IMQS

IRISH MINING & QUARRYING SOCIETY

ANNUAL REVIEW 2020

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Notes from the Editors 2020

2020 – it's difficult to know how best to summarise this year! We expected that the focus of our Annual Review would be on the implications of Brexit and the status of what appeared, in late 2019, to be a potential "No Deal" Brexit. Although 2020 commenced with Brexit to the fore and a General Election that resulted in a 3-party Government in the Republic of Ireland, bigger challenges were looming.

Covid-19 took us all by surprise and has resulted in a community effort across the island of Ireland to stop the spread of a vicious and unpredictable virus. It has been a significant game changer in the way that we communicate, operate and exist. The Construction industry shut down in March 2020 (as well as normal life, as we knew it) and the implications on personal and professional well-being was felt far and wide. As we continue to move in and out of various phases of Lockdown, the industry and the very people upon whom the industry relies, are continually adjusting to new ways of living and working in order to protect ourselves and our future.

Yes, businesses have been decimated by the economic instability that resulted from Covid-19. However, in other cases, some companies have adapted and found new ways of working.

This year's IMQS Annual Review is particularly interesting because there are examples across the sector of innovation and perseverance in the face of very challenging circumstances.

We have feature papers and updates from industry associations on the impact that Brexit and Covid-19 have had (and are continuing to have) on their businesses and the advances that have been made to counteract some of the negative forces that impacted the sector in 2020.

It is encouraging to note that a number of the case studies included in this year's Annual Review showcase the great strides that have been made in the continued development and advancement of individual projects within the sector and the cutting edge technology that has been developed by our industry colleagues to allow this progress to be realised.

In this most unusual year, we elected a new President, Ms. Nicola Nixon, to the Irish Mining and Quarrying Society. With a significant portfolio of experience within the mining industry, Nicola marks her first year as President of the IMQS by providing a message to our members within this Review. We wish Nicola every success in her new role. This message is also supported by a Foreword from Mr. Philip Nugent, Assistant Secretary with the Department of the Environment, Climate and Communications. We are grateful to Philip for contributing to our Review in what has been a particularly busy year for his Department.

As always, the IMQS thrives on collaborative work and support from like-minded associations and we are delighted to have updates from industry partners including the ICF, IGI, EFEE, GSI, Geoscience Ireland, IQ, iCRAG, Carlow IT, IAEG and MPANI and the Irish Mine Rescue Committee (IMRC).

Some fascinating feature papers have also been provided by a range of contributors with a focus on case studies and showcase projects. Papers have been prepared by Irish Cement, Boliden Tara Mines, Gyproc Saint-Gobain, M. Keane Consulting, LKAB, Sandvik, Tony Hand, Finning, Paddy McConnell, Tellus, LTMS Ltd., DECC, GSNI, Whitney Moore and Dalradian.

There is also an updated feature on the value of Corporate Membership of the IMQS, a review of the 2019 Annual IMQS Golf Competition and Dinner Dance (K Club) and, back by popular demand, a chance for some of our younger readers to win construction-themed Lego!

Our "industry leaders" feature this year focuses on the careers (to date) of two individuals who have played a significant role in the extractive industry in Ireland – Dr. Marie Cowan and Mr. Paddy McConnell.

Sadly, we have lost a number of colleagues and friends since last year's Review. In honour of these dear members of our industry, we have included a selection of obituaries to celebrate their achievements and to mark their contribution to the industry.

As always, and this year more than ever, 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. Thank you also to Louise Lynch, TOBIN Consulting Engineers, who assisted the editorial committee with final edits this year.

We hope that you enjoy the IMQS Annual Review 2020 and that you will avail of our invitation to you to contribute an article to next year's edition!

the Editorial Team


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contents

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Foreword from the Department of Environment, Climate and Communications

by Philip Nugent, Assistant Secretary, Circular Economy, Waste Policy and Natural Resources, Department of the Environment, Climate and Communications

I'm pleased to provide this foreword to the Irish Mining and Quarrying Society 2019 Annual Review to provide some updates on the role the sector has to play in bringing about Ireland's transition to a circular economy and also to flag some organisational changes within the recently renamed Department of the Environment, Climate and Communications.

Minerals provide the raw materials that allow society and economies to function and evolve. Ireland's decarbonisation journey and our roll-out of the digital agenda will depend on the availability of minerals supply. Decarbonising the EU's energy system is critical to reaching climate objectives. Access to critical raw materials (including minerals) used in digital and clean technologies was labelled as "a strategic security question" in the European Green Deal (March 2020).

