridge saws.

"Over the years we've seen an increased demand from clients for different surface finishes on the stone," says Phillip. "To meet this, we have purchased industry-leading Textures lines from Italy and can offer finishes in Diamond sawn, Flamed, Bush-hammered, chiseled for exterior use, and for internal applications Sanded, Honed and Polished tiles.

Kilkenny Limestone's significant investment in technology has allowed us to compete in Markets where we would not have traditionally served. These investments also have increased efficiency which has resulted in increased output from the Quarries and Factories.

Skills Shortage

Phillip Maher explains, "While new technology has replaced some of the labour-intensive processes we now have other challenges in attracting skilled operatives to run and maintain these machines and production lines. We do on-site training to alleviate this issue, but the interest and passion needs to come from the operative as there are specific machines unique to this industry".

Brexit

Another obstacle facing the organisation, and almost every other company in Ireland, is Brexit. "The impact on our business is unavoidable and a serious concern," he comments. "We're facing increased costs when selling our material into the UK and currently unknown delays in deliveries due to border checks. We're working on diversifying and expanding our markets and product range to limit the potential damage."

These industry-wide issues aside, Kilkenny Limestone is enjoying continued growth.

"The company is going from strength to strength, and we're in a strong position to face any economic shifts. We're noticing an increased appreciation and interest in native Irish material and the craftsmanship that goes with them," says Philip Maher. "Architects and Specifiers now visit the quarries in person. They want to personally see the Quarrying and Production process from start to finish and understand how a finished Product ends up on a pallet from a Block on the Quarry floor . It reflects the value that is now placed on sourcing the best material, not the cheapest. When you choose Kilkenny Limestone, you choose tradition, quality, longevity and ultimately, value for money."

Geo Drilling Apprenticeship

by Stephen Walsh MIPI AIED, Senior Market Advisor, Geoscience Ireland

Following a market review In late 2017, Irish drilling companies who export their services to overseas markets concluded that in order for them to continue to successfully export their services overseas a bespoke formal training qualification was essential.

The establishment of such a qualification had been discussed for many years and a number of stop gap measures had been employed in the interim to enable Irish drilling companies to compete overseas, such as the register of drillers operated by the Geological Survey Ireland.

On foot of a successful application to SOLAS, the State agency charged with overseeing training and education provision in the area of apprenticeships, an industry consortium comprising drilling companies, their clients and the Institute of Technology Carlow (ITC) set about developing the Geo Drilling Apprenticeship programme. The initial proposal and the subsequent development of the apprenticeship was led by Geoscience Ireland, on behalf of the Geological Survey Ireland.

Drilling is a fundamental activity underpinning the Irish geoscience sector, which is a multibillion-euro industry. Drilling contributes vital support services and technical knowledge to wider society by supporting the delivery of critical infrastructure. The overall direct impact of the sector is estimated at €1.5 billion euro with an indirect impact of €1.8 billion. The sector supports 24,700 jobs when combining direct and indirect employment.

Objective

The objective of the Geo Drilling apprenticeship is to provide drillers across a range of technologies with a dedicated Higher Certificate qualification (National Framework of Qualifications Level Six). The apprenticeship is a two-year programme which combines 'on-the-job' work experience with academic study. Apprentices will work with their employer's for 41 weeks, and attend classes at IT Carlow week for 11 weeks each year.

Course Content

Drillers operate complex machinery in often unknown and challenging environments to service the wider geoscience industry and their clients.

The course content reflects this...

The **'on the job'** training component which will entail the apprentices learning from experienced senior members of the profession will be supported by an 'off the job' training programme that is tailored toward equipping apprentices for the life in the modern technological, quality driven, information dependent, health and safety conscious work environment. During the **'off the job'** training periods, the apprentice will be receive training in the areas of;

- Drilling Equipment & Operations;
- Communications;
- Geo-informatics;
- Sample Retrieval & Processing;
- Geology;
- Health & Safety;
- Environmental Management & Stakeholder Engagement;

Steering Committee

The new model of apprenticeship development requires strong industry engagement in the development of the educational and training content delivered both on and off the job. The members of the Steering Committee who guided this process are set out in the table below.

Status to Date

On the 7th of May 2019, the Geo Drilling apprenticeship programme was validated by an academic panel in ITC. Validation approves the roll out of the apprenticeship as a formal programme of training in Institute of Technology Carlow.

Next Steps

Over the course of the summer, Authorised Officers from the ITB's across the State will be briefed by ITC and the Industry about the apprenticeship. A briefing for Authorised Officers (AO) about the Geo Drilling Apprenticeship took place on the 18th of June in ITC, running from 1000hrs to 1200hrs. AOs work with Educational and Training Boards (ETB)s across the country. AOs are an important part of the apprenticeship training apparatus as they manage, support and administer a portfolio of apprentice approved companies and apprentices within their region on behalf of SOLAS. It is anticipated that the pre-apprenticeship induction will take place in September with the first block of students commencing in the off the job training component in the fourth quarter of 2019.

For further information on apprenticeships please contact stephen@gsi.ie

Name	Association
Dr Frances Hardiman	Head of Faculty
Mr Eoin Homan	Head of Department
Mr Ger Keohane	Lecturer (Programme Leader)
Mr Brian Byrne	Lecturer
Mr Shane Murray	Lecturer
Ms Anita Hogan	Associate Lecturer (Work based Learning)
Stephen Walsh	Industry Liaison (Geoscience Ireland)
Roisin Dowd Smyth	National Federation of Group Water Schemes
Lisa O'Brien	Dalradian
Mike McCarthy	Priority Drilling
Tom Fogarty	Fogarty Drilling
Eoghan O'Neill	Boliden Tara Mines
Ciaran McCreanor	Dalradian
Ronan Killeen	Irish Drilling
Sean Finlay	Geoscience Ireland
Malcolm Doak	Irish Water
John Regan	SIPTU
Brendan Morris	Lisheen Technical Mining Services
Niall Meehan	GeoDrilling Solutions
Ciaran Killaly	IGSL

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Farrans Construction
Lakeside - The After Life

by Dominic Lavery, Deputy Managing Director, Farrans

When a quarry comes to the end of its mineral extraction life, it is always a dilemma what to do with this facility. There are many examples throughout the countryside where quarries have been abandoned and through time has become dangerous lakes and a headache for owners to keep secure.

Such dilemma faced Northstone when mineral extraction from its quarry on the Bushmills Road near Coleraine Town Centre, Northern Ireland ceased around 2006.

The site was formerly known as Spital Hill quarry and was in existence since the 1830s as a small basalt rock quarry. Operations expanded in the 1960s as demand for aggregate increased and the stone was used to produce asphalt and concrete blocks. The quarry was finally closed in recent years and the site once on the periphery of Coleraine, has now been enveloped by the town itself.

Farrans Construction, a CRH company, and part of the Northstone Group, developed proposals to engineer this facility creating suitable platforms to accommodate a modern housing development of some 450 homes with a feature lake at its heart; the development being called **Lakeside**.

Central to providing this development was the re-modelling of the site's topography to create the necessary profile for developable areas and internal roads.

Aerial Photo - Pre development.

Furthermore, it was a strict condition of the planning that remediation works were carried out to the development site; verification reports had to be submitted prior to occupation of any dwelling to confirm that the proper remediation works had taken place.

Quarry wall.

Quarry wall.

Phase 1 Housing.

Phase 1 Housing.

The enabling works required to comply with the remediation and re-modelling included 400,000m^3 of bulk cut to fill earthworks, 75,000m^3 of rock excavating utilising blasting and conventional methods, construction of a 370m long by 12m high reinforced earth retaining wall and formation of new engineered access roads, construction of foul and storm pumping stations as well as main infrastructure drainage. The ground behind the retaining wall was filled with rock cut from an existing level area at the top of the site that graded it into a slope, suitable for building houses.

The feature lake itself acts as a sustainable drainage system, and has an aeration system oxygenating the water, so that it can eventually support fish and other wildlife. The existing cliff face is the back drop to the whole development, and the lake has its own unique microclimate, sheltering the lowest slopes within the development from prevailing winds. The shadows from the cliff were also carefully analysed so as not to affect the proposed dwellings unduly.

Farrans took an engaged approach at all stages of the construction project with the local community, through schools programmes, leaflet drops and open-site days, educating the public with regard to the environmental aspects of the scheme, managing the interface during the construction processes as the site was transformed from redundant quarry to housing development.

The key to achieving planning permission on this ambitious land transformation project through the statutory processes and into implementation on site was continual liaison and dialogue with the environmental agencies, ensuring that processes, wildlife and environmental conditions including messages of safety were all adhered to. Such a significant undertaking over a sustained period of time is continually reviewed for financial viability at all stages, with housing units being built to suit market forces and **to date 70 units have been delivered**.

Lakeside concept layout.

Lakeside is a sustainable scheme and demonstrates its environmental credentials through its engineering initiative and excellence to re-use this redundant basalt quarry to meet the present-day housing needs of this expanding coastal university town.

This has been achieved without harm to the established wildlife habitats and environments of the quarry and will provide housing in a place of relaxation, leisure, enjoyment and learning for future generations to benefit from, uniquely delivered from the construction phase onwards through targeted conservation awareness programmes, activities and reporting.

MinLand and lessons from Europe for Ireland:

How can we integrate raw materials in land use planning?

by Sybil Berne (Planning Consultant, MacCabe Durney Barnes) and Eoin McGrath (Head of Minerals, Geological Survey Ireland)

MinLand is a pan-European project including 22 partners, linking geologists, planners, policy and decision-makers. It is funded under Horizon 2020's topic SC5-15d on linking land use planning policies to national raw materials policies. Geological Survey Ireland (GSI) and MacCabe Durney Barnes form part of this consortium and organised in September 2018 a workshop seeking to gather Irish experience on the integration of raw materials in land use planning. The Irish partners also presented a case study on the full life cycle of a modern base metal mine, from discovery through to post-closure maintenance.

The goal of the project is to safeguard access to necessary raw materials through better land use planning. At a strategic level, the EU seeks to protect sustainable access to raw materials, including metals, industrial minerals and construction raw materials. Minerals are essential in supporting economic growth and are vital for the transition to green growth. With the recent declaration of a climate emergency, the Irish planning system will be heavily focused on greener lifestyles, electric mobility and sustainable development for which raw materials remain critical, but has it moved toward safeguarding access to them? In some ways, it has. The National Planning Framework (NPF) now includes a policy which supports extractive industries (NPO 23) which considers that ***'the planning process will play a key role in realising the potential of the extractive industries sector by identifying and protecting important reserves of aggregates and minerals from development that might prejudice their utilisation'.*** Notwithstanding this, all three Regional Spatial and Economic Strategies (RSES) omitted mining and quarrying activities at draft stage. This might appear as an oversight, but it is a clear indication that planning also does not actively promote safeguarding of raw materials. They do not always appear as core concerns of policy-making/forward planning, unlike housing and other infrastructural developments, which ironically depend heavily on access to these materials.

Planning for raw materials is not as straightforward as other land uses as it is three-dimensional (sub-surface, surface and above); it is highly complex; far more engineering-oriented and can suffer at times with poor public perception and misinformation. Additionally, natural resources are by their nature spatially constrained and cannot be moved to an area which might be viewed as more suitable for the industry. The planning process can be risky and cumbersome with uncertain outcomes, although to date no mine was ever refused planning permission in Ireland. MinLand, to some extent, seeks to reconcile land use planning and minerals planning, with a particular focus on identifying how to safeguard resources, what works and why.

MinLand explored 16 case studies from 12 European countries, including Ireland. These case studies identified elements which contribute to successful raw materials extraction. They reviewed different stages from exploration to development and closure, including forward planning. These can be seen on the **www.minland.eu** website in more details. Successful elements include (but are not limited to):

a) Geological Mapping and Databases

To ensure successful outcomes, the technical expertise of Geological Surveys and the data they gather, are recognised as essential in any mineral and raw materials development programme. The Fraser Institute carries out yearly surveys and gathers views of mining companies on how 'attractive' countries are for mining investment. One comment attributed to Ireland referred to its comprehensive database (collated through GSI). MinLand found that Norway had a similar tool in place with a classification system for mineral resources based on value creation potential available for the public or interest parties. This type of platform or freely available database allows access to knowledge of what is available and where, as long as it is not commercially sensitive.

b) Combining spatial planning with geological skills

Ultimately if mineral and aggregate deposits were to be included in spatial planning in Ireland, be it at a national, regional or local level, forward planning authorities would need to work in close collaboration with the Department of Communications, Climate Action and Environment and importantly with GSI.

A common theme across Europe, including Ireland, is the lack of geological expertise in spatial planning. Conversely, a raw materials plan or strategy could not be prepared by geologists alone as they may lack in expertise in mitigating conflicts between land uses and designations.

The identification of any area would have to be done in context of existing and potential land uses conflicts and existing environmental designations, having, of course, due regard to public and other stakeholders input.

c) Spatial Identification

During the course of a survey carried out by MinLand in the summer of 2018, the issue of zoning for raw materials was discussed. Some countries in Europe chose this approach to safeguard access to significant deposits.

This can be done at national level, with a government department and/or a Geological Survey mapping important deposits as was done in Norway, Sweden, Poland, Finland and to some extent in Austria. This might also be carried out at lower level (either regional or local) as is done in Italy, Greece, Belgium, Spain and the UK.

This exercise could be carried out nationally in Ireland, particularly when substantial data has already been collected and could be geared toward evidence-based policy. In many of the aforementioned cases, these

designations have been inserted into local spatial plans. Ireland has limited experience in that matter.

The Kilkenny County Development Plan is one of the few plans which includes detailed aggregates mapping. Spatial identification could prevent undesirable uses and users from 'freezing' mineral and aggregate deposits.

To date, Ireland has shied away from any form of national spatial designations other than natural designations.

d) Permitting

In 2018, some issues arose over the status of deep drilling for mineral exploration and its position within the planning process. This issue has now been resolved reflecting generally that exploration in land use terms is a relatively benign activity, with no conflict with other land uses.

Exploitation and development of minerals involve on the other hand significant land use issues, requiring no less than three different permits (planning permission, integrated pollution control and state mining lease). Interactions between authorities can generate certain challenges and perhaps a form of one-stop-shop such as the system adopted in Portugal, Italy, Hungary, and Finland could help.

e) Preferred outcomes promoting happy endings

Ultimately, should Ireland decide to produce more raw materials, it will have to work actively at promoting positive stories in relation to the raw materials industry. One obstacle identified in almost all cases reviewed by MinLand is, in fact, a non-technical barrier: social acceptance.

The industry, the government and its state agencies will need to work proactively to educate the public for the need for raw materials. The legacy of past environmental disasters should make way for more positive spins. Portugal directs up to 25% of mining royalties to local social and environmental development.

Tara Mines has cohabited with a large urban area for 40 years and is its first employer. Lisheen and Galmoy were both successfully rehabilitated after years of supporting rural community employment.

The planning policy and framework is fundamentally based on cultural values, framed by environmental safeguards and decided upon by elected representatives. For raw materials to be valued in spatial planning, substantial education needs to be undertaken and positive stances should be promoted.

In conclusion, there is still a long way to go before raw materials are valued in the context of other land uses. The EU supports and funds projects like MinLand, which seek to identify how these can be safeguarded in the grand picture that is the planning system. Planning is a political process which manages conflicts. It is a balancing act seeking to achieve the ideal goal of sustainable development. Mineral planning should therefore be part of the equation.

MinLand

Check the project website: www.minland.eu or get in touch with us!

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 776679

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Promoting Irish Geoscience Expertise Overseas

by Sean Finlay, Director, Business Development, Geoscience Ireland

Geoscience Ireland (GI) is the geoscience business development cluster which supports its Member Companies in winning business in overseas markets. GI was established formally in late 2012 in response to the economic crisis in Ireland and has grown to thirty-eight member companies.

The member companies target mineral, water, environmental and infrastructure projects in markets including the UK, France, the Nordics, the Balkan States, sub-Saharan Africa, the Middle East and North America.

Since last year's IMQS Annual Review publication, GI has welcomed 3 new members including **Golder, Aurum Exploration** and **CDM Smith**.

In winning business overseas, GI Members are supporting and diversifying the Irish geoscience sector which in turn creates highly-skilled domestic jobs; these are pivotal jobs that act as a "gateway" to further economic development.
Since its inception in 2012, GI Member Companies have created more than 1,356 net new jobs, employing almost 4,000 people (2,199 of which are employed by small- and medium-sized enterprises (SMEs)) and generating more than €926 million in turnover.

GI is supported in its ambition to win business overseas by Geological Survey Ireland (a division of the Department of Commutations, Climate Action and Environment), Enterprise Ireland and the Department of Foreign Affairs and Trade.

The GI initiative is led by Sean Finlay, Director, and business development activity is supported by Andrew Gaynor, Business Development Manager. A key part of GI's business development is to provide quality networking and networks to leverage on behalf of its Members; Today, the established GI network comprises a diverse range of export agencies, ministries, trade associations, chambers of commerce, domestic and overseas business networks, private sector contacts and research agencies and institutions.

GI, in employing the 'cluster' model to engage industry, academia and government agencies in order to assist in the development of Ireland's geoscience sector, is delighted to have been awarded the **'Bronze Cluster Management Excellence Label'**; the accreditation is supported by **DG Enterprise and Industry (DG Growth)** of the **European Commission**.

Collaboration & Growing GI's International Presence

The common vision and ambition of GI and its Member Companies is to target and win business overseas through collaborative efforts. Such efforts include the ongoing delivery and sharing of market knowledge and experiences, the communicating and peer review of Member activities,

Richard Bruton TD with GI Team and Koen Verbruggenof GSI at COSME Visit to Dublin.

establishing networks and access points in target markets, and joint bidding on commercial projects.

Jessica Allen, Market Advisor, and Stephen D Walsh, Senior Market Advisor, provide the platform for Members to target and track international opportunities and tenders.