The European Green Deal also signposted the introduction of the second EU Circular Economy Package. While, intuitively, the extraction of minerals might not seem to be consistent with the principles of circularity and the circular economy, the minerals and raw materials sector has a significant role to play too in the transition to a circular economy for the EU and Ireland.

In a circular economy, waste and resource use are minimised; the value of products and materials is maintained for as long as possible through good design, durability and repair; and when a product has reached the end of its life, its parts are used again and again to create further useful products. The circular economy often thrives within different business models – sharing schemes for tools, bikes and cars; leasing arrangements for home appliances, bikes, even jeans; repair and remanufacture. It is an alternative to the traditional, linear economy, in which we extract great quantities of natural resources to make things that we may use once only before throwing them away.

At its best, living in a circular economy allows us more access to things which are well-designed and can be shared, reused, repaired and remade; and when we keep manufacture and remanufacture as local as possible we provide local jobs and services with the lightest impact possible on the quality of our water, air, soil and health. In recent times in Ireland we have seen the value of shorter and more localised supply chains providing for our needs as the fragility of global supply chains has been exposed.

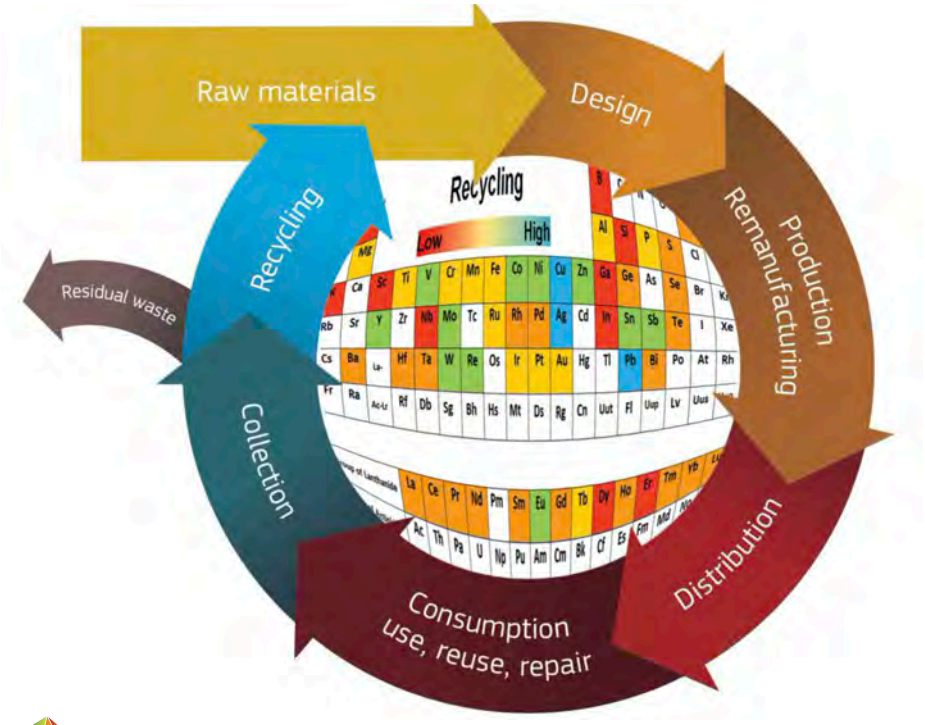

Image attributed to the Joint Research Centre, European Commission.

Ireland is fully committed to making the transition to a circular economy and every sector of the economy, along with every household and business in the State, has a role to play in helping that transition. The recycling of waste electrical and electronic equipment (WEEE) is a practical existing example how precious metals can have multiple productive lives. Similarly, there are successful procedures and systems in place for the reuse, recycling and recovery of End-of-Life vehicles (including the recycling of metals) and waste battery recycling, where valuable materials such as cobalt, nickel, rare earth metals, zinc, lithium, lead, manganese and steel are recovered from the batteries.

However, a circular economy and resource efficient vision for mineral exploration, mining and other raw materials needs to look beyond just recycling end of life products. We need to shift our focus back along the full production and product life-cycles. The mining process produces waste (including waste heat) and by-products which could re-enter the circular economy to improve sustainability and derive additional economic value. There is the opportunity and a requirement for the minerals and broader raw materials sectors to continue to move mining towards a "zero waste" industry, with a renewed focus on productivity and energy/water/waste efficiency, reducing the carbon footprint (for example through using renewable energy) and generally increasing the

resource efficiency of mineral exploration and mining activities.