Some recent developments include:

- **Fehily Timoney** acquired Applied Ground Engineering Consultant's (geotechnical consultants)
- **ByrneLooby** acquired TerraConsult (UK-based land remediation experts)
- **Compass Informatics** was acquired by UK-based Tracsis Ltd (data services)
- **Designer Group** and J Sisk & Son established a new facilities management joint venture: Sensori
- **QME** signed an agreement with Anglesey Mining plc to assist in the development of the Parys Mountain copper, zinc, lead, gold and silver project, located in North Wales.
- **LTMS** was awarded a one year contract with Hindustan Zinc for design and supervision of installation of mine service lines in the Sindesar Khurd Mine
- **Nicholas O'Dwyer** has won a range of economic infrastructure contracts in Zambia, Liberia, Uganda and Tanzania
- **PW Nigeria** was awarded the Open Pit Contract Symbol Mining's zinc/lead mine in Nigeria
- **Verde Environmental** entered in to a joint venture with **FLI Group** on China-based projects

Trade Missions (TM) remain an important route to market for GI companies. **JB Barry** and **Nicholas O'Dwyer** participated on last Novembers visit to Ethiopia and Kenya; The Kenyan leg was led by **Pat Breen TD, Minister for Trade, Employment, and Business**.

FLI Carlow, Golder and **ERM** participated on a market visit with GI and Enterprise Ireland to Sweden to coincide with the Nordic's annual Suppliers Day forum, Trafikverket. The forum outlines the pipeline of infrastructure projects and capital spending in the region.

Ireland's presence in international markets continues to grow; elsewhere in the Review Andrew Gaynor of GI gives an overview of Ireland's growing participating at the leading international mining conventions.

Such events observe high participation levels among GI member companies with 10 companies travelling to the annual PDAC mining convention in Toronto at which GI and Enterprise Ireland hosts the 'Ireland - Open for Business' forum. Survey responses outlined a demand for a reciprocal event to be hosted in Ireland which would allow for mineral exploration companies to showcase projects and developments to an international audience,

Ireland Contingent at Trafikverket, Sweden.

and for Irish agencies and companies to promote access to data, policy, professional services and innovations; it was agreed that GI and IMQS collaborate in deliver 'Mining Ireland' in Dublin this October 8th.

European Collaboration: COSME Geothermal

Work on the European Commission funded 'GEO-ENERGY EUROPE' project is continuing in 2019. Now in its second year, this project presents GI with the opportunity to link with European clusters in order to assist the members of each cluster to explore and export to geothermal energy markets in countries outside of the European Union.

GI project partners are based across Europe, with participants in France, Spain, Germany, Belgium, Turkey and Hungary. Over three hundred and eighty companies are members of the combined 'super-cluster'; GI hosted the project partners in Dublin in January of this year, the super-cluster was joined by the Dublin-based scientific and economic attachés of the respective embassies of the project partners.

GI completed its project deliverable in 2019; building on expertise acquired serving its own members in the evaluation of markets and the identification of procurement opportunities outside of the European Union, Geoscience Ireland evaluated third country markets that are of interest to the members of the combined cluster. This evaluation was worked up into a comprehensive report which is now informs the internationalisation strategy of the project and the development of services that the combined cluster can provide to its members.

Geo Drilling Apprenticeship

Stephen Walsh of GI provides a detailed update of the Geo Driller Apprenticeship being delivered by the Institute of Technology Carlow. The Apprenticeship was validated in May and first entrants will be registered in the autumn of 2019.

Outlook 2019/2020 & Future Ambitions

Through its ongoing engagement with Members and stakeholders, GI will continue to identify overseas opportunities, and encourage market diversification and agility in a changing global landscape.

GI will continue to support its Members in embedding themselves in those sectors in which they have sustained themselves while also supporting market diversification whether this is geographical regions or sectors.

Its ambition is to:

- Support its Members in c**reating 150 net new jobs in 2019**.
- Support its Members in bidding better through the GI **Procurement Hub**.
- Establish Ireland as a leader in geoscience expertise, and support innovation in the sector.
- Deliver balanced regional growth.
- Gain greater traction with International Financial Institutions (IFIs); we look forward to participating at this October's IFI Conference in Dublin which will welcome the World Bank, the Asian Development Bank, the European Bank for Reconstruction and Development and the African Development Bank

For further information, please contact the team; +353 1 678 2673 or GIteam@gsi.ie

Institute of Geologists of Ireland (IGI)

An overview of activities

by Eur Geol., Catherine Buckley, P. Geo, IGI President

The Institute of Geologists of Ireland (IGI) was established in 1999 with the mission of promoting and advancing the science of geology and its professional application in all disciplines, especially the geosciences and to facilitate the exchange of information and ideas in relation thereto.

IGI Members are required to uphold, develop and maintain the highest professional standards in the practise of their profession. To this end all members must undertake CPD recording for approval on an annual basis.

Professional membership of the IGI is open to all practising geoscientists who meet the required standards of qualification and experience. For information on how to apply, please visit www.igi.ie.

The mining and quarrying sectors have always been very well represented within our membership, with approximately 35% of our members specifying 'Mining Geology and Exploration' as their main area of expertise at application stage.

Activities in 2018 - 2019

2019 marks a significant year for the IGI as the organisation celebrates its 20th anniversary. A conference field trip are planned for 11th and 12th October 2019 during which we will enable our members to network, increase their knowledge and celebrate the IGI.

Whilst this event is shortly after the Geoscience Ireland and IMQS Mining Ireland event we do hope to see the IMQS represented at our conference. We hope this event brings together past, current and future IGI members and that some of our overseas members, who make up 10% of our membership, can join us.

The successful IGI Mentor Programme was further strengthened in 2018 when we facilitated a Mentoring Workshop. This scheme currently has 13 active mentors in a wide variety of geoscience disciplines.

In March 2018 the IGI invited Canadian based Mining Engineer Mr. Larry Smith to present a two-day course on Economic Evaluation of Mineral Exploration Projects. The 2-day course will cover Cash Flow Evaluation principles, components and modelling of mineral projects, with overview of studies at various stages of advancement, including due diligence and risk assessment considerations.

IGI President Catherine Buckley PGeo presenting Ollie Bonham PGeo with the inaugural IGI Honorary Fellowship.

Attendees at the Economic Evaluation of Mineral Exploration Projects in March 2018

Our early career stage members availed of a Report Writing and Presentation Skills course in early 2019, which was so well received it is likely that it will be repeated in the near future. In April 2019, the IGI, Irish Mining and Quarrying Society, the Irish Association for Economic Geology and Geoscience Ireland co-hosted a Practical Mining course delivered by LTMS – Lisheen Technical and Mining Services, which was attended by over 60 members of the various organisations.

Our members also attended some varied talks covering topics such as environmental impacts of mining, case studies of remediation, ethics in geoscience and domestic groundwater supplies in rural Eastern Canada. The latter talk was delivered by the President of Geoscience Canada, Mr. Mark Priddle PGeo who took the time to connect with IGI whilst on holiday in Ireland.

A cold and wet day in November saw a group of members visit the Avoca Mine site area of Co. Wicklow, a trip facilitated by the Exploration and Mining Division.

The IGI was delighted to award the inaugural IGI Hononary Fellowship to Ollie Bonham PGeo in recognition of his many achievements including developing the much-valued Mutual Recognition Agreement between Geoscience Canada and the IGI. The award ceremony took place in the National Concert Hall, Dublin.

Irish Geoscience Network (IGN)

The Irish Geoscience Network (IGN), convened by the IGI, was formed in early 2012 to provide a forum for communication and sharing of ideas and resources for all bodies, organizations and departments involved in the Geosciences. The group has now grown to circa 32 such bodies and meets once a year. Along with access to an exclusive Professional Indemnity (PI) insurance scheme for the IGI Members and affiliated organisations, the Geo-Calendar of Events http://www.igi.ie/events_calendar.htm is available to assist all members of the Network to plan and where possible to avoid conflicting dates in their events.

Current and Future Direction

The Board of the IGI have established a Working Group to update the Strategy of the IGI and during 2018 our members and stakeholders were surveyed for input into an updated strategy document. A working group has been formed to develop the strategy to ensure the IGI remains vital and relevant for its members in the future. The new stragety will be launched at the IGI 20th anniversary conference in October.

A number of training courses are currently being considered including Oral Hearing and Expert Witness training and Pyrite Assessment training. The Board would be interested in hearing from members about other topics which may be of interest for courses in the future. Suggestions for courses should be sent to the office: info@igi.ie.

The 20th anniversary celebration in October will offer the geoscience community an opportunity to come together and acknowledge the achievements of our various disciplines. The IGI Board hopes that the IMQS and its members will join us in marking and celebrating this significant milestone for our organisation.

The IGI acknowledges the continued support of our sponsoring bodies, the Irish Mining & Quarrying Society (IMQS), Geophysical Association of Ireland (GAI), Geotechnical Society of

Ireland (GSI), Irish Association for Economic Geology (IAEG) and the International Association of Hydrogeologists (IAH Irish Group).

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Kazakhstan & Siberia | LTMS delivering mine safety training

The Geoscience Ireland (GI) network comprises over 35 Irish companies that deliver the science and engineering needed for minerals, environmental, water and infrastructure developments in over 75 countries: the UK, the Nordics, France, the Bal-kans, the Middle East, sub-Saharan Africa and North America.

Its Member Companies have capabilities ranging from civil engineering, geotechnical and environmental consultancy and geophysical / geological surveying, to drilling and contracting. GI, supported by the Department of Communications, Climate Action & Environment, Enterprise Ireland and the Department of Foreign Affairs & Trade, provides unique access to international markets through its partners and Member Companies.

For further information, and to see our Case Studies, please visit www.geoscience.ie

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Local Development Plans and Mineral Development in Northern Ireland

by Mark Patton, Minerals Geologist, Geological Survey of Northern Ireland

As a result of the creation of 11 new 'super councils' across Northern Ireland in 2015, responsibilities for the creation and management of local development plans has been devolved to individual councils.

Plans for local issues that had previously been handled centrally by the then Department for the Environment (now the Department for Infrastructure) are now in the process of being developed at a local level. The main issues and options being considered by the new councils are, among other things:

- *Spatial development*
- *Economic development*
- *Social development*
- *Environmental management*

Intrinsic to the economic, environmental, social and spatial aspects of these new plans is the matter of mineral development, specifically in relation to construction minerals (aggregates, sand and gravel). As part of the process of creating Local Development Plans, which are to run to 2030, councils have been engaging in a public consultation process involving stakeholders at a local and regional level. The process has a number of steps illustrated in the table below.

Although the Department for the Economy (DfE) has no remit for the extraction of construction materials, under the Quarries (NI) Order 1983, the economics of mineral extraction, in the form of weight and value of material produced and staffing levels, are collected as part of the Annual Minerals Statement.

This economic aspect gives DfE a legitimate interest in how the development plans are drafted. Decisions made and implemented through the local development plan, by the district councils, have the potential to directly affect the quarry industry and more broadly those industries it supports.

Data held by DfE and the Geological Survey of Northern Ireland (GSNI) have been used as part of the evidence base for drafting preferred options and subsequent draft Plan Strategies. Initial input to the Preferred Options Papers has been aimed at highlighting the importance of the minerals industry to the regional economy, assisting with the understanding of the distribution of local geology and identifying areas of mineral potential.

A specific exercise, carried out by the Geological Survey illustrated the impact that surface development has on the accessibility of minerals, which at first glance at a resource map may seem to be wide spread. In almost every case across Northern Ireland surface infrastructure, housing, roads and waterways, areas where extraction could not occur, reduce the available resource by approximately 50%.

Figure 1 shows a graphical example from just one district council area, Fermanagh and Omagh.

Also within the LDP process, DfE/

Task	Time Frame
Robust evidence gathering	9 weeks
Publish Plan Timetable & Statement of Community Involvement	4 weeks
Publish Preferred Options Paper	12 week consultation period
Publish Draft Plan Strategy	8 week consultation period
Independent Examination of Draft Plan Strategy	8 weeks
Adopt Plan Strategy	8 weeks
Publish Draft Local Policies Plan	8 week consultation period
Independent Examination of Draft Local Policies Plan	4 weeks
Adopt Local Policies Plan	4 weeks
Monitoring & Review of Plan	4 weeks

Table1: Local Development Plan timetable

> ***"Surface infrastructure, such as housing, roads and waterways, can reduce the available resource by 50%"***

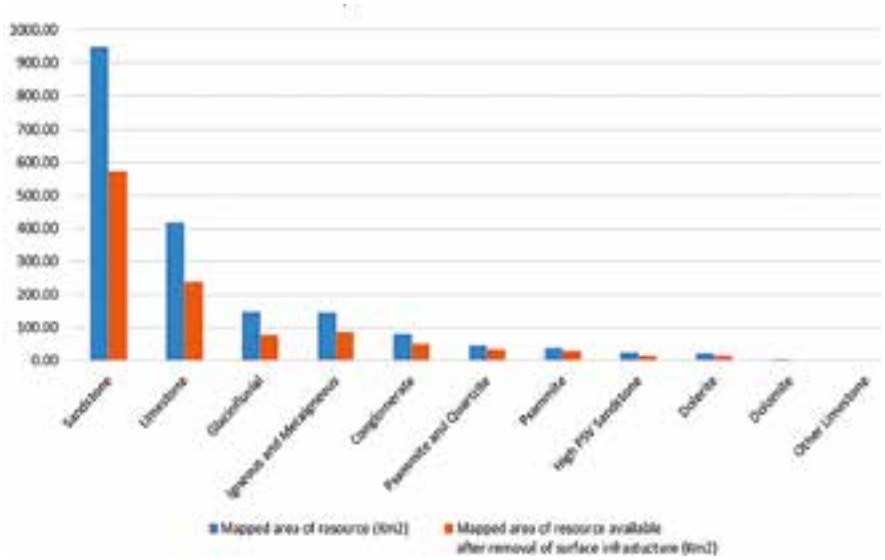
GSNI are providing advice to councils in respect of valuable minerals (metals and industrial minerals). It is important that councils consider the impact of their mineral policies on the potential discovery of valuable mineral deposits and that known deposits of valuable minerals are safeguarded for potential future access.

At time of writing three district councils have published draft plan strategies: Fermanagh and Omagh, Mid Ulster and Belfast. Belfast has no operating extraction sites, but Fermanagh and Omagh and Mid Ulster are the two most important areas of Northern Ireland for mineral extraction, particularly sand and gravel. Both these areas also have considerable tracts of countryside designated as Areas of Outstanding Natural Beauty (AONB).

Both Draft Plan Strategies highlight how difficult it is to effectively balance preserving these areas whilst not being overly restrictive to mineral extraction. This remains a key consideration in the formulation of the Draft Plan Strategies for both councils and one on which DfE, GSNI and the minerals industry have provided comment.

The next stage for these councils will be consideration of the responses to the draft plans prior to taking them for independent examination where the content, conformity and process by which the plan was produced will be tested for soundness.

Fermanagh and Omagh District Council Area
Spatial resource assessment



In the meantime, the remaining eight councils watch with interest and take the opportunity to learn from the experiences of those that have led the way.

IRISH DRILLING LIMITED

Irish Drilling Limited (IDL) is the leading Irish Geotechnical Investigation and Mineral Exploration Drilling Company that was established in 1968. Based in Loughrea, County Galway it currently employs over fifty people ranging from Engineers, Geologists, Drillers, Mechanics and Laboratory Technicians.

IDL has carried out major site investigation and mineral exploration drilling contracts in Ireland, Britain, France and The Isle of Man.

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Planning Update:
What planners have been up to in the last 12 months...

by Sybil Berne, BSc, MRUP, MSc, MIPI, MIEnvSc,
Planning Consultant, MacCabe Durney Barnes

2018 was a busy year for Irish planning. In the space of twelve months, the planning system has seen an array of new legislation and policies.

Legislative changes

The Planning and Development (Amendment) Act 2018 was passed in the course of 2018 and is now partly commenced. It amends the parent act, the Planning and Development Act 2000. Changes include the formalisation of the role of **Planning Regulator** who will provide a review function of all local authority and regional assembly forward planning, including zoning decisions[1]. Mr Niall Cussen was appointed to the role.

The new legislation also brings the formal creation of an entirely new forward planning system for the marine area. It provides the primary legislative basis for the preparation of a marine spatial plan for the Irish marine environment and allocates forward planning responsibilities. This is paralleled with the ongoing preparation of the **National Marine Planning Framework**[2] which will set out policies and objectives for the use of marine space, including the exploration and development of marine aggregates. Upon adoption, future license and lease applications will be assessed in the context of this new plan.

The new act also implements some of the recommendations of the Mahon tribunal, specifically in relation to transparency and efficiency in the planning system. All submissions on development plans and local area plans must now be made available and reported upon in the Chief Executive's report. S.22 facilitates the introduction of **ePlanning** for the online submissions of planning applications and appeals, which will make it easier and reduce the need to travel (especially to An Bord Pleanála in Dublin!).

The **2014 EIA Directive** was finally transposed in Ireland in September 2018 through new Regulations and revised Guidelines. New topics must now be considered when preparing **Environmental Impact Assessment Reports** (EIAR) specifically human health, climate change, biodiversity, disaster prevention and resource efficiency are now considered in addition to the other topics we already know. Developers must now employ/ engage competent experts to prepare EIAR.

Policy Changes

Most readers would be aware of the adoption of the **National Planning Framework** (NPF) in February 2018. The NPF is a clear departure from its predecessor the National Spatial Strategy and formally supports mining and quarrying activities, recognising their contribution to the economy. The three Regional Assemblies are now at various stages of the preparation of the **Regional Spatial and Economic Strategies (RSES)**.

In May 2019, only the Eastern and Midland Assembly adopted their RSES. The other assemblies will adopt the new RSES in Q3 of 2019. This will allow the Planning Authorities to progress with the review of their **Development Plans** and will give the opportunity to organisations and citizens to have a say in policy which is now becoming outdated. Many of these had to either be paused or postponed due to the lack of RSES.

MDB MacCabe Durney Barnes
Planning Environment Economics

1 www.opr.ie

2 https://www.housing.gov.ie/planning/maritime-spatial-planning/maritime-spatial-planning-directive/maritime-spatial-planning

Department for the Economy
www.economy-ni.gov.uk

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www.bgs.ac.uk/gsni

Minerals in Northern Ireland

Find the information and data you need at the Geological Survey of Northern Ireland

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INQUA Conference 2019

by Kieran Craven, PGeo

INQUA 2019 was held in the Conference Centre, Dublin 25th-31st July, with 2981 abstract submissions and 2243 registered delegates (56% Male, 44% Female) from 68 countries, INQUA2019 was both the largest Geoscience conference ever held in Ireland and the largest INQUA congress since its foundation in 1928.

A huge thank-you goes to all our sponsors and exhibitors, including Science Foundation Ireland, Geological Survey Ireland, Geological Survey Northern Ireland, and Fáilte Ireland (a full list available on www.inqua2019.org). Without all our sponsors and exhibitors help and support the congress would not have taken place.