An enhanced focus on resource efficiency will help ensure that the sector can contribute to achieving the transition to a circular economy, complementing the Government's Waste Action Plan for a Circular Economy, published on 4 September 2020. The Department is also now working on a whole of Government, cross-sectoral Circular Economy Strategy that will aim to draw together how the circular economy agenda can be realised across all sectors of society and the economy. The draft Strategy will be published before year end.

In additional related news, the Department of the Environment, Climate and Communications is restructuring the delivery of its Geoscience functions in a way that will support this enhanced focus while ensuring that the Department continues to meet its policy, legislative and regulatory roles to the highest standards. At the end of 2020 the Exploration and Mining Division and Petroleum Affairs Division will cease to exist.

Each of these Divisions currently discharge a range of policy, legislative and regulatory functions, one in respect of minerals and mining (EMD), the other in respect of

petroleum (PAD). From January 2021, the regulatory and enforcement functions now held in these areas will transfer to a new dedicated Geoscience Regulation Office.

This new Office within the Department of the Environment, Climate and Communications will be responsible for regulation, including monitoring and enforcement, of the minerals and petroleum sectors (including, for example, all licensing functions, decommissioning of Kinsale gas complex, site inspections and compliance assistance). All minerals and petroleum policy and legislative functions will move to a new Geoscience Policy Division, also within the Department.

The new structures will ensure a clear dividing line between policy and legislation functions from regulation and monitoring functions, building on the expert and professional manner in which these functions have long delivered.

The role of the Geological Survey of Ireland (GSI) is changing too, although to a lesser extent for the moment. The GSI will take on the consolidated geoscience research and open data management functions of the Geoscience Regulation Office, the Geoscience Policy Division while, of course, continuing to manage its own extensive research and data sharing programme.

In a sense, the new structures are a model of the circular economy model in operation: the GSI will provide the research and data, the Geoscience Policy Division will take this raw material and convert it into robust, evidence-based policy and legislative frameworks which the Geoscience Regulation Office will use as a the basis for a strong, fit-for-purpose regulatory and decision-making system.

In turn, regulation requires monitoring of awarded licences/permits that often have work progammes associated with new data acquisition that can feed into future research programmes.

We look forward to working with IMQS and all other stakeholders under our new configuration.

Message from the President

by Nicola Nixon, IMQS President

Welcome to the 2020 edition of our Annual Review. I am honoured to be writing this as President of Irish Mining and Quarrying Society. It has been an interesting year since our last review. The extractive industry, Ireland and the world have been faced with a pandemic, on a scale unprecedented for many.

For a long time Brexit consumed our thoughts with worries about how it would affect the industry unfortunately now we must consider the detrimental long term effects Covid-19 will have. In these challenging times with a new coalition government and the demand for minerals on a decrease and share prices falling since the first quarter as a result of the Covid outbreak, we must work through this together, bearing in mind the smaller companies and our local business that may struggle during these uncertain times.

Mining has always played a role in my life. I grew up in Navan with my father working in Tara Mines and this is where the seed of interest was planted. I joined the IMQS as a Student Member eighteen years ago when I was studying Mineral Engineering in Athlone IT, I never dreamt one day I would be on the Council let alone the President.

After college I was employed with Golder on Tara Mines Tailings Facility before being employed as an underground surveyor which I thoroughly enjoyed for 9 yrs before moving to my present position of Drill and Blast Engineer. Along the way I completed my studies with a Masters from UCD in Environmental Sustainability.

As a female from the mining sector holding the office of President of the Irish Mining and Quarrying Society it is important to me to promote diversity within the industry and educate the younger generations, both male and female, of the opportunities that are available to them in a variety of positions within our interesting, sustainable and growing industry.

I would like to take this opportunity to thank Mike Lowther, IMQS Council member with whom I had the good fortune of working. Without his encouragement to put myself forward for the Council I would not be in this position writing this today for you.

Conference

In October 2019 the IMQS in collaboration with Geoscience Ireland hosted the 'Mining Ireland' conference in Dublin. It was a sell-out event with our keynote address provided by Minister for Natural Resources, Community Affairs and Digital development Sean Canney.

The conference focused on mineral exploration and development activity on the island of Ireland. Exploration companies provided updates and panel discussions related to exploration, planning, mining operations and mine closure. It was an extremely interesting and captivating day for all who attended.

Unfortunately due to the Covid 19 crisis encapsulating the world all planned seminars had to be postponed for 2020 but we would hope that we will be back in 2021 with more engaging topics to discuss.

European Mining Convention

In early December 2019 EMC, with supporting partner IMQS, welcomed delegates from across the world for a 2 day conference and exhibition. IMQS Corporate members exhibited and provided presentations at the event.