The congress was officially opened by Mary Robinson on Thursday 25th July with a packed programme.

Eleven sessions ran in parallel consisting of talks on Terrestrial, Coastal and Marine Processes, Palaeoclimate, Stratigraphy and Chronology, and Humans and the Biosphere.

Field trips ran pre-, mid- and post-congress, ranging from 1-5 days and incorporate the rich Quaternary story in all corners of Ireland taking in the Mournes, Clare Island, the Shannon, Wicklow and Dublin among many others.

Please follow us on facebook (@inquadub2019) and twitter (@inquadub19) for updates from the congress, including Quaternary-related verse from our official poet in residence!

For any further information, please contact info@inqua2019.org.

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Geological Survey Ireland is a division of the Department of Communications, Climate Action & Environment

International Thermonuclear Experimental Reactor

by Michael Keane - principle, M. Keane Consulting

The world's biggest experiment lies in a quiet wooded area in southern France, near Aix en Provence. This project is a potential game changer in the vital battle against climate change and could impact every single person on this planet.

It's known as ITER, the International Thermonuclear Experimental Reactor.

So what is the ITER project?

It's an international effort to prove that power from fusion, the same energy source that powers the Sun and gives our planet light and warmth, can be produced on a commercial scale on Earth, in a sustainable manner. The facility is being built by a scientific partnership of 35 countries.

Each of the seven ITER members, the European Union, China, India, Japan, Korea, Russia and the United States, are designing and fabricating a significant portion of the machine. ITER's highly specialised components, many of which are unique and made up of roughly 10 million parts in total, are being manufactured in industrial facilities all over the world.

They're subsequently shipped to the worksite, where they must be assembled, piece-by-piece, into the final machine. The cost of the project will be more than €20 billion and is funded by all of the partners.

The project passed its 60% completion point early 2019 and is well on the way to phase 1 of the start up, scheduled for 2025.

The worksite and the flags of all involved.

A little history:

Over 30 years ago, a group of industrial nations agreed on a project to develop a cleaner, more sustainable source of energy. ITER was set in motion at the Geneva Superpower Summit in November 1985, when the idea of a collaborative international project to develop fusion energy for peaceful purposes was proposed by General Secretary Gorbachev of the former Soviet Union to US President Reagan.

One year later, an agreement was reached: the European Union, Japan, the Soviet Union and the US would jointly pursue the design for a large international fusion facility, ITER.
The People's Republic of China and the Republic of Korea joined the Project in 2003, followed by India in 2005.

So what is fusion?

The promise of fusion energy has seemed fantastic and unattainable; it is the power behind the sun and the stars. So how do

The work site – January 2007.

The work site - early 2019.

we replicate that here on earth? The quick answer "with great difficulty!"

In a fusion reaction, two light atomic nuclei combine, form a heavier nucleus and release energy. The Big Challenge: to reproduce a similar reaction on Earth, within a fusion machine.

The science bit:

A small amount of deuterium and tritium (hydrogen) gas is injected into a huge, donut-shaped chamber, called a Tokamak.

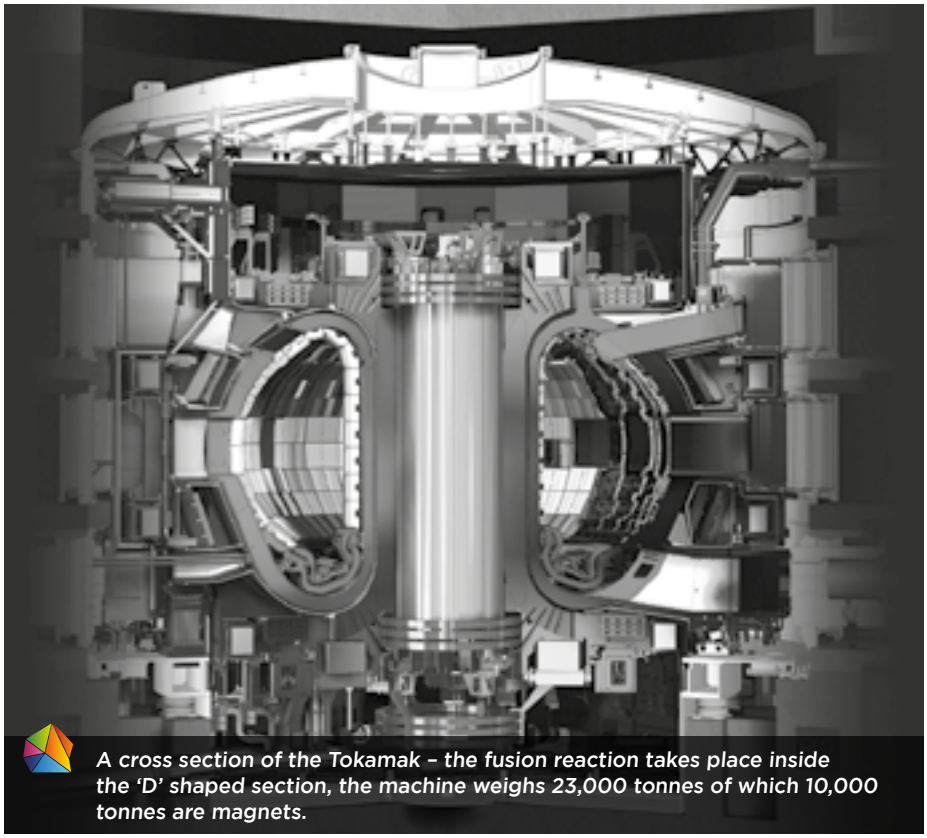
Once in operation the hydrogen is heated until it becomes an ionized plasma.

Giant superconducting magnets, integrated with the Tokamak, confine and shape the ionized plasma, keeping it away from the metal walls. The central solenoid of the magnet is so 'magnetic' that it could lift an aircraft carrier out of the water. These magnets have to be cooled to be 'superconducting', in fact are cooled to minus 269 deg.Celsius – the temperature of interstellar space.

When the hydrogen plasma reaches 150 million degrees Celsius - ten times hotter than the core of the Sun - fusion occurs.

Ultra-high-energy neutrons, produced by fusion, escape the magnetic field and are absorbed in the metal Tokamak chamber walls, transmitting their energy to the walls as heat. Some neutrons also react with lithium in the Tokamak walls, creating more tritium fuel for fusion. ITER's fuel is recycled for re-use. Fusion produces no high-activity, long-lived radioactive waste.

Water circulating in the Tokamak walls receives the heat and converts to steam as in any steam turbine power station. In a commercial reactor, this steam will drive turbines to produce electricity.



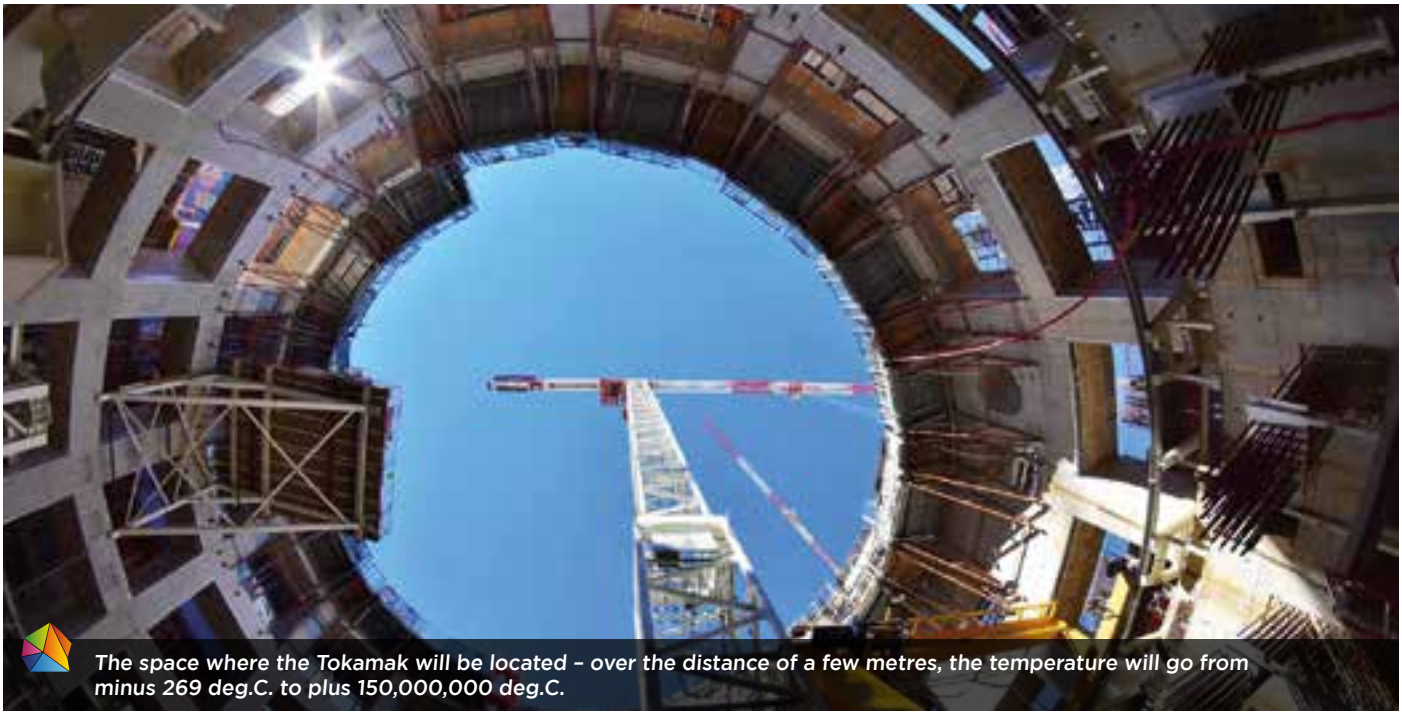
A cross section of the Tokamak – the fusion reaction takes place inside the 'D' shaped section, the machine weighs 23,000 tonnes of which 10,000 tonnes are magnets.

The environmental bit:

Fusion energy is carbon-free and environmentally sustainable. It is much more powerful than fossil fuels. ITER uses two forms of hydrogen fuel: deuterium, which is easily extracted from seawater; and tritium, which is bred from lithium inside the fusion reactor. The supply of fusion fuel is abundant, practically unlimited in fact.

And in terms of safety, when the fusion reaction is disrupted, the reactor simply shuts down—safely and without external

This photo gives an idea of the scale of the actual Tokamak chamber – note the people in the middle.



The space where the Tokamak will be located – over the distance of a few metres, the temperature will go from minus 269 deg.C. to plus 150,000,000 deg.C.

assistance. Tiny amounts of fuel are used, about 2-3 grams at a time; so there is no physical possibility of a meltdown type accident.

The Irish involvement:

Ireland's role in the project is a result of our EU membership - there is formal collaboration through DCU and National Centre for Plasma Science and Technology. Regarding the people actually on the ITER site, we (a few Irish people having coffee one day) worked out that, in terms of population, Ireland is reasonably well represented here.

Overall, there are about 1,000 people here involved in designing and planning this mega-project, and more than 2,000 people, at any one time, on the work site involved in the actual buildings construction and commencing machine installation. There are many thousands more working on the ITER project around the world in their own countries.

Site view May 2019.

I work, part of my time, for the Diagnostics Division. Diagnostics are the 'eyes and ears' of the project and uses many different systems and techniques to carry out the job. Most of the systems are one of a kind and will have added spin off benefits for industry and medicine.

I have never worked on such a multi-cultural and diverse project with many highly specialised people in a huge variety of fields of expertise. It does present some cultural challenges beyond the language barriers. I quickly realised that, in practise, a Korean meeting is very different from a US meeting. Despite everyone being involved in the same project, things get done in many different ways and I needed to figure this out quickly.

Overall, my task in the Diagnostics Division is primarily to help make sure we can turn the theoretical into the actual.

Last week, I read a very apt sentence noting that the principles of fusion might be relatively simple but the implementation, on Earth, involves mind-boggling complexity. Considering recent press on climate change and how this is affecting us all due to global warming and the seemingly inevitable catastrophic effects on us all, we don't have many alternatives – fusion represents one of the best chances of tackling this.

The views and opinions expressed herein do not necessarily reflect those of the ITER Organization.

It's not always sunny in Provence - a rainbow over the site recently.

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MDS International
Turning Overburden Waste into a Profit

by Raheel Qamar, Marketing & Sales Manager at MDS International

MDS International is a manufacturing company based in Carrickmacross in Co. Monaghan that has been making its own brand of heavy-duty rock trommels. The company is fully Irish, and every component is made and assembled at its factory in Ireland. The company is the only producer of Mobile Heavy Duty trommels and boasts having built the World's largest trommel on tracks which sits at almost 200 Tonnes!

Overburden is an issue faced by many quarries across the world and numerous operators treat this as an unsolvable problem and let it rest for years. However, in recent years MDS has seen a shift of focus of its customers to this issue and there is a growing trend of processing overburden to recover stones and clay. MDS range of trommels have been at the forefront of helping companies tackle this issue, irrespective of where the quarry is or what the climate and weather conditions are!

Majority of customers have used MDS M412 trommels to separate fines and M515 Trommels to create Riprap (Armour Rock) in grades of 5/60kg, 60/300kg and 300/1000kg rocks at high output rates of up to 550 tons per hour. However, more and more customers are now using these units to deal with overburden.

In the current economic climate, businesses especially in the quarrying and mining sector are trying to maximise their productivity and make their quarry operations as efficient as possible. To do this they use every resource that they have available and eliminate all waste. More and more companies are joining the trend of processing their overburden using MDS trommels and extracting stones from all areas within their quarries.

The Overburden Issue

Overburden is a problem for quarries as it sits at the top of the quarry and eats up a lot of quarry space. It also has a high volume of rocks in the mixture that are being wasted by not being recovered.

The overburden in quarries contains a mixture of soil and rocks. The soil has a high plasticity clay content which is stuck to the rocks. This type of clay clumps together instead of breaking up and is very problematic for regular vibratory screeners. The vibrating action liquifies the clay and makes it stick to the openings and blocks up the screens. Also, the rocks found in this mixture are as large as 800mm and are too big for regular vibratory screeners or recycling trommels.

This is a common problem found all over Ireland and there is an accumulation of difficult sticky overburden in the North East of Ireland especially around the intensely populated quarry region of Meath. This area has a high percentage of recoverable aggregates contained within the overburden.

The MDS Advantage

MDS trommels use a Heavy-Duty Hardox Steel drum with Opening sections made of Hardox Steel that is capable handling the most abrasive rocks that weigh up to a tonne. The cleaning action of the rotating drum is the most effective way of scrubbinh off clay and sticky materials from rocks. This is facilitated by the tumbling action of rocks and soil in the drum. The rocks with dirt stuck on them hit off against the surface of the drum walls and against other rocks and this separates the sticky soil materials giving clean rocks.

MDS tackles the issue of blocking of openings by using a Steel drum cleaner that is used with the drum and it keeps pushing into the openings and removing any blockages. All this is done at a high output rate of up to 550 tons per hour. The trommel boasts a large feeding hopper so customers can load using 20 Tonne dump trucks.

This solution has proven to be a game changer in this application and customers across the world (Specifically Germany, Australia, UK and USA) have successfully recovered rocks from their overburden. The M515 unit recently cleared a lot of overburden in Roadstone Duleek.

It is now evermore apparent that our European customers are embracing the sentiments of the Canadian, Australian and US dealerships in this application.
They have acknowledged that the latest

advertorial

Trommel technological advances present in our M412 and M515 range have made huge savings in terms of fuel efficiency and low wear costs when dealing with overburden.

Going from Waste to Profit

Utilising the M515 setup with a drum cleaner to process rocks mixed with harsh sticky materials is a huge economic driver and tackles a problem that until now has been deemed unsolvable. It is estimated that each overburden site contains approximately 50% of recoverable rocks which can be processed and sold off for a profit. The other advantage is clearing up of quarry space that is being eaten up by large stockpiles.

Results from several case studies around the world (Vulcan Materials, Heidelberg Cement and CRH Roadstone) have reliably informed that the myth of overburden material being un-processable (Which was experienced using conventional vibrating screens) has been effectively eliminated thanks to MDS.

This is a great opportunity for Irish quarries to utilise this innovative solution to process their waste and get considerable returns from the unit. The M515s are versatile machines and can be used in other applications such as processing of demolition waste, limestone, granite, steel slag and using as a primary processing unit.

Details of this Case Study

Trommel Used: MDS M515 Track
Features: Drum Cleaner
Material: Limestone with clay
Fines: 0-100mm
Mid-Product: 100-300mm
Oversize: 300-800mm
Output achieved: 520 TPH
Customer: CRH Roadstone
Location: Roadstone Duleek

View the Video

Scan QR code to view M515 with a drum cleaner in action in Duleek, Ireland.

MDS
mds-int.net

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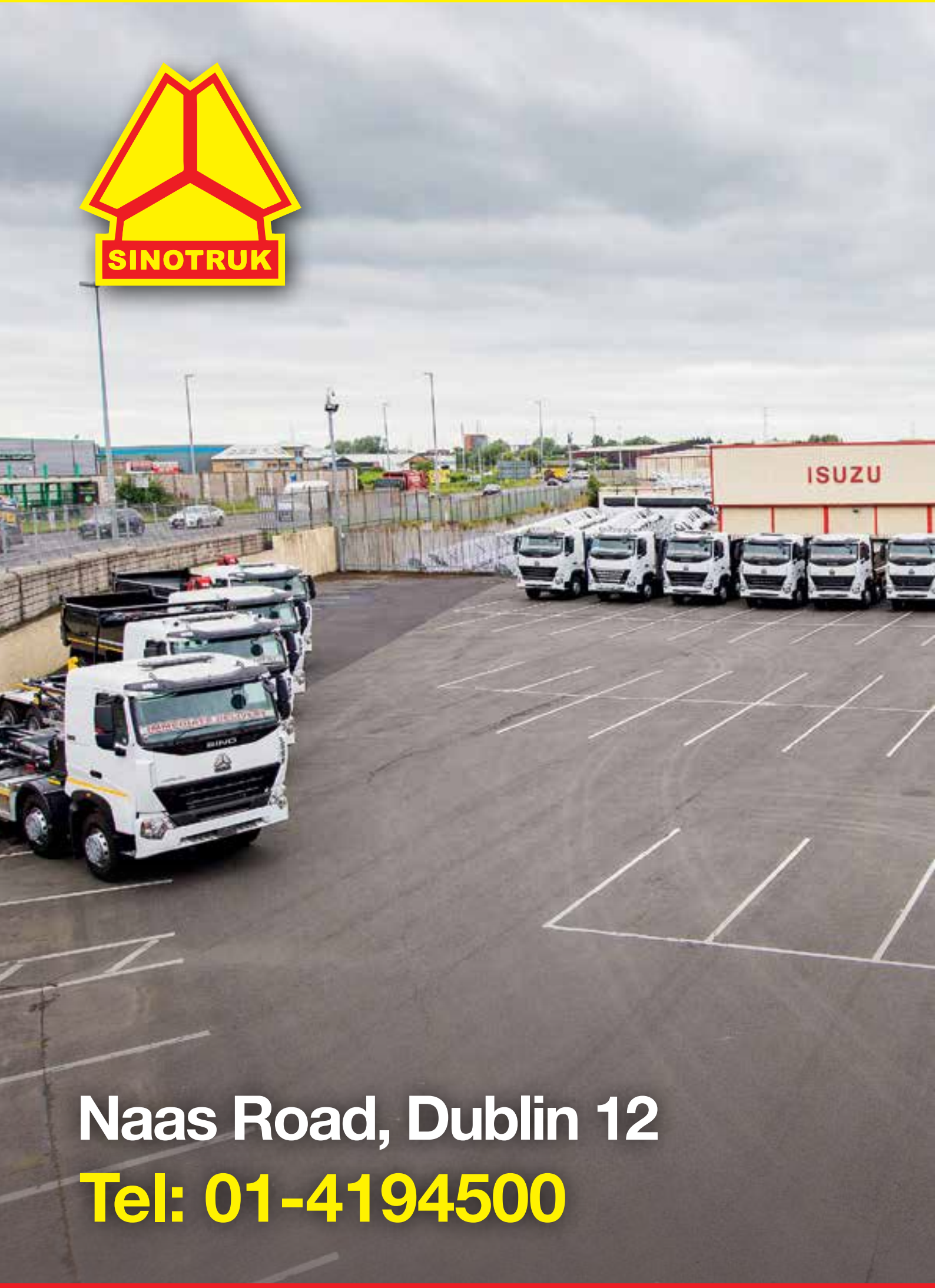

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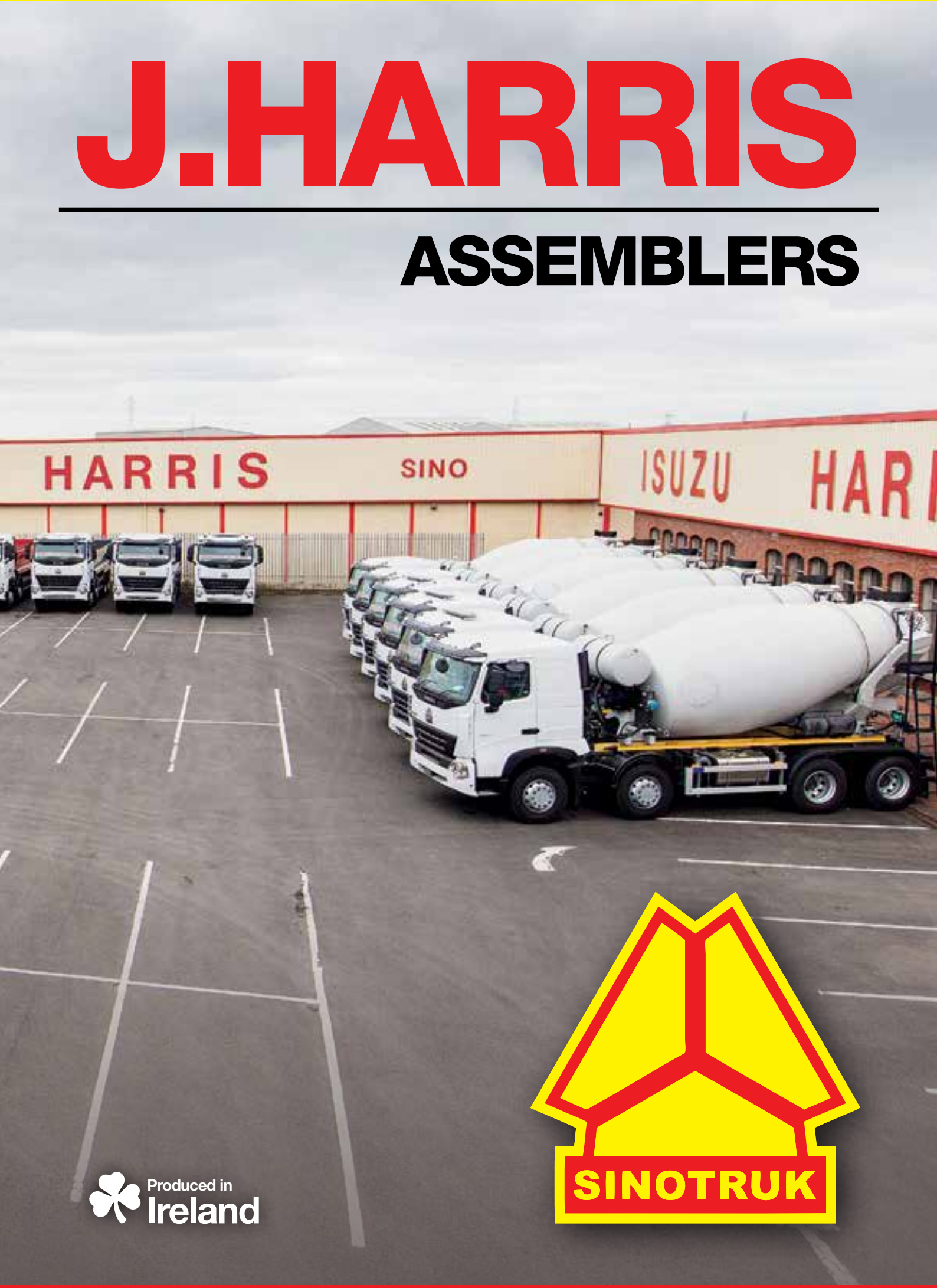


Produced in Ireland

Exploring concrete solutions for a carbon neutral future

by Brian Gilmore, Communications Manager, Irish Cement

From the rock face to the finished facade, the construction of our built environment really does require many hands. From architects to specifiers, regulators to engineers, material manufacturers to builders and indeed the occupiers of the built environment, each of us helps shape the spaces where we spend up to 95% of our time. Today it has become clear that each link in this chain also bears part of the responsibility for the impacts of our built environment.

This closely linked value chain has inspired what is being called the '5C' approach, Cembureau's latest framework to address the challenge of a carbon neutral future. The 5C approach: clinker, cement, concrete, construction, and carbonation, seeks to secure a collaborative effort to this common challenge.

Cembureau is the European Cement Association based in Brussels representing the European cement industry and is working to ensure that future European policy frameworks foster this collaboration approach ensuring the scale of the sector can be harnessed to construct a climate-resilient future.

Clinker

Clinker is the active ingredient in cement. It is produced from limestone and other minerals using extreme heat inside the cement kiln. CO2 is released from the limestone as part of this chemical transformation. To get these extreme temperatures requires the combustion of fuel leading to more CO2 emissions. Over decades, the European cement industry has already invested heavily to reduce these CO2 emissions, and it continues to search of further reductions.

Thermal Efficiency

Modern cement kilns have become highly energy efficient as older plants have been upgraded or replaced. The energy intensity of cement manufacturing is influenced by many factors, however in simple terms less fuel is required today to make a tonne of clinker compared to 1990.

Fuel Replacement

The fuel mix is also changing, fossil fuels are being replaced by alternative fuels. The increased use of these lower carbon fuels directly reduces CO2 emissions. Wastes for example; used tyres, mixed plastics, composite materials that are difficult to recycle through conventional processes can be co-processed in cement kilns.

Break-Through Technology

A number of European projects are examining the possibility of electrifying either all or parts of the clinker production process. This is a novel approach and the initial work will be to determine what, if any technical barriers need to be overcome.

In addition, the industry has been working on the key breakthrough technology of carbon capture. Through the development of multiple capture technologies, the European cement industry is leading the way in addressing these questions and investigating if carbon capture can become a commercial and technical reality.

Cement

As clinker-based cement provides the durability, safety and strength of concrete globally, the cement industry is ensuring that product performance is not compromised as it pushes for further innovation. Significant progress has already been achieved and now the industry is directing its research into a detailed assessment of the impact of other raw materials on the durability and strength of the concrete.

Energy Efficiency

The cement industry has been continuously investing and improving the grinding and mixing technology required to produce fine homogenous cement. In addition, new grinding compounds have been developed to improve the 'grindability' of cement leading to reduced energy consumption.

Clinker Substitution

Early cements were made by grinding 95% clinker with gypsum to control concrete setting and workability. More recent innovation has led to a reduction in the proportion of clinker required. The current average clinker content in cement in Europe has been reduced to 77%. This has largely been achieved through clinker substitution, however limited availability of suitable materials will impact on the rate of further progress.

New Binders

The cement industry is also exploring the potential to develop new low CO2 binders. A number of these projects are exploring technologies that could achieve 30% lower CO2 emissions. Novel materials based, for example, on industrial by-products or suitable clays, instead of clinker can offer lower carbon alternatives in regions where these raw materials exist.

Concrete

No other material provides the versatility, resilience, safety, and durability as well as high thermal mass, which makes concrete a highly energy efficient construction material. Thanks to their durability, concrete structures can last 100 years or more, which means total life-time emissions are low when compared to most other construction materials. And at the end of life concrete is 100% recyclable.

Cement Replacement

The use of fly ash or blast furnace slag in concrete, as partial cement replacers, can reduce the overall greenhouse gas emissions associated with the production of concrete.

The challenge remains that compared to the abundance of natural raw materials like limestone, some of these other materials are quite scare.

Concrete Technology

The industry is working in partnership with its suppliers and customers on a range of technological improvements aimed at reducing the carbon footprint per tonne of concrete.

Examples include; low-clinker cement, using concrete more efficiently, optimising the mixes for different applications, aggregate packing, and fine-tuning additives.

Co2 Binders

CO2 can be used to bind concrete made from recycled aggregates. This is done by exposing the aggregates to very high levels of CO2 in a controlled curing chamber triggering a chemical transformation that locks the CO2 in the concrete.

Unlike traditional hydraulic binders where the concrete hardens with water, these so called, 'carbonatable' binders harden when exposed to CO2.

Construction

Buildings are responsible for 36% of CO2 emissions in the EU and 40% of energy consumption. For this reason, assessing the entire life-cycle of buildings and infrastructure, to drive emissions reductions is essential. To meet the Paris Agreement by 2050, the building sector, as a whole, needs to move towards full carbon neutrality. The Global Alliance for Buildings & Construction has identified several levers available to achieve this, including: nearly-zero energy buildings (nZEBs), deep renovation, better building management, and production of low-carbon energy. Cement and concrete can play a role in all.

Thermal Mass

Conventional buildings use 150-200 kWh/m2/year. By contrast, today's concrete buildings, thanks to thermal mass, long-lasting air-tightness, and other measures, can be designed to use 50 kWh/m2/year or less. "Thermal mass" refers to concrete's unique ability to store energy and release it over a daily cycle, leading to reduced energy for heating and cooling, and more comfortable indoor spaces.

Renovation

Thanks to its durability, concrete structures can last several renovation cycles without the need to be rebuilt. At some point rebuilding may be required to improve the energy efficiency and here concrete is the material of choice. It allows reuse of the existing resources, structural elements and recycled concrete making it the best option from an economic, energy efficiency, and social point of view.

'Smart Concrete'

Better building management includes both user behaviour and automation of controls. "Smart" (automated) control of heating and cooling through thermally activated concrete, in communication with the smart electricity grid, is one of the best ways to manage energy supply and demand, harness the thermal mass and fully use all renewable energy produced.

As well as making buildings more energy efficient, the thermal mass of concrete buildings can be used to store energy and better match fluctuating renewable energy sources to demand. This is known as "demand response". Several pilot projects in Austria have demonstrated the effectiveness of using concrete to store excess energy produced when renewable energy was available thus taking full advantage of renewable energy peaks – allowing buildings to run year-round for virtually no heating or cooling costs.

(Re)Carbonation

Concrete acts as a carbon sink! This is a natural reaction based on the fact that hydrated cement used in concrete or mortars naturally absorbs CO2 during its lifetime, a process known as (re) carbonation. The Intergovernmental Panel on Climate Change (IPCC) recognises the phenomenon of (re)carbonation for carbon removal, even though it is currently not calculated in the countries' GHG inventories.

Recent studies have shown that up to 25% of process emissions related to the production of the cement is (re)absorbed by the building stock. The cement industry is currently working on developing a suitable global assessment methodology. This would allow Members States to account for this form of stable long-term CO2 storage in buildings and infrastructure thanks to concrete carbonation.

As the industry brings these innovations to the market it is important to emphasis the role of education and training of architects and engineers on the applicability of lower carbon concrete mixes and efficient design opportunities in buildings and infrastructure. Parallel development of sustainability standards that encourage the use of these lower impact products is also essential.

The momentum to find a global solution is building and the demand for action becoming more acute. Because of its scale, transitioning the built environment to a carbon neutral future is a considerable undertaking which requires commitment and collaboration from every link in the construction value chain.

Irish Cement's limestone quarry, Platin *Image Credit: Ted Keane*

Earth Observation for the mining of Raw Materials (EO4RM)

by Brendan Morris, Managing Director - LTMS and
Stephen Wheston, Principal Health, Safety and Environmental Specialist - LTMS

LTMS has been engaged as part of a consortium to carry out a project for the European Space Agency titled 'Earth Observation for the mining of Raw Materials (EO4RM)'. The consortium is led by Deltares (The Netherlands), S&T (The Netherlands and Norway) and Geoville (Austria).

The project started in April 2019 and will be completed in late 2020.

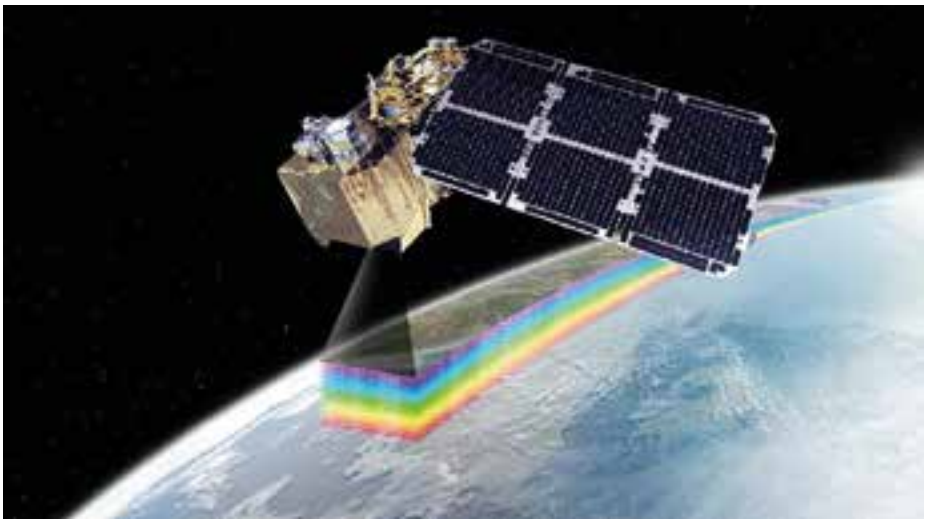
Project Overview

The project has the following objectives:

- Identify and consolidate the geoinformation needs and priorities of the mining industry and its related industry regulators, and assess their current and planned uses for satellite-based Earth Observation (EO) data;
- Define the current EO capabilities and uses based on the various available EO sensors and EO service provider capabilities to support the entire mining cycle, also anticipating future development of EO sensors, systems and services;
- Develop a roadmap to enhance the uptake of beneficial EO capabilities, and to establish them as a part of the mining industry 'best practice' guidelines;
- Develop EO service mock-ups on a virtual platform to demonstrate relevant EO capabilities for the mining sector.

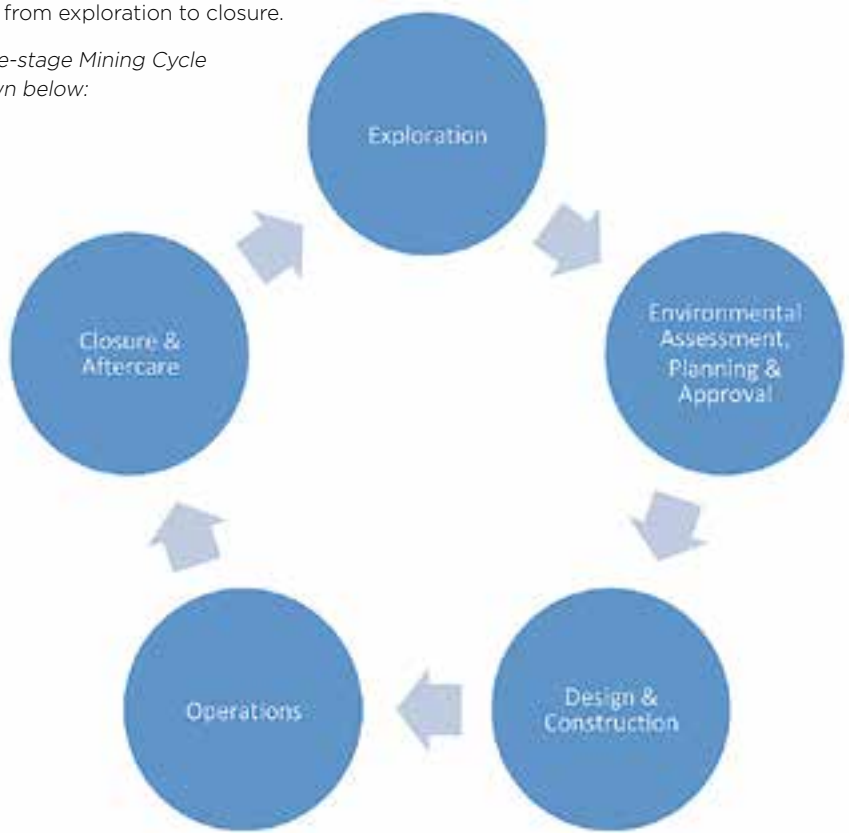
As part of the project, a stakeholder consultation workshop was carried out (June 2019), to ensure that relevant stakeholders had the opportunity to provide their input at the earliest stage.