Sean Finlay, past president IMQS gave the welcoming remarks and outlined the strength of Irish companies in the global mining supply chain. I delivered the keynote address outlining the role of the Society and an overview of Irelands mining sector and its history.

Discussion panels relating to public policy, legislation and sustainability were moderated by Brendan Morris, Past president and Andrew Gaynor, Executive Secretary IMQS. While the foot fall was not as hoped the content was there and the EMCs ambition over the coming years is to host in different European Capitals.

Field Trips

The IMQS would like to thank both CDE Global and Dalradian Gold for hosting our field trip on June 6th 2019. CDE & Dalradian, were happy to open their doors and share their knowledge.

Both sites provided a presentation on their work followed by a tour.

CDE have their global headquarters in Cookstown and their factory facility where they manufacture and dispatch its wet processing machinery. The afternoon session was hosted by Dalradian Gold where a presentation on work-to-date was given and a tour of the site and shaft.

Both field trips had full attendance, this shows the interest within the industry to learn, explore and network.

It is important that we work together as an industry and strive to inform the public that responsible exploration, mining and quarrying are a necessity if the industry within Ireland is to continue developing.

Media/Website

Social Media allows information that was visible to some and invisible to many become a 'reality' for all, it is crucial that this information is fact-based truth.

Based on this concept the Minerals Information Working Group was established in 2019.

Under The Institute of Geologists of Ireland people from all sectors of the industry have come together to ensure that the correct factual information is out there for people to access, this is an ongoing project at the moment and one which the IMQS are delighted to be involved in.

Drilling Apprenticeship

The Drilling Apprenticeship was formally launched on November 11th 2019 at Boliden Tara Mines by Damien English TD, then Minister for Housing and Urban Development. Sixteen apprentices began their studies in January 2020 in Institute of Technology Carlow.

On completion they will receive a Higher Certificate in Science, Level Six on the National Framework of Qualifications. Geological Survey Ireland, IT Carlow and the IMQS in conjunction with the drilling industry recognised the need for this qualification and we wish all the current apprentices the very best with their studies.

EFEE

In September 2019, the IMQS in conjunction with Fáilte Ireland and Dublin Convention Bureau travelled to Helsinki to put Ireland forward as the host country for the European Federation of Explosives Engineers 2023 World Conference. I am delighted to say that we were successful in our endeavours and it will be the first time the conference has come to Ireland.

I would like to thank Alan Dolan, IMQS Vice President, who introduced the negotiations between IMQS and EFEE and helped make this happen.

Dinner Dance

Our 2019 held once again in the fabulous K Club, was a great success. We brought together nearly 300 guests from the industry. The day started with a golf tournament on the Smurfit Course, won by Brian Keenan of Golders, congratulations.

Simultaneously the inaugural IMQS Clay Shooting Competition was taking place at Abbeyfield Farms Centre, Clane which was won by John Francis, both were a great start to our day which continued with our black-tie evening dinner and drinks. We were delightfully entertained by Irish Magician Jack Wise with dancing continuing well into the night!

Unfortunately, due to current circumstances we have decided this year to cancel our Annual Dinner Dance in the K Club. While it is disappointing to do so it is the welfare of our members that is our highest priority and we hope to see you all again next year for an excellent night.

Health & Safety

Health and Safety is more important then ever at the moment in our workplaces. I would like to praise our members who quickly got on board with the Government guidelines and ensured they provided safe working environments for their employees. Ciaran Greenan and Brendan Morris, on behalf of the IMQS, continue to work with the Quarry Safety Partnership and (unfortunately, now postponed,) the bi-annual All-Island Quarry Safety Conference was due to be held on the 14th Oct in the Armagh City Hotel.

This conference is an excellent opportunity to obtain information on current guidelines and information on managing safety in cost effective ways.

Today Ireland has an international reputation for mining in a responsible manner regarding both the environment and safety, and it is highly regarded as an attractive destination for mining investment and for positive government policy.

The IMQS continues to promote Ireland as one of the worlds best destinations for investment in mineral exploration and mining, with well-defined fiscal and regulatory systems, attractive geology and a well-developed supply chain to the sector both local and internationally.

There were many plans for 2020 to continue with our goal but as Robert Burns said 'the best laid plans of mice and men often go awry' so for now we must concentrate on getting back to a new normal. I would like to thank the IMQS Council for all their hard work in the past year, it is always done with enthusiasm and a spirit of teamwork.

So, while it is disappointing to have to postpone our plans, it is a time to stay safe, to work together, follow the guidelines and to look forward. While uncertainty still looms, I have no doubt we will be back next year with many more great opportunities for our members.