A key part of the project is the engagement of an International Industry Board (IIB), to provide input, guidance of the activities and ensure a strong mining sector focus in all phases of the study. The IIB is comprised largely of people that are active in various aspects of the mining life cycle from across the globe, involving the most important mining regions. The IIB members come from a variety of sectors (i.e. mining companies, governmental regulators, consultant firms, network platforms and academia). The IIB includes a member from both Geoscience Ireland and Geological Survey of Ireland.



The project focusses closely on the Mining Cycle which represents all of the stages of mining from exploration to closure.

The five-stage Mining Cycle is shown below:

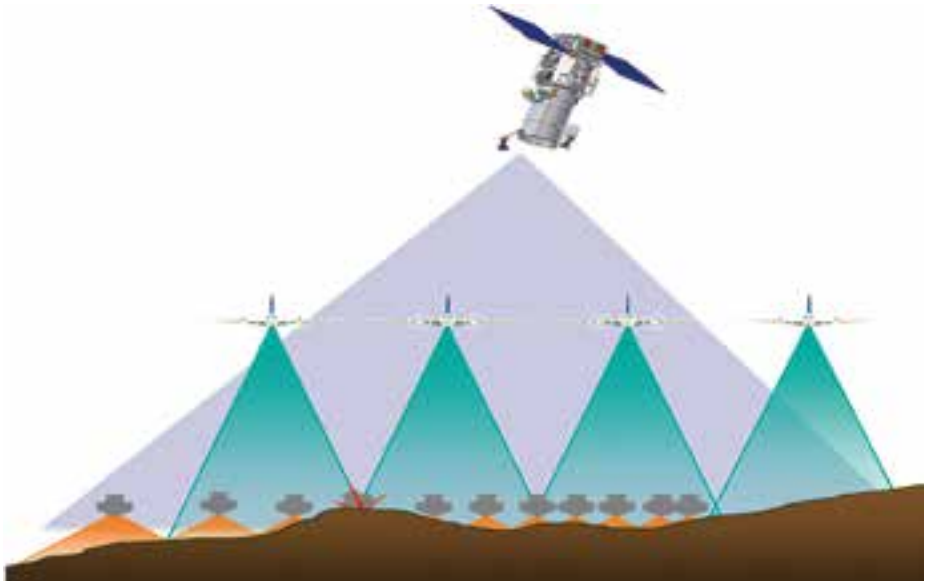


Each stage of the process has a wide variety of geoinformation needs, many of which are currently facilitated by traditional means, while others are (or can be) managed using contributions from EO technology.

The first stage of the project was tasked with identifying the geoinformation needs at each stage of the mining cycle and some examples are shown below.

At the time of writing this case study, the project is at an early stage. Further information will be provided as the project progresses through this Annual Review in 2020, the IMQS website, Geoscience Ireland and from LTMS directly.

Advancements in EO technology have the potential to benefit significantly the mining industry and its regulating bodies. This technology can save time, reduce cost and improve efficiencies at all stages of the mine cycle.



Mine Cycle Stage	Geoinformation Need	Previous & Current Technology	EO Technology
Exploration	Topographical Mapping	Government issued maps and Surveys	LiDAR - aircraft InSAR - satellite
Environmental, Assessment, Planning & Approval	Characterisation of Flora & Fauna	Reports, site surveys, sampling	Optical Sensors - satellite
Design & Construction	Geotechnical data for construction	Probe drilling, site sampling	Gravity Sensors - satellite
Operations	Pit Slope Stability	Surveys, geotechnical instrumentation	InSAR – satellite
Closure & Aftercare	Re-Vegetation – demonstration of return to pre-mining conditions	Surveys, walk-overs, sampling, drones	Optical sensors – satellites- Drone – new technology

Satellite image shows an open pit mine with ore & waste tips, processing and administration facilities.

The Raw Materials Challenge in Ireland

by Eoin McGrath (Head of Minerals, Geological Survey Ireland)

We live in interesting times for the raw materials industry, with an increasing awareness of the sector's importance across a breadth of societal challenges. The UN's Sustainable Development Goals, the national vision for Project 2040 and the global climate emergency will all be heavily reliant on the continued production of raw materials, from construction materials for critical infrastructure to rare earth elements for smart technologies.

The carbon cost of aggregate and metal production and importation from abroad will grow in importance over the coming years as society strives to develop. Forming an effective response to this challenge in an Irish context will entail public policy makers and industry working toward the use of aggregate resources and rare earth metals where they occur, under a regulatory framework which is attentive to the fact that such resources occur in discrete locations which cannot be strictly designated in advance of their discovery.

At a national level in Ireland the importance of raw materials has been largely recognised and work is currently underway

to translate strategic aspiration into functional and realistic policy. **The National Planning Framework for Project 2040** states that; "The planning process will play a key role in realising the potential of the extractive industries sector by identifying and protecting important reserves of aggregates and minerals from development that might prejudice their utilisation."

It is vital that such recognition exists at a national level however the question arises as to how to translate a national aspiration to solid regional and local level plans. It is clear that the technical work of identifying important reserves is beyond the scope and ability of the planning process, yet the protection of potential sources is critical to the country's ability to deliver on its Project 2040 goals. When existing infrastructure and incompatible land use is taken into account, a large percentage of area is already unsuitable for raw material production and it is increasingly important that any remaining prospects are identified and sufficiently protected. Tackling this challenge will require a greater interaction between those with expertise of the subsurface and those charged with deciding on the development which takes place on the surface.

GSI has begun work with several local and regional authorities to facilitate the generation of sub-level minerals and raw materials strategies which can be taken into account by planners. **The initial steps must be for all relevant planning authorities to do a full evaluation of their projected raw materials needs to deliver Project 2040.**

This includes assessing the aggregate requirements for roads, residential and business construction, to an appropriate level of detail. Local authorities compile numerous strategies (such as housing and retail) in support of their development plan policies.

Using the projections contained within these strategies (such as projected residential units required over the development plan period) as well as national infrastructure plans for the counties concerned, projections of the required quantities of aggregate required can be derived. Certain specific materials have a restricted range of sources and it is these materials which are most likely to form a supply chain bottleneck, inhibiting the sustainable delivery of spatial and economic plans.

With a greater understanding of the raw materials requirements, national, regional and local planning and infrastructure authorities can then focus on the raw materials production capacity within their hinterland. This should include an evaluation of the current available resources and a realistic projection of whether the expansion of existing developments or the opening of new extractive facilities will be required.

Once the forecasted supply and demand is more fully understood will it be possible to sustainably integrate the strategic importance of the raw materials industry into the planning framework. GSI will assist stakeholders to ensure that important resources are recognised and protected from inadvertent sterilisation to ensure the

availability of suitable raw materials.

Taoiseach Leo Varadkar highlighted the dangers of untrammelled growth in a recent Late Late Show appearance, referencing the pyrite and mica issues that have resulted in such a significant societal and financial burden. While technical issues can be dealt with through a process of standardisation and testing, the underlying reason for these problems requires more coherent planning and foresight. The conditions whereby a significant unforeseen increase in aggregate demand may result in the production of sub-optimal material have not been addressed; in fact it is all too easy to see them occurring again, particularly given the large construction plans inherent in Project 2040.

In the current **Climate Emergency** it is incumbent on all industries to contribute to the mitigation of climate change and the transition to a greener low carbon economy. The carbon footprint of raw materials for construction is heavily influenced by transportation from source to destination.

This could easily double the environmental impact of production from cradle to gate. Recent work in Norway has estimated that a 30 tonne load will emit approximately 2kg of CO_2 per km travelled. Given the projected increase in the cost of carbon, increasing transport distances will not only detract from efforts to reduce Ireland's climate impact but will also inhibit the effectiveness of the economy and the cost of construction.

Global view

While significant challenges exist within the raw materials space, there is a window of huge opportunity for the sector to highlight and develop its strategic outlook and to place raw materials at the centre of the conversation about our sustainable society. Future planning must take into account the entire value chain of the extractive industry, including the carbon savings for source material in proximity to markets, the generation of waste capacity for inert soil and rock material and the strategic importance of raw materials to the implementation of the Project 2040 vision.

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EIT RawMaterials

by Tony Hand, European Institute of Innovation and Technology in Raw Materials

I am kindly requested once again to provide an update on the progress of the European Institute of Innovation and Technology in Raw Materials (EIT RawMaterials). Since being established in 2015, the organization has become the largest and strongest consortium in the raw materials sector worldwide. Just a little over halfway through its initial seven-year phase, the organization has closed its 6th call for project proposals in February last and will provide just short of €100 million euro to fund the successful applicants who will have been announced by the time this goes to print.

To provide a quick recap, EIT RawMaterials comprises of a strong European-based community with more than 120 partners from more that 20 EU countries. The community consists of leading businesses, universities and research institutions across Europe as well as numerous cooperating project partners and support partners and is known as the Knowledge and Innovative Community, or KIC.

Partners of the EIT RawMaterials are active within the entire raw material value chain; from exploration, mining, mineral processing, substitution, recycling and circular economy.

The complementarities and diversity in EIT RawMaterials communities combined with a strong focus on innovation, business and entrepreneurship provide a novel collaborative community that is now a fertile ground for breakthrough innovative developments and radically new ways to address raw materials challenges. To address such challenges in a more focussed way, EIT RawMaterials has developed Lighthouse programmes for 2019.

Lighthouses are large-scale and long-term coordinated innovation initiatives that address critical and specific raw materials challenges for Europe. They are mission approaches to innovation and education challenges, directly steering EIT RawMaterials activities towards the achievement of its strategic objectives.

They will generate tangible solutions to societal challenges that have raw materials at their core. In doing so, they will enable the EIT RawMaterials to raise awareness of the role and importance of raw materials in a sustainable society and create a positive perception of raw materials and their associated industries. Two of the major challenges facing Europe today are in the areas of increasing need in electric mobility and circular economy/societies and EIT RawMaterials has developed two Lighthouses to address these challenges, they are;

Image courtesy of EIT RawMaterials

- **Raw Materials and Circular Societies**
- **Sustainable Materials for Future Mobility**

An additional Lighthouse will be implemented for the next call later this year and will address the upstream part of the raw materials value chain; exploration, mining and processing. This is the area that has a critical impact on the rest of the raw materials value chain. This Lighthouse will be called **Sustainable Discovery and Supply**.

The major challenges faced by the sector in this third Lighthouse are technical and social. The technical challenges such as automation and digitalisation can be addressed through the likes of innovation and education, however, the social challenges are not so straightforward.

True, innovation and, in particular education, can influence this area, but how do we convince people that the opening of a mine or quarry can bring benefits to the local and wider communities. Stakeholder engagement cannot be done by computer hardware/software, or sensor technology.

Of course, they can aid in the delivery of information to the public, but it is the content of this information that can decide whether or not a mine would be welcome in the community. Who delivers the information is important also.

The **Social Licence/Acceptance to Operate is a global challenge** and the extractive sector is beginning to work towards the United Nations Sustainable Development Goals which EIT RawMaterials is fully committed to. Mining influences each of the 17 goals to a greater or lesser extent.

Tackling Climate Change requires cleaner energy technologies and this is highly dependent on ever increasing amounts of **Rare Earth Elements (REEs)** and **Critical Raw Materials (CRMs)**. Mary Robinson's recent book, Climate Justice: Hope, Resilience, and the Fight for a Sustainable Future (2018), highlights the damage of climate change and how this affects

communities at all levels in society, but poorer communities in poorer regions take the major brunt.

Many of the REEs and CRMs Europe consumes tend to be from such countries and can we in Europe be happy with ourselves driving our electric vehicles and using our "green" energy without knowing the impact we are creating in other parts of the planet?

The irony of this situation is that **many of the minerals required for tackling climate change can be found within Europe**, but more often than not, political and societal challenges create obstacles to the extraction of these deposits.

But, here in Europe, we have the experience, knowledge and developing technologies that can discover, extract and process our own resources in a sustainable, ethical and environmentally friendly way and EIT RawMaterials is continually working towards this, especially in the projects addressing wider society.

Wider Society Learning projects at EIT RawMaterials raise society's awareness of the use of and need for raw materials. Projects at EIT RawMaterials inform, educate and reach out to school children, the general public, NGOs and decision-makers across Europe.

Image: UN.ORG

Working to incite enthusiasm and passion for raw materials-related topics, projects also aim to break down stereotypes and misinformation surrounding the raw materials industry. By demonstrating the attractiveness of the sector this can ensure the education and securing of a constant supply of well-qualified professionals to meet the sector's needs and become the game-changers of the future.

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Recent Activites of the IAEG

by Shane Lavery, IAEG Secretary

The IAEG are pleased to contribute to this year's IMQS Annual Review. The IAEG and IMQS have had a long-standing relationship and we are confident that this relationship will be maintained and strengthened in the future.

2018

2018 was a busy year for the association as usual, with a fascinating series of talks held throughout the year, as well as courses, our annual conference, and our AGM. The conference for the year was held in Ballinasloe on the topic of Geochemistry.

Lecture series

The IAEG hosted four talks through the year which were very well attended. Matt Grimshaw, formerly of SRK Exploration, started the year off with a talk on his research on gold mineralisation in the famous Klondike district, before Lars Dahlenborg of Hannan Metals gave a great insight into the current work going on around the Kilbricken deposit. Kent Balas gave us an Explorer's Guide to Kazakhstan in October, and Group Eleven CEO Bart Jaworski entertained the attendees at our AGM with an overview of their recent work around the country.

IAEG Courses

The IAEG ran two courses in 2018. Starting the year off, our now highly anticipated Student Logging Course was hosted this year by Boliden Tara Mines and attended by students, early career geoscientists and those looking for a refresher in core logging.

The course has been running now for several years and aims to introduce students to practical 'hands on' experience of logging core with guidance from industry professionals.

The students are also provided with industry best practice quality control procedures.

At the Annual Conference in May, Benedikt Steiner of the Camborne School of Mines gave a short course entitled "Geochemical Interpretation for Exploration and Mining Geologists; Examples from SE Ireland".

The course highlighted that trace element geochemistry can now provide the necessary information to interpret bedrock geology and mineralisation systems.

The practical aspect of the course investigated the Tellus dataset for SE Ireland for regional prospectivity using ioGAS software.

2018 Annual Conference

The IAEG 2018 Annual Conference was held over the weekend of 18th-20th May at the Shearwater Hotel in Ballinasloe.

The topic focused on Practical Applications and Novel Techniques for Mineral Exploration. A broad range of excellent talks on the topic provided many discussion points over the weekend.

ALS Global Laboratories in Loughrea kindly offered a guided tour of their laboratory facilities and practices as part of the conference weekend.

The conference was attended by 84 delegates from various sectors, institutions and commodities.

2019

2019 has so far proved to be a busy year for the IAEG. Our regular weekend course on applied geophysical techniques had a capacity crowd in Louisburgh, Co. Mayo in January, where students and early career geoscientists gained hands-on experience with various geophysical methods, and evening lectures in the accommodation.

In May the 2019 Annual Conference took place at Hotel Kilkenny, with a record crowd attending 'Mining: Our Future' to learn about Ireland and the world's future prospects and challenges we as an industry face.

Upcoming Short Courses

The remainder of the year will be a particularly busy one for the IAEG. The lecture series continues as usual, with a busy calendar planned for late summer and into the winter.

Two short courses are planned for the Autumn/Winter, with Grinding Solutions presenting a workshop on **GeoMetallurgy** on Friday the 4th of October. This course will follow up on Phil Hingston's great talk at the Annual Conference, and is sure to generate a lot of interest. The venue is still to be confirmed.

Dave Stewart will present his always excellent QA/QC course on Friday 15th of November in the Radisson Blu Hotel, Athlone. This course is now a staple of the IAEG's calendar and is always popular amongst our members.

Work continues to progress on publication of an updated Mineral Exploration

Students getting an overview of core logging techniques at last year's logging course held in Navan.

Some of the presenters and IAEG Council at the 2019 Annual Conference in Kilkenny.

Handbook, and an update to the IAEG 'Blue Book' - Carboniferous stratigraphy of the Irish Midlands, in joint association with Mike Philcox and iCRAG, is progressing well with invaluable input from the Geological Survey, Ireland.

Minerals 2020

2020 will be an important year for the Irish Association for Economic Geology, as we hold our decennial conference, which we are pleased to announce will be titled **"Minerals 2020: Europe's Past, Present and Future"**. The conference will be held in the Salthill Hotel, Galway, from the 14th to 16th of May 2020. The conference will cover the geology and development of mineral deposits across Europe. A book of extended abstracts will also be published.

Looking even further into the future, the 50th anniversary of the founding of the IAEG will be commemorated in 2023 with a celebration of the association and its achievements over its first half century of existence. Planning is already getting underway for what is sure to be a memorable occasion.

A summary of all IAEG events and articles from industry, government and academia are provided in the IAEG 2018 Annual Review. To keep up to date with all IAEG events and view past annual reviews please visit our brand new website **www.iaeg.ie**

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Solving the Soil Problem?

by Liam Smyth, FIEI, Senior Manager - Regulatory Compliance, Irish Concrete Federation

Following on from my presentation at the IMQS seminar earlier in 2019, the following are welcome updates on the position with regard to use of surplus soil produced during construction activities.

Update on DCCAE changes to permit upper threshold for inert soil and stone

After much anticipation, the legislative changes required to lift the soil recovery licence threshold for Class 5 have been put in place; the Waste Management (Facility Permit and Registration) (Amendment) Regulations 2019 (No. 250 of 2019) were signed into law by Minister for Communications, Climate Action and Environment Mr. Richard Bruton and were published in Iris Oifigiúil on 3rd June 2019.

There are some aspects of these amendments which are worth noting as a starting point:

1. The changes provide for Waste facility Permitting for soil recovery for up to 200,000 tonnes cumulatively, a doubling of the existing upper threshold beyond which an EPA licence would be required;
2. Following the date of publication (3rd June 2019), the effective date for issuing permits with the new threshold will not 'kick-in' for a further 3 months (presumably 2nd September 2019);
3. Due to perceived complexities of legislation realised late in the day, revisions of existing permits will continue to only cover to a total of 100,000 tonnes – this means that the current position of only one such permit per site is effectively changed to provide for a follow on permit;
4. New permits will be required on existing sites where tonnage is required over 100,000 tonnes though a fresh site will be able to apply for 200,000 tonnes at first instance;
5. This provides an opportunity for local authorities to re-visit the planning requirement (permission or certificate of exemption) attached to permitting and to ensure that the most up to date requirements of EIA and NIA legislation and case law is applied;
6. It is likely that good practice with regard to the submission of both Schedule 7A EIA Screening and Stage 1 AA Screening Reports will be required with each new permit application;
7. It is envisaged that the 3 month 'moratorium' post publication will result in the dissemination of guidance on implementation of the changes.

It seems reasonable to assume that local authorities would, in the intervening three month period, validate applications to both the planning and environmental services sections for developments covered by these amendments.

Finalised EPA Guidance on Article 27 for soil

On Wednesday, 19th June 2019, the EPA published its finalised guidance on the use of Article 27 which deals with the declaration and use of soil as a by-product. While this methodology has been the subject of much debate, the finalised guidance has pros and cons.

The declaration of soil as a by-product must be done by the material producer or have the express permission of the material producer for such a declaration; this essentially confirms the material producer's intentions that the material is a by-product, not waste, in the first instance.

A declaration will now set off a ten week process during which the EPA undertakes to either declare the material a by-product or will seek further information to inform its assessment. Presumably, a declaration that the material is waste can also be made without recourse to further information. Requests for further information then set off an indefinite timeframe until the EPA is sufficiently satisfied as to make its decision in the particular circumstances.

Material producers and operators working on their behalf are advised not to move material until the ten week period is up and a response from the EPA has been received; obviously where the response is to seek further information, the material should not be moved until the outcome with the EPA is reached and then acted upon accordingly.

This ten week delay does not suit developers and waste collection contractors but the regulator's advice is to plan for this that much earlier. It is suggested that the ten week period might be shortened for applications which are technically comprehensive but that appears wishful thinking.

Importantly, the position with regard to the 'burden' element highlighted in the EPA's public consultation document in 2018 has been softened in that the financial burden may be a factor, rather than precluding a successful declaration that soil is a by-product. This is important as it opens the door significantly for much soil otherwise bound for permitted sites.

It is suggested that if soil is used as a by-product and that use mitigates burden on a developer (all other considerations being satisfied), then that saving would clearly be a financial gain, meaning the considerations with regard to burden would either not be relevant or otherwise seen as a positive contribution (presumably to the circular economy policy).

Conclusion

Together, these changes are welcome and will do much to provide regulatory certainty with regard to soil placement and overall available capacity. While perhaps still cumbersome, they provide improvements on the existing failing systems and are indicative of positive market driven responses by DCCAE and the EPA.

EFEE (European Federation of Explosives Engineers)

by Alan Dolan, Ground Control Engineer, Boliden Tara Mines

EFEE was founded in 1988 and has 25 National Associations representing 25 countries. Its purpose is to provide a European forum for professionals working in the field of commercial explosives.

The IMQS represents Ireland as a National Association at EFEE council meetings. The EFEE have many committees representing the interests of explosives users and manufacturers in Europe (see **www.efee.eu**). The association holds a bi-annual world conference. The 10th EFEE World Conference on Explosives and Blasting will take place from 15th September to 17th September 2019 in Helsinki, Finland. More details at **www.efee2019.com**.

The IMQS, in conjunction with Dublin Convention Bureau (DCB) and Tyler Events Ltd, a Professional Conference Organiser, have tendered to hold the 12th EFEE World Conference on Explosives and Blasting in Ireland in 2023.

Should the conference come to Ireland, it will be an opportunity for Irish explosives manufacturers, suppliers and users to be part of this prestigious event. The vote for host nation will be made at the board meeting in Helsinki in September 2019. Refer to our communications platforms for updates.

One of EFEE's primary on-going projects is PECCS (Pan-European Competency Certificate for Shot Firers/Blast Designers).

Currently in Europe there is no minimum training standard to become a shotfirer/blast designer. Each country has its own training requirement and standards which makes working in more than one European country difficult and quite often prohibitive. To help solve this problem, EFEE has created PECCS which aims to aid the transfer of shotfiring and blast design skills within European member states.

A one day conference was held on 27th March 2019 where the existing course content was presented for critique to the organising parties. Using this feedback, the final course structure and cost estimate will be presented in Autumn 2019. For more about the project's progress, learning material used or to take part in the course, visit the official web site; www.shotfirer.eu.

Is there a sinkhole coming to a field near you?

by Eoghan Holohan and Fergus McAuliffe,
Irish Centre for Research in Applied Geosciences

This piece was first published on RTÉ Brainstorm http://rte.ie/brainstorm

Analysis: sinkholes like the one last month in Co Monaghan are a reminder that our place on this dynamic planet depends on the support of what lies beneath our feet

Last month saw a 100 metre-wide sinkhole open up overnight in Co. Monaghan. The sinkhole has generated national headlines, with impressive drone footage featuring spectacular brown scars and cracks arcing across the green Irish landscape. Unfortunately, it has also badly damaged the local community centre and GAA club, which has led to their closure. So what exactly are sinkholes and what happens to make them form?

From RTÉ News, a report on the dramatic subsidence in Co Monaghan

Simply put, a sinkhole is a hole in the ground. Technically put, it is an enclosed topographic depression. Either way, a sinkhole forms by subsidence, or sinking, of the earth's surface. Such sinking can be a slow sag or a rapid collapse. In three dimensions, sinkholes can be shaped like a saucer, a bucket or an ice-cream cone. The width or depth of sinkholes can range from a few metres to a few hundreds of metres.

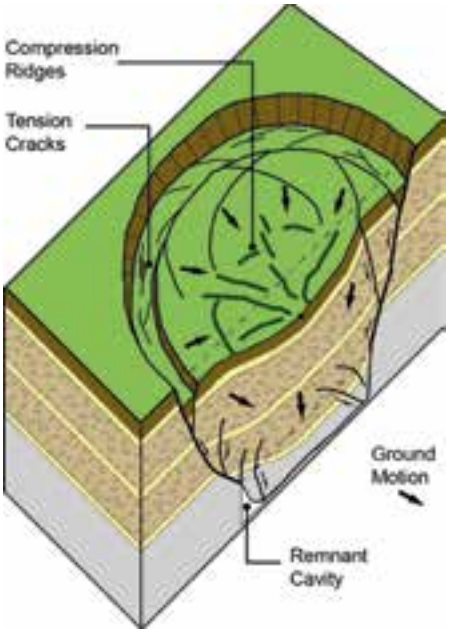
The story of how sinkholes form starts with gravity. This continually pulls all things down towards Earth's centre. Usually we here at the Earth's surface are prevented from embarking on an unplanned journey to the centre of the Earth by all the soil and rocks already underneath us. These serve as underlying support to resist this gravitational pull, and so things stay up where they should be. The solid foundation of your house plays a similar role; this ensures no sinking and no surprises.

In modern times, a sinkhole collapse is reported in Ireland once every few years. Just like in a game of Jenga, removing rock or soil from underground weakens support for what is above. In nature, the removal of material commonly occurs chemically by water dissolving rock.

For example, the dissolving of limestone bedrock over time by naturally acidic rainwater gives us the caves and caverns that we are so familiar with.

Alternatively, the removal of material can be physical, for example by water rushing through soil from a burst underground water pipe or by people digging out underground mineral deposits. In many such instances, large voids are created at depth. Gravity pulls the overlying material downwards into these voids, bringing the Earth's surface down with it. Depending on the nature of the materials and the voids, this can form a surface depression - slowly or suddenly.

Dig your own hole: a tractor in a sinkhole at Isakeen in Co Donegal in 2017.



The Magheracloone sinkhole.

The vast majority of sinkholes are natural depressions. These are commonly found in "karst" landscapes, where they are also called "dolines". Karst landscapes are special in that they develop on top of rocks – such as limestone, gypsum or rock salt - that can be dissolved by water. Other sinkholes are man-made depressions. These can develop in areas where underground mining, drilling or construction activities have been carried out, or they can form in karst areas where human activity has changed some water-related aspects of the environment.

In Magheracloone, a particularly striking features of the sinkhole were the circular cracks that opened up across the GAA pitch. To understand these, it is helpful to know that all sinkholes ultimately want to be shaped like an ice-cream cone. The material sinking within the cone shape must deform in order for it to fit down into the narrower void below.

At the top, near the edge of the cone, the soil is pulled apart giving the circular or arcing ground cracks. Meanwhile in the middle, the soil is compressed giving rise to small uplifted ridges. These appear like wrinkles on a carpet of grass. The investigation into the Co. Monaghan sinkhole collapse is still ongoing, and it would be remiss to speculate here as to the exact cause until the investigation is complete. What we do know is that sinkhole collapses are relatively rare occurrences in Ireland.

Rates of sinkhole formation depend on how easily the bedrock is dissolved and how perturbed the groundwater system is. Although the Geological Survey Ireland has mapped over 6,000 in the limestone that underlies about 50 percent of our island, many of these seem very old, perhaps thousands or millions of years old.

In modern times, a sinkhole collapse is reported in Ireland once every few years. This is because our groundwater system is relatively undisturbed and the limestone dissolves very slowly. By comparison, several holes or even several tens of holes form per year in Florida, with entire houses and persons swallowed up. These collapses are also related to limestone, but they are triggered by rapidly changing groundwater levels – partly natural, partly man-made.

At the extreme end of sinkhole formation rate is the Dead Sea region. Here, a rapidly changing water level combined with fast-dissolving rock salt is producing several hundreds of new sinkholes per year.

Ultimately, wherever and however they form, sinkholes are a reminder that ours is a dynamic planet, and our place in it depends on the support of what lies beneath our feet.

Dr Eoghan Holohan is an Associate Professor in the UCD School of Earth Sciences and an Investigator in the Irish Centre for Research in Applied Geosciences (iCRAG). Dr Fergus McAuliffe is Public Engagement Manager at iCRAG.

The views expressed here are those of the author and do not represent or reflect the views of RTÉ

Gypsum rock production keeping pace with demand

by Benson Plunkett, Mine Manager

Gyproc would like to thank local residents, the GAA Club and Community Centre for their continued patience and co-operation since the subsidence event at the old mine workings in Monaghan last September.

Gyproc is engaging with Magheracloone GAA and Community Centre, local residents and businesses impacted by the subsidence to address issues and to facilitate two-way communication of relevant information.

In addition to working with the community stakeholders, Gyproc continues to work with the Department of Communications, Climate Action and Environment, Monaghan County Council, and Environmental Protection Agency to address the issues rising from the subsidence event.

Gyproc has continued to supply gypsum rock for the manufacture of plasterboard and bagged plaster products from Knocknacran Open Pit Mine and Drummond Underground Mine.

Production from the mines has been successfully achieved by multi-skilled, flexible mining and maintenance crews operating both in the Open Pit and Underground.

In 2019, investment in the mine will facilitate overburden removal and restoration works.

These projects, contracted to Wills Bros. Ltd., will enable the mine to continue to supply gypsum rock to the manufacturing plant in Kingscourt for the next 5 years.

Below is the current remediation project also in the Knocknacran Open Pit Mine June 2019.

Pictured below is a blast in the recently developed extension to the Knocknacran Open Pit Mine. (Phase 1 completed June 2018)

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Industry Leader

by John Ashton BSc, ARSM, FGS, PhD, MIMMM, C.Eng. P.Geo, Eur. Geol.

John Ashton recently retired from the position of Chief Exploration Geologist at Boliden Tara Mines and is currently consulting for Boliden. Originally from Aberystwyth in Mid Wales John's interest in economic geology started at school during extensive underground exploration of disused Pb-Zn mines of Mid Wales.

Following graduation in Mining Geology from the Royal School of Mines in 1975 he undertook PhD research at the University of Aberystwyth into Pb/Zn and Au veins in Wales. After joining Mogul of Ireland Ltd, Silvermines in 1978 and Tara Mines in 1980 his career focused on mine geology, delineation, production and resource estimation, extending to delineation and feasibility on the Southwest Extension (SWEX) in the late 90s.

In the 80s and 90s, together with several colleagues he led the introduction of computers in mine geology and resource estimation at Navan, with Tara Mines systems being regarded as being 'state of the art' at that time. In 1996 he was promoted to Chief Mine Geologist and became responsible for annual reserve and resource estimation. While developing the SWEX, Tara re-examined and re-acquired the Nevinstown part of the Navan orebody and the period to 2005 saw major capital projects underway in both areas - accompanied by change in ownership from Outokumpu to Boliden.

In 2005 he became Chief Mine and Exploration Geologist for Boliden Tara Mines with additional responsibilities in near mine and regional exploration, and inclusion in the Boliden Exploration Management group, involving collaboration and visits to the Nordic countries.

Since then he has been involved in extending the resources within and surrounding the Navan deposit and in exploration throughout the Irish Midlands. Most recently he led the team that discovered the Tara Deep prospect at Navan and which has the potential to significantly extend mine life.

John has given many invited presentations at conferences internationally and was awarded the IMM Consolidated Goldfields gold medal (jointly with Colin Andrew) in 1985 and the IOM3 Medal for Excellence in 2011. Economic geology research at Navan has been a particular area of interest via numerous undergraduate to post-doctoral projects and connections with Universities worldwide and the recently formed Irish Centre for Research in Applied Geosciences (iCRAG).

John is an honorary member and past-President of the Irish Association of Economic Geology (IAEG) and helped organise the Geology and Genesis of Mineral Deposits in Ireland (1984) and Europe's Major Base Metal Deposits (2000) conferences.

John would like to thank the IMQS for this profile and thank his many friends and colleagues at Tara Mines and further afield, together with the Outokumpu and Boliden companies, for all the great support over the years.

John pictured in Stockholm with Boliden Tara's Management Team in May 2017 on winning Boliden's prestigious 'Unit of the Year 2016' award. From the left: George Wilkinson, Eoghan O'Neill, John, Jason Morin, Mick Flynn, Mike Lowther, Paschal Walsh, (Tadg Farrell not pictured).

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Industry Leader

Mick Flynn

Recently, on July 31st 2019, Mick Flynn retired from Boliden Tara Mines after a long, varied and successful career at the company spanning 40 years.

His mining career commenced in 1977 in Athlone Regional Technical College (now Athlone Institute of Technology) by undertaking a Mine Engineering Diploma course. He remarked that at that time, he had a choice between Mining and Plastics Engineering but he then predicted that in the 21st century the world would need metals more than it needed plastics!

In June 1979 he commenced working at Tara Mines as a Mine Engineering student. Tara was only in production for two years at that stage and were continuously hiring underground operatives and miners therefore Mick decided to take a break from his academic pursuits and continue with Tara after his summer vacation work ended. He trained and qualified as a miner by the end of that year and worked in production loading/hauling and long hole drilling. (He subsequently completed his Mine Engineering course of studies during 1981/1982).

He continued as an underground miner for seven years until 1987 most of which were as a development miner involved in face drilling, ground support, explosives charging. He remarked that these were important formative years for his career progression and continuously advises all young professionals to grasp every opportunity to spend time "at the coal face" in whatever discipline or life career they choose before embarking on more technical, managerial and leadership aspects.

In 1987 Mick eventually realised his main ambition by transferring into mine technical engineering by joining the Mine Engineering Dept as part of the Drilling and Blasting Design team. He also embarked on another course of education in DCU achieving a Diploma in Information Technology. This was particularly useful as he then worked with the IT team and other colleagues with in house design and implementation of a computerised Long Hole Drilling and Blasting System. His career path started to progress rapidly and

750 Level Mobile Equipment Maintenance Workshops.

in 1989 he was appointed Mine Planning and Design Engineer focussing on design and production planning for the 2-5 lens west. As Chief Planning Engineer from 1992 to 1995 he promoted ongoing development of computerised short, medium to long term production solutions and systems as well as supporting continued CAD development for drift/tunnel and stope design. In 1995 he was appointed Chief Mine Engineer and during the following four years was principally involved in organisation design and conceptual/feasibility studies for the new SWEX area of the mine. (South West Extension)

In 1999 Outokumpu decided to proceed with the SWEX Project. Mick was appointed SWEX Project Superintendent leading a separate project team tasked with the design and development of the SWEX area including 14,000 meters of development and contract supervision, the design and build of a new ore crushing/hoisting system (No. 5), ventilation shafts, fan stations, mechanical workshops and miscellaneous infrastructure.

After completion of the SWEX Project in 2003 he became Mine Superintendent, and then Mine Manager, and successfully set about harnessing the new production potential from SWEX and the recently acquired Nevinstown part of the Navan orebody.

During 2012 and 2013 he was appointed Interim General Manager and became a Director of Boliden Tara Mines Ltd. In 2014, as part of a new and rationalised organisation, Mick was appointed Manager of the new Projects Department. This involved program management of many tangible projects from a design/build/delivery perspective. During this period, he again utilised his mine design and economic evaluation experience by completing an initial conceptual study on the Tara Deep Prospect alongside a small team from mine technical/planning, exploration department and Boliden Technical Services.

From 2016 to 2019 Mick was Manager of the Mine Assets Department leading teams from mobile equipment acquisition/maintenance, fixed plant maintainance and electrical/communication networks design and installation. In this role he was involved in developing the principles and practices of physical asset management and systems therein. He also pointed out to the author that much was achieved during this time in the design/implementation/execution of autonomous and teleremote operations underground utilising a new and extensive WLAN throughout the underground workings. He is particularly proud and delighted with what his teams have achieved with new technologies and the passion and interest they have in this alongside mine operations and IT department co-workers.

To conclude, Mick wishes to sincerely thank Boliden Tara Mines for the opportunities and the exciting, and varied, roles over the 40 years. He pays tribute to the countless number of people he has engaged with, and is grateful to them for their help, support and advice.

He wishes everyone in Boliden Tara Mines a safe, secure and very long future and hopes that the mining industry in Ireland continues to grow.

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Tellus Programme

Ireland's ground and airborne geoscience data acquisition

by Jim Hodgson, Tellus Programme Manager, Geological Survey Ireland

The Tellus Programme is Ireland's ground and airborne geoscience data acquisition programme, collecting geochemical and geophysical data to inform the management of Ireland's natural resources and environment.

The programme, run by Geological Survey Ireland, a Division of the Department of Communications Climate Action and Environment (DCCAE), involves two types of surveying – airborne geophysical surveying using a low-flying aircraft, and ground-based geochemical surveying of soil, stream water and stream sediment.

To date over 50% of the Republic of Ireland and all of Northern Ireland has been surveyed and plans are underway to survey the remaining 50% of the country. The data collected by Tellus is used by a wide range of stakeholder groups across Ireland, particularly mineral exploration, environmental management, agriculture, human health and third level researchers in these areas.

Tellus has recently established a Product Development work stream in order to produce more focused, user-centric data products, the need for which has been identified through stakeholder consultation, independent reviews of Tellus and government policy. Out of this, a major new project 'Terra Soil' was launched in October 2018.

This project is a joint research collaboration between the Geological Survey Ireland and Teagasc which will produce new agricultural advice using Tellus data and soil samples. It represents a new, multidisciplinary approach to smart agriculture and brings together geologists and agronomists in order to meet the challenges of increasing agricultural productivity and protecting the environment.

Tellus data is also being used to inform the management of waste-licenced Soil Recovery Facilities. Geological Survey Ireland is assisting the Environmental Protection Agency with the development of an approach for establishing 'Geochemically Appropriate Levels' for the acceptance of greenfield/non-greenfield soil and stone into soil recovery facilities.

Tellus' airborne geophysical survey comprises measurements of magnetic field, gamma-ray spectrometry and electromagnetic data.

The high resolution data collected is an invaluable tool for effectively 'seeing through' Ireland's often deep glacial deposits and extensive peat cover. Allowing geological features not apparent from conventional mapping techniques at the surface to be resolved.

The data collected is being used to revise the Geological Survey's quaternary and surface bedrock geology maps, assist in mineral exploration, identify potential areas of contamination and map areas of radon risk.

The Tellus geochemical survey is characterizing the baseline chemistry of soils, stream water and stream sediments across Ireland, taking samples at a density of approximately one every 4km^2. Multi-element laboratory analysis of these samples allows a suite of some 55 elements to be mapped, which are important for both agricultural productivity and environmental management, particularly for improving our understanding of how trace elements, essential for animal and crop health, are distributed in the environment.

Tellus' plans for summer 2019 see the Tellus airborne survey moving into the south east of Ireland, into counties Carlow, Wexford, Wicklow and neighbouring parts of south Kilkenny, south Kildare, and Waterford.

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The Design of the Grave Site of President John F. Kennedy at Arlington Cemetery Washington D.C.

Tracing the input of a nineteenth century emigrant stonecutter

Assembled by Tony Killian R.I.P

On a visit to the gravesite I found the polished granite wall adjacent to the President's grave to be the most impressive and memorable part of the gravesite. This wall is inscribed with the wording of President Kennedy's famous speech at the time of his inauguration.

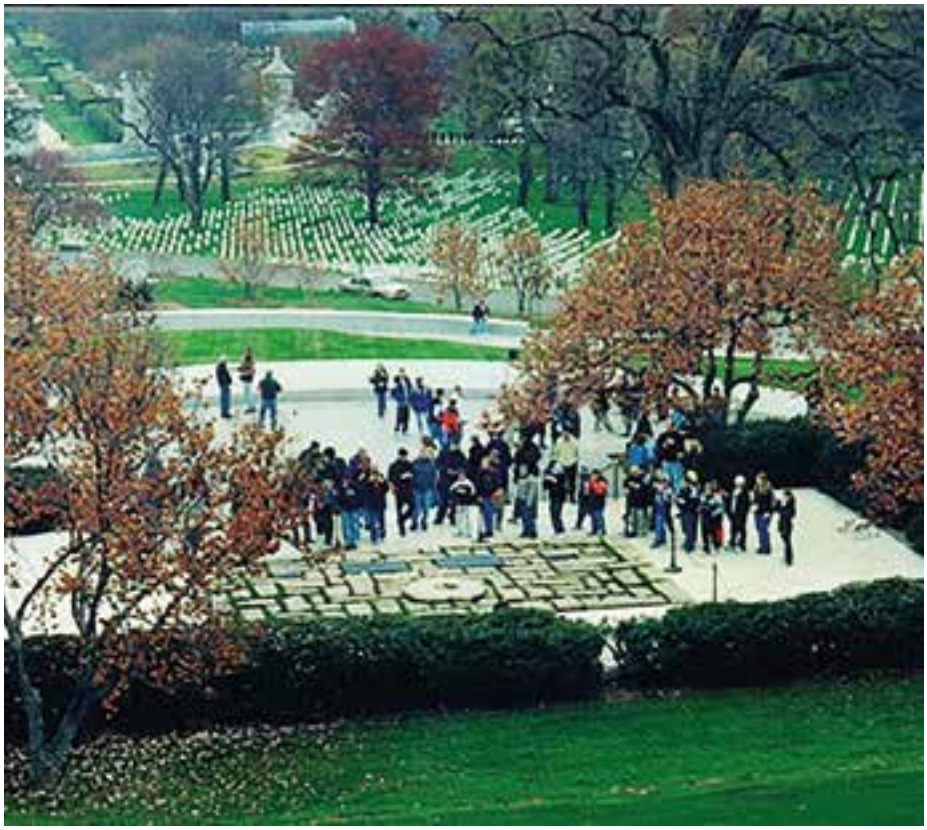
The wall is built with what is known as "Sherwood Pink." Granite from a quarry on Crotch Island in Maine which was operated at the beginning of the 20th Century by a firm called Casey & Sherwood. Tom Casey, one of the partners, was an emigrant from Co. Cork and is a prime example of how a young man with basic skills, honed by further experience and allied to American business know-how could make a positive impact in his particular field.

Matthew Davis, a great grandson of his, who lives in central Connecticut, USA traces Tom Casey's career:

Matt's words: "A few years back I was poking through some family history and came across some stories my Grandmother Elizabeth (Casey) Davis had written back in the 1950's. They include stories which her father, Thomas Winn Casey, had told her of his childhood back in the little village of Curraglass, Co. Cork, Ireland. Like his father and his grandfather, Tom was a stonecutter, working at a quarry near Curraglass in Co. Cork, where a Waulsortian Limestone formation exists.

Tom was seventeen when he came to America in 1871 on the steamer "City of Limerick."

He became quite successful, having apprenticed in New York City for approximately three years, then moving up the coast of Long Island to settle in Groton CT, where he ran the quarry owned by his wife's family, the Scullys. The Scully family was originally from Bear Island in



Bantry Bay and had come to the U.S. in the 1840s during the height of the famine. Tom leveraged his experience and success in operating the Scully quarry to open his own firm in New London CT, then later to establish a partnership with a Mr. Sherwood from New York, calling this larger firm "Casey & Sherwood." Their business office was located on Madison Avenue.

In 1891, Tom's new firm bought a quarry on Crotch Island, located off Stonington Maine in the Deer Isle Thoroughfare. Like most if not all of the islands in this part of Maine, Crotch was made entirely of granite and the depth of the adjacent waters made it very easy to off load stone directly to coasters. These coasters would then travel southerly to supply raw stone to major operations on the entire north-eastern coast of the US and as far west as Utah.

At their peak, Casey & Sherwood employed around 450 men, most of them also immigrants like Tom. They focused on a seam of high quality pink granite which

still to this day is known as "Sherwood Pink." It was used in headstones and other cemetery monuments, in memorials to Civil War veterans, and in grand public buildings and private estates.

The reputation and quality of Sherwood Pink was so great that, although well after Tom's day, it would become the personal choice of Jacqueline (Kennedy) Onassis' to feature the carved Kennedy quotations in the low stone wall of the plaza to the side of the grave, which is arguably the most memorable feature of a visit to this gravesite.

Tom's company also produced a fairly large monument that is located in Saint Francis cemetery in Pawtucket, Rhode Island. There is no surprise in the fact that at that time, over half of Rhode Island's citizens were Irish.

Much to the chagrin of the Maine cutters, most of whom were die-hard Red Sox fans, Sherwood Pink was chosen by the dreaded New York Yankees to be used as exterior treatment for portions of the new Yankee Stadium, with the granite surmounted by Salem limestone, quarried at Bedford,

Stepping in the footprints of Great-Great-Grandfather.

Remains of old limekiln.

Refilled quarry at Shanakill Lower (left on map).

Refilled quarry at Lisabrin north.

O.S. Map of 1841.

Indiana. Sherwood Pink was also used in decorative planters.

Since the middle 1800s, Maine has been a major source of granite in the building industry. These quarries combined good hard rock with easy transportation. Most of the important quarries were on the islands on the south central coast.

Maine granite went into structures throughout the eastern seaboard, such as the Brooklyn Bridge, the U.S. Treasury Building in Washington, D.C., and Boston's Harvard Bridge"As with most booms it ended when the use of cement construction made the cutting of granite uneconomic, except for special projects....

Now, only one island quarry remains, the one on Crotch Island.

Thanks to Tony Ramos, the current owner of Crotch Island, I was privileged, with family members, to visit "Tom's" quarry in the summer of 2011. The section Tom's men worked is now silent and largely overgrown, but easily discernible. Other portions of the island are still actively being quarried and I'm very thankful to Danny Hypes, foreman, who pointed me to the exact location of the quarry.

Curraglass

On the advice of Dr. Jim Collins, the author of a paper on lime burning in Ireland, for an earlier Review, contact was made with the Community Centre at Tallow, Co. Waterford, who advised that I should speak to Pa Barry, a local historian. and here we struck pure gold.

Pa Barry who possesses an encyclopaedic knowledge of the area, not only knew of the Casey family but could trace the family line down to the Tom Casey who emigrated to America.

He could also pinpoint where the Casey home (now demolished) was and passed on a copy of an Ordnance Survey sheet on which he had marked the location of the Casey home and the location of two lime quarry sites (now filled in).He sent photos of three filled-in quarry sites and the barely recognisable picture of an old limekiln.

All this was passed on to Matt Davis, who was very pleased to learn so much of the family history, of which previously he had only third hand information. He intends to correspond with Pa and perhaps visit him in Ireland.

Matt's final words; "And if you ever want to visit an authentic down east Maine fishing village, get yourself over to Stonington, Maine, before it gets "discovered" and turns into just another over-priced, over-hyped, faux-community. See for yourself what some Paddys from old Ireland accomplished here in their new home."

Editor's notes

1. **Pa Barry's email address is barrypa@eircom.net**
2. **Photo reproduction and enhancement by John Fox**

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What it means to be an IMQS Corporate Member

See www.imqs.ie and LinkedIn (Irish Mining and Quarrying Society (IMQS)) for all the latest industry news.

"As long term supporters and corporate members, the access provided by the IMQS to Ireland's quarrying and mining sector, across the island, is well-valued by Finning. Networking events, seminars and field visits are excellent opportunities to promote our business and engage with our customers on another level; we wish the IMQS the best in supporting this vibrant sector and look forward to a long and successful partnership"

"The Dalradian Gold application to build a gold and silver mine at Curraghinalt is making its way through the planning process in Northern Ireland, establishing a new and exciting reality in a part of the island where investment is needed and the economic future uncertain. A new industry in the locality, we receive invaluable collective support from IMQS as a key focal point in presenting our project to the mineral extraction sector. IMQS have also been pivotal in establishing and developing our communication and networking opportunities with sister organisations involved in the responsible management of extractive processes and development of educational and training programmes that will deliver a highly skilled and qualified workforce. We particularly thank all those members of IMQS who came to visit recently. That invitation remains open to others who couldn't make it on the day and who still want to come and see and discuss our Gold mining project here in Tyrone."

"The value that Sandvik sees from IMQS membership is being part of the Irish mining and quarrying community as well as building awareness of our presence, offering and service to the Irish customer base. It also builds a clearer picture for ourselves of that customer base in Ireland, where we share our experiences and knowledge to make a safer and more sustainable industry for all."

"Lagan Breedon recognises the importance of a strong industry voice and the promotion of Ireland's quarrying sector. We highly value the IMQS's continuing support and communication of quarrying in Ireland and look forward to participating at its future planning seminars, field trips and networking events."

"Membership of IMQS affords CDM Smith the opportunity to engage with fellow professionals through its events and publications. Membership also facilitates the contribution to the safeguarding of the natural resource and extractive industries in Ireland in a sociably and environmentally responsible manner."

"Irish Drilling is a firm believer in relationships and the IMQS provides access to, and updates from, all parts of Ireland's mining and quarrying sector. We were delighted with the role they played, and for engaging with Irish Drilling and the industry, in delivering the Geo-Drilling Apprenticeship, the first of its kind for the drilling profession."

"Through a collaborative process with its clients and fellow IMQS members, CDE engineers and manufactures materials wet processing systems that maximise the use of finite natural resources while minimising environmental impact. The IMQS provides a vital platform for partnership within the industry in Ireland, bringing together the expertise of mine and quarry owners and operators, geoscience, and engineering specialists to ensure we continue to pioneer solutions that sustain our planet."

"The IMQS provides relevant information and Guidance, and their representation and promotion of Irelands natural resources is very important to Companies who operate in this sector. Kilkenny Limestone Quarries appreciate the importance and value of being members of this Organization."

"Epiroc, although a new brand has been involved with IMQS events for some time when we operated under the Atlas Copco brand. We have always appreciated the networking opportunities and the support and development the IMQS offer in the Irish mining and quarrying industry; pushing for its future development, safety and sustainability."

"As a newly established business formed in 2016, IMQS has offered a platform for broadening our network, attending seminars and having access to valuable information. The IMQS has a great history of being able to connect people and businesses in Ireland and abroad."

"We are very pleased to have joined the IMQS in 2019 and have already found it to be a great resource for up-to-date industry information, networking opportunities and relevant fieldtrips and events."

"Being IMQS members provides us with a co-ordinated view of the challenges and successes of mining, quarrying and related industries. By enhancing our knowledge and connections, it enables us to deliver excellent bespoke funding solutions and achieve shared goals with businesses."

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Australia's Tribute to a Famous Irish Civil Engineer

by Patrick McConnell

The story of Charles's life begins in Gravelmount House, Castletown K.P., County Meath in Ireland, two years before the great famine in 1845. His parents were moral and considerate people of Anglican Protestant faith. John, his father, held Gravelmount on a long-term lease.

During the famine he was overcome by the agonising sights of starving Catholic families who had lost their staple diet due to the repeated failure of the potato crop. John did all he could to provide food for as many as possible. He immediately became immersed in famine relief activities with other local landowners, which included setting up a fund to buy meal and sell it at the lowest possible price, remit the rent of his tenants and hiring many more workers. It is also believed that he financed a ship to bring food into Ireland by way of a mortgage, which later he was unable to pay. This cost him his house and farm, and in 1851 the family moved to a small house in Waterford. Here he was employed as a Company Secretary to the Waterford Limerick Railway Company.

C.Y. was educated in Waterford and then was articled to John Chaloner Smith's Railway Company. He worked as Assistant Engineer on railways in Tipperary, Westmeath and Kilkenny, and also on several weirs on the river Bann in Northern Ireland. He gained experience in solving problems of drainage, gradients and gauges, the power and limitations of different engines and rolling stock, rock cutting, tunnelling and building bridges. Due to a declining demand for railways in Ireland C.Y. migrated to New Zealand in December 1864.

Overlooking Freemantle Harbour, which he designed, stands this Statue of Charles Yelverton O'Connor'

C.Y. worked first as a surveyor on North Island and then joined the Government engineering staff of Canterbury on South Island. He worked on surveys of the first coach road through the Southern Alps in extreme conditions, his route still been the one in use today. Over the following twenty-six years he designed and built railways, roads, harbours, water races for goldmines and numerous other engineering projects. He had a reputation as a brilliant Engineer who could overcome seemingly insurmountable problems in the most difficult terrain. Rising from Assistant Engineer to Regional Engineer and later gained administrative experience as Undersecretary, he was widely regarded for his railway and harbour building feats.

Charles married Susan Ness (of Scottish parents) in 1874 and four sons and four daughters were born to them in the following years as they moved to different locations around the island as the work necessitated. In 1880 he became a member of the Institute of Civil Engineers, London. Due to poor treatment from the New Zealand Government and unjustly denied the position of Chief Engineer, O'Connor was forced to seek financial security for his family elsewhere. He accepted the position of Engineer in Chief in Western Australia, at a salary of £1,200 per year, and moved to Perth in 1891.

The Premier of W.A., John Forrest, informed C.Y. his priorities were a harbour for the capital city of Perth and also, as manager of the railways, to provide transport and communications throughout the fledgling impoverished state. He set up a works department and immediately used his experience to overhaul the railways and extend them across rough country and desert interior with little water. This was a huge task given the rundown and fragmented railway system (some of which was privately owned) He standardised the gauge and linked and extended the railway from 304 Km (189 miles) of track and loss making, to 922 Km (573 miles) and in profit by 1895.

Fremantle Harbour

t the same time he was studying the location of a port to act as a gateway to the continent. He carried out a long and meticulous study of sand movements at

Castletown

the Swan river mouth and consulted local fishermen in the design of his plan. C.Y. proposed an inner harbour for Fremantle port against all established advice (expecting it to silt up). There was uproar as Engineers and politicians said he "had it wrong". His thoroughness at examining all factors and strength in sticking to his guns against all opposition eventually impressed his Premier, and the plan was approved. It included removing (blasting) a limestone bar obstructing the mouth of the Swan river and dredging to 12m depth, building North and South protective breakwaters over 1,200 m in length out into the Ocean and constructing wharves on reclaimed land. Work began in 1892 and an opening ceremony welcomed in the S.S. Sultan in 1897. His design has stood the test of time and is largely unchanged today.

Goldfields

Goldfields were again to play a major part in C.Y's engineering career with another new discovery of gold by Clare man Paddy Hannon in Kalgoorlie in 1893 -prompting one of the world's great gold rushes. Thousands flocked by foot to the Yilgarn area where water was extremely scarce, and conditions harsh. C.Y. provided transport and facilitated supplies by extending the rail lines over hundreds of miles to the goldfields, after much debate as to whether the gold find would last. However the water problem was constantly at crisis point. Conditions for miners were extremely primitive with water more expensive than whiskey and Typhoid outbreaks in the camps. In extreme summer temperatures the steam driven trains couldn't run due to lack of water. C.Y. built great water holding tanks along the route but still the supply of water couldn't keep pace with the demands of the exploding gold seeker population.

The Engineer–in-Chief was instructed to examine the possibilities of delivering adequate water to the desert towns and his public works department, working at high intensity, prepared 31 alternative proposals and C.Y. narrowed it down to three.

O'Connor and his staff proposed a plan to

C.Y. in typical pose

pump water using a series of eight steam powered pumping stations from a dam in the Darling Ranges through a 0.762m dia. (30") pipeline over 539 Km (335 miles) raising it 300m to a reservoir in the goldfields. It would deliver 23 million litres (five million gallons) per day at a cost of 3s 6d per 4,545 litres (1000 gallons) and would cost £2.5 million and take three years to build. This was risking twice the state annual budget on an untried engineering design. The very magnitude of the project appalled the public and many believed it doomed to failure. The scheme came under severe criticism from opposition politicians and newspapers and this continued unabated until the water arrived in Kalgoorlie in January 1903. O'Connor's planning and detail had been examined and approved by expert engineers and the scheme was lauded as the greatest of its kind in the world. C.Y. was later awarded a C.M.G for his engineering achievements.

In 1898 the plan was sanctioned by Parliament and construction of the Mundaring Weir, the eight pumping stations and the pipeline began, supervised by O'Connor. It was a colossal project. For the dam the catchment area of over 800 acres of scrub had to be cleared by hand, and the river Helena diverted. Foundations for a massive weir took 18 months to dig by hand to 30 metres depth to remove fractured granite and ensure solid bedrock. Mundaring Weir concreting started in January 1900 and continued non-stop 24 hours a day, 7 days a week until its completion in June 1902.

The pipeline design itself also was a daunting challenge. If riveted pipe was used then leaks would lose most of the intended flow. A new "locking bar" system by a Mr Mephan Ferguson was tested and was courageously adopted for the pipeline. Some 70,000 tonnes of steel was imported from Europe through Fremantle harbour, manufactured into 10 meter lengths and carried to the pipeline sited along the railway.

At the same time the eight massive steam driven pumping engines and their infrastructure were been constructed and placed in position along the route.

Despite good construction progress Parliament came to within a couple of votes of cancelling the whole scheme. Mounting criticism from the Parliament, in the absence of John Forrest (gone to Federal Govt.), and the press and public forced him to defend himself and his team. He suffered constant insults like "no wonder he was born in Ireland and best he returns there". He felt let-down by abuse from Labour leaders as he had always acted in the best interest of the labouring classes and procured an 8 hour day. His preference for using "day labour" instead of contractors also ensured constant attack by vested interests at any perceived delays in the project. Also he was greatly disappointed to learn that one of his senior engineers had been buying up land ahead of the publication of the pipeline route. The Sunday Times asserted that O'Connor was party to the deal and called him "this palm-greased humbug and imposter". The Government launched a commission

Gravelmount House Castletown K.P.

Western Australia railways 1904

of enquiry to examine the conduct and completion of the water scheme in early 1902.

In March 1902 O'Connor's confidence in his scheme was vindicated by a successful preliminary pumping test of six miles of the water main over the most difficult part of the route. However he was by now suffering exhaustion from work overload and intense anxiety from his responsibilities for the scheme. He wrote "better that the scheme be taken over by some new man unbridled by prior events__", and could no longer absorb the constant personal attacks, and on his professional integrity and that of his team, and knowing his great work was nearly complete he committed suicide on the March 10th 1902.

The grand ceremonial opening of the Goldfields Pipeline Scheme took place on Saturday 24th January 1903 in Coolgardie, and later that afternoon in Kalgoorlie in temperatures of 44 deg. C. (111 deg.F) in the shade – a fitting temperature to emphasise the value of the fresh water supply. John Forrest spoke of his sadness that his friend Charles Yelverton O'Connor had not lived "to receive the honour so justly due to him".

C.Y.O'Connor could not have known the far reaching effects his pipeline would have on Western Australia's economy. He pumped water to the goldfields long before the full extent of the "Golden Mile" mining district was known – still producing gold to this day, and he could not have envisioned the water been used to help develop vast tracks of country. The scheme has been expanded enormously allowing three times the water held at Mundaring Weir (now at 77 million cubic metres), and pumping 90 million litres (20million gallons) per day. Pipeline branches 200 Km. north and south, supplying huge tracts of farmland and over 100 towns and covering up to 2.5 million Hectares (6 million acres).

Charles Yelverton O'Connor' greatest achievement perhaps was that he delivered this mass of infrastructure, Fremantle Harbour, W.A. Railways and the Goldfields Water Supply Scheme, each of which depended on the other, during a period of financial and political instability, on borrowed money, on schedule, and that the various projects proved profitable is little short of miraculous.

C.Y. never lost his love of Ireland or his soft Irish accent. He was amiable and very courteous, and a devoted family man. He had a lifelong love of horses and always employed Irish men to look after them. Irish emigrants arriving in Perth could rely on been supported by Charles for work. He had great compassion for working men-perhaps remembering his childhood

Mundaring Weir 2000

in Ireland, and fought for the rights of workers. He instigated an eight hour day for his staff, supported better wages and encouraged them to join a union. He had enormous determination, and upheld the honour and high standards and integrity of his profession right to the end. As for "flourishing on palm grease" his family were left with less than £200 in his estate. This was later supplemented by a state annuity of £250 per annum to his widow.

His story has great potential for a film as one of life's genuine heroes. Picture his blissful early years at Gravelmount House and then the desolation of the famine years in Ireland and the unjust Landlord / tenant relationship in "a land of plenty". His early training and works on railways and weirs in Ireland's beautiful countryside.

His emigration and then his achievements in ruggedly scenic New Zealand where his roads and bridges are tourist sites today, and later his unfair treatment by the Government forcing him to move again. Finally his pioneering and vast projects in Western Australia - Fremantle Harbour, extending the railways and providing fresh water to the goldfields to alleviate the harsh conditions endured by miners from every nation. His thoroughness and courage and belief in his plans showed his strength of character, and he had great compassion for working men.

This is in contrast to the constant undefended abuse, anti-Engineer and anti-Irish attitudes practised by some of the then elite leaders of the community. Overcome by exhaustion from work overload and huge responsibility and taking his own life before completing his great project, and this act, perhaps, finally "setting the seal on his greatness Commemorative plaque.

The small picturesque village of Castletown K.P., situated in north County Meath, commemorated its most famous engineer Charles Yelverton O'Connor (1843 – 1902) on Saturday 8th September 2007 with the unveiling of a plaque at his birthplace, Gravelmount House.

Australian Ambassador Anne Plunkett and C.Y.O'Connor's granddaughter Mrs Pat Nuttall and three great-granddaughters - Claire Delaney, Theresa Rawlins, and Davilia Bleckly and other dignitaries were guests of current house owners, Brian and Eunice McKenna at a reception in Gravelmount House prior to the unveiling ceremony at the entrance gates with over 200 people present.

The plaque (sponsored by Boliden Tara Mines) was the work of Castletown Heritage Committee in association with Meath Archaeological and Historical Society's Hon. Sec. Mr Oliver Ward, and The National Science and Engineering Commemoration Committee, and Patrick McConnell.

As a mining engineer and a fellow Castletown man I have had a great interest

Fremantle Harbour (present day)

Mundaring Weir 1899

The Pipeline

Laying pipes across Darling Ranges

The plaque (sponsored by Boliden Tara Mines)

in C.Y.O'Connor's story since word of his deeds reached Castletown in 1991 when my Aunt, who had taught in schools around Kalgoorlie, returned from a visit there with Hasluck's book - "Great Australians".

In Western Australia C.Y.O'Connor is a legendary figure with schools, streets, lakes etc named after him. Some radio documentaries on his life (including our local "LMFM") have been broadcast but my attempts over the last fifteen years at getting producers interested in a film documentary have been to no avail.

However I am delighted that a fictional novel loosely based on his life called "The Drowner" by Robert Drewe is presently been made into a "big budget" film (Impian Films) in Australia and perhaps finally this great man will receive the world-wide recognition and honour justly due to him.

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Obituary

Herbert McDowell Stanley

Born 4 January 1937 - Died 3 January 2019

by Sean Finlay (First published by "The Irish Times" February 2019)

One day short of his 82nd birthday, Herb Stanley died at his home in Loughrea Co. Galway. Originally from Carleton Place, near Ottawa in Ontario Canada, Herb came to Ireland in the early 1960's to work on the exploration of the Tynagh zinc-lead-silver mine in east Co Galway. His expertise in the mining industry was invaluable in that regard, as there was limited availability of advanced mineral drilling technology in Ireland at that time.

Shortly afterwards, Herb founded his own company Irish Drilling Ltd (IDL) in the mid 1960's. Based in Loughrea, Co. Galway, IDL has gone on to provide mineral exploration drilling services to companies active in Ireland, Northern Ireland, the UK and France. IDL has been involved in the discovery and delineation of almost every mineral deposit and /or mine on the island of Ireland including gold, base metals and industrial minerals.

In the 1980's IDL extended its services to include site investigation drilling and laboratory testing services for a wide range of infrastructure developments in Ireland, including motorways, wind farms, commercial developments and the onshore and offshore elements of the Corrib Gas Field. IDL remains a significant employer in Galway; many of the staff have been with the company for decades.

IDL is now managed by Herb's son in law Ronan Killeen and his fellow director Declan Joyce, both Chartered Engineers. Herb served as Chairman and was until a year ago still very active in the affairs of the company.

Herb was also a founding shareholder in several mineral exploration companies in Ireland and in Canada, including Jamex, New Sabina, and Dungannon. In 1987, the Irish interests of these companies were combined to form Celtic Gold plc which listed in Dublin and London which was later taken over by a UK insurance group. Herb maintained a keen interest in the

Herbert McDowell Stanley.

sector, often supplying drilling services and accepting shares as payment, a strategy that was often very successful.

On the occasion of Herb's 80th birthday, Koen Verbruggen, Director of Geological Survey Ireland commented that the Tynagh Mine which Herb Stanley helped delineate was the foundation of the modern Irish mining industry. The development of Irish Drilling Ltd. is a great example of community gain and of the multiplier effect arising from mining. IDL is a key member of the Geoscience Ireland cluster of 37 companies providing services to the international mining sector.

Herb's other interests included ownership of several successful racehorses (National Hunt and Flat). Among these were Deep Idol, Merry Gale (both Grade 1 Chase Winners), Derrymoyle and more recently Captain Joy. He also owned a horse called Celtic Gold; Herb commented that like the company of the same name, it showed well from time to time, but was never a winner!

Herb was deeply involved in the social life of Loughrea, being a member of Loughrea Golf Club, Lions and Loughrea Rugby Club. He was also a founding member and promoter of the Galway Bay Golf and Country Club.

Herb married Emily Brady from Loughrea in 1963 and has been based there ever since. He is survived by his two daughters Lillian and Avril; son in law Ronan Killeen and Shantanu; grandchildren Caimin, Tiernan, Cullen and Jarah, and by his twin Hannah and sister Lillian. Like Herb, his extended family is deeply involved in Loughrea life, with Emily a stalwart member of the Golf Club; Lillian serving with Loughrea GAA and his grandsons playing at club and county level GAA. Avril is a successful concert promoter and businesswoman.

The affection felt for Herb by his family, his business and sporting friends and his local community was very evident by the huge attendance at his funeral service in St Brendan's Cathedral in Loughrea. Ten priests and a bishop presided; his daughters Lillian and Avril gave eloquent and moving eulogies, noting that some bets that Herb had placed on the day he died had come good.

Bishop John Kirby noted that like earlier Norman settlers, Herb had become more Irish than the Irish themselves. In a fitting summary at the end of his homily, Mgr Cathal Geraghty said; "Herb's race is run; Winner All Right, Winner All Right."

I had the pleasure of knowing Herb for over 40 years and working with him for 10 of these years. I am not alone in having found him to be astute, fair, honest, loyal and that his many successes left him unchanged; his essential simplicity, good humour and zest for life were never dimmed. He was big in heart and in character and made his mark.

Ar dheis De go raibh a h-anam

HEALTH AND SAFETY AUTHORITY

How do I use the SLAM technique to do an on-the-job risk assessment?

To help create a healthy and safe quarry, use the SLAM technique to determine the risks involved in any given task. There are four stages to SLAM:

Stop - Look - Assess - Manage

Stop

Stop the task and think. Consider each step of the task. Ask yourself:

- Is this a new task or has the task changed in any way?
- When was the last time I did this task?
- Do I feel comfortable doing this task?
- Do I need training? (You should not perform the task until you have been trained.)

Look

Look at the work area before, during and after completion of the task. Ask yourself:

- What are the potential hazards (unsecured ladders, untidiness, etc.)?
- Are there different hazards for each step of the task?
- What should I do to address these hazards?

Assess

Assess each step of the task. Ask yourself:

- Do I have the correct knowledge and skills to perform the task safely?
- Do I need more training?
- Am I equipped with the appropriate tools to perform the task safely?
- What else do I need to perform the task safely?
- Do I need help? (You should always ask for help when you need it.)

Manage

You and your employer should take appropriate action to eliminate or minimise any hazards on site by ensuring that the proper equipment is used and is well maintained and by reviewing completed tasks. Ask yourself:

- What went well? What did not go well?
- Did anything unexpected happen?
- How can I be better prepared and plan for this in the future?

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sophisticated sound and look, the band perform a brilliant mix of music from Pop to Country and the Classics!

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Individual or small groups will be accommodated on members tables, so don't be put off if you want to come by yourself or in a small group.

Tickets are now available on the IMQS web page http://www.imqs.ie/DinnerDance.aspx

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IMQS Golf & Dinner Dance 2018

by The K Club Hotel, Straffan, Co. Kildare. November 10th, 2018.

IMQS President John Francis and family.

John Francis (President IMQS) addressing the audience.

Seán Canney, (Minister of State for Natural Resources, Community Affairs and Digital Development).

Compere Brendan Morris.

Heather & Les Sanderson, Elizabeth Murphy, Stephen Walsh & Robert McNulty.

Garfield Harrison, Sean Finlay, Brendan & Jo Morris.

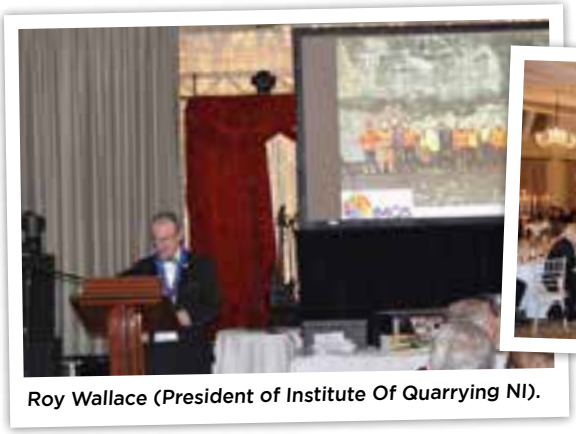
John & Sinead Francis.

John Francis (President IMQS) & Roy Wallace (President of Institute Of Quarrying NI).

Stephen Walsh & Siobhan Tinnelly.

Koen Verbruggen, Eibhlin Doyle & Brendan Morris.

Winner of the IMQS Golf Maters Gordon Best (centre) Brendan Morris & Jason Hopps.



Roy Wallace (President of Institute Of Quarrying NI).

Heather Sanderson with Eileen Johnston & David Johnston.

Brendan Morris with the Overall Winning Golf Team: Garfield Harrison, Phil Eaglestone, Ciaran McCreanor & Gordon Best. Prizes presented by John Francis (President IMQS)

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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: .....
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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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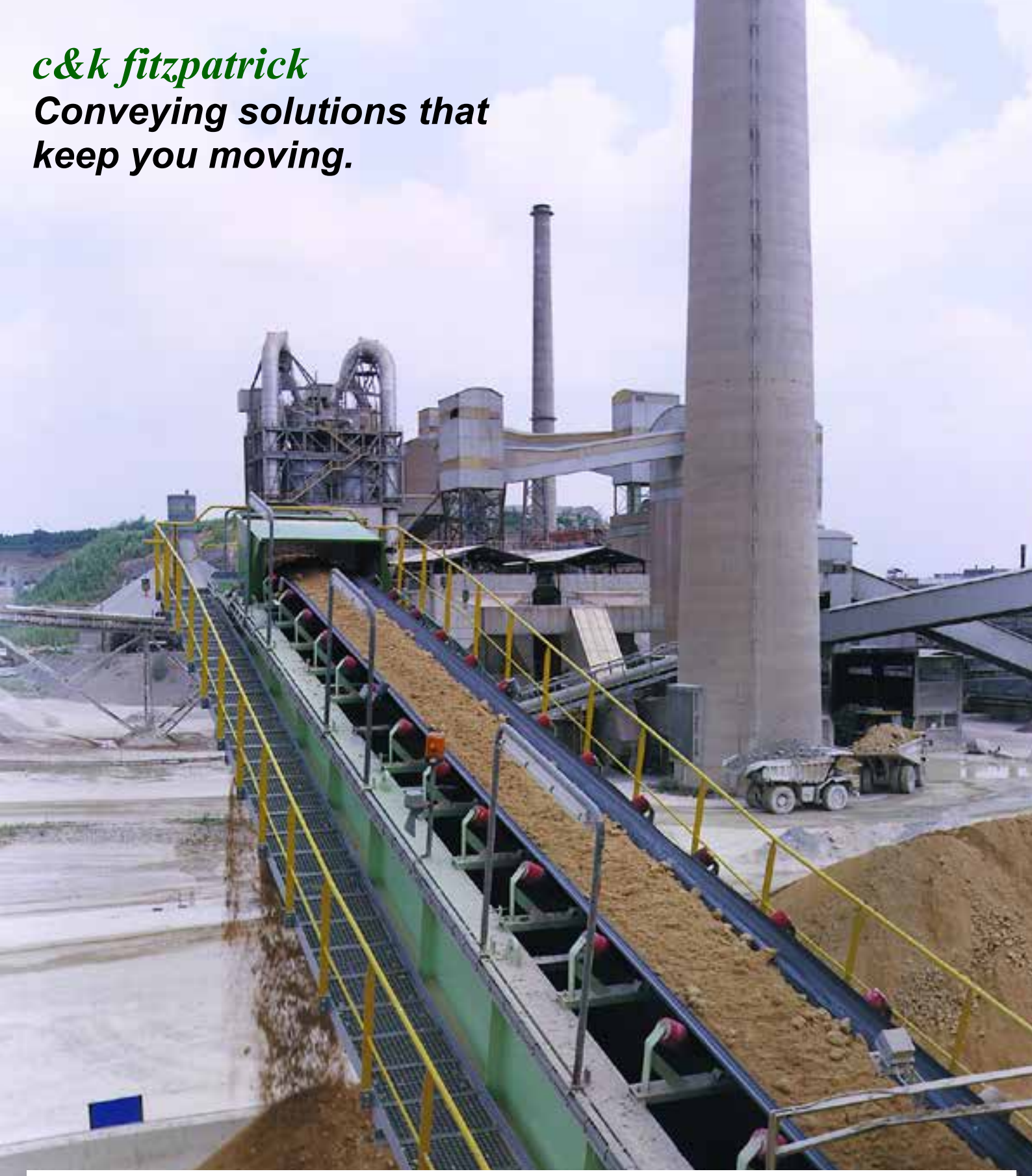

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