Activities of the Society 2019-2020

by Alan Dolan, Honorary Secretary & Vice President, Irish Mining & Quarrying Society

The following are the main activities of the society in 2019/2020.

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

Council Meetings

2019 - September 10th, October 15th & December 10th.

2020 - January 14th, February 18th (AGM), March 10th, April 28th, May 26th.

Representations in 2019

Council members represented the IMQS at the following events/committees during 2019 & 2020.

- European Federation of Explosives Engineers Conference
- European Mining Convention - supporting partner
- Prospectors and Developers Conference in Toronto (PDAC)
- Standing Committee on Public Engagement
- Geoscience Ireland
- Sinn Fein Motion 68 on mining (by correspondence)
- Quarry Skills Certification Scheme meetings (QSCS)
- Quarry Safety Partnership (QSP)

Annual Review 2019

The Annual Review 2019 as well as reviews from previous years, can be viewed at **www.imqs.ie**.

Annual Dinner Dance 2019

The 2019 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. A golf tournament was held that morning on the Smurfit course and a clay pigeon shoot was held in Abbeyfield Farm Country Pursuits, Equestrian and Activity Centre.

Roy Wallace (President IOQ NI), was our guest speaker. Jack Wise entertained the crowd with his unique comical talents and Vegas Nights played well into the night.

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, 2019.

John Francis and Brendan Morris joined our colleagues from Northern Ireland and the UK, at the event.

Annual Field Trip 2019

The Annual Field Trip was held on the 6th June of 2019. CDE Global and Dalradian Gold Mine were the destinations. CDE Global presented the range of applications for their wet processing equipment, followed by a tour of their impressive factory and R&D facilities.

The afternoon visit to Dalradian Gold Mine was a fascinating underground tour followed by discussions and refreshments. Many thanks to the management of both sites for facilitating our visits.

EFEE 10th Annual World Conference on Explosives and Blasting

The EFEE conference was held between 15th and 18th September 2019 in Helsinki, Iceland.

An IMQS delegation of Alan Dolan, Nicola Nixon, John Francis and Brendan Morris vied for and won the competition to hold this prestigious conference in Dublin in 2023.

Mining Ireland - Ireland open for business

In collaboration with Geoscience Ireland, the conference 'Ireland – Open for

IMQS Field trip to Dalradian Gold – June 2019.

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

Business', was held in The Radisson Blue Hotel Dublin Airport on 8th October 2019. Minister Sean Canney T.D., gave the keynote speech.

The conference will focused on mineral exploration and development activity on the island of Ireland and provided updates from exploration companies.

Mine Rescue 2019

The All Ireland Mine Rescue Competition was hosted by Irish Salt Mining and Exploration at Kilroot on Saturday 15th June 2019. The ISME team were the winners.

Flight training with the Helicopter Wing of the Irish Air Corps took place with Boliden Tara Mine Rescue in June 2019.

Due to the impact of the global pandemic, mutual training has been put on hold. Mine rescue response across the island of Ireland remains in place.

The 12th International Mine Rescue Competition due to held in West Virginia, USA has been postponed to 2021.

A full summary of Mine Rescue activities can be found in the 2020 review.

Geo-Driller Course

Geoscience Ireland, in collaboration with the Institute of Technology Carlow, is running a Geo Drilling Apprenticeship. It was officially launched in Boliden Tara Mines on 11th November 2019 by Minister Damien English TD.

The course commenced in 7th January 2020 and has 13 participants. The Geo Drilling Apprenticeship awards 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. More details can be found at **www.imqs.ie**.

Events in 2020

Due to the Covid-19 restrictions, all social events post-March 2020 have been impacted.

Our AGM was held in the Spa Hotel in Lucan on Tuesday, February 19th 2020.

Ciaran McCreanor was co-opted to the Council.

The annual Prospectors and Developers Association of Canada (PDAC) Convention was held in Toronto, March 3rd- 6th 2020. The IMQS was represented by Jennifer Craig and Sean Finlay.

Due to Covid Restrictions, the planned Annual Field Trip for 2020 is on hold.

Due to Covid Restrictions, the annual Dinner Dance for 2020 will not go ahead.

The All-Island Health and Safety Conference & Exhibition is a bi-annual event that alternates between Northern Ireland and Southern Ireland. It was planned to be held Armagh City Hotel on the 14 October in 2020. Due to Covid restrictions, details have yet to be finalised. It did not take place.

We have a very active LinkedIn page with industry relevant discussions and updates.

We have again increased our Corporate Membership number in 2019. With benefits such as free advertising on the IMQS web site, free job postings, IMQS support, 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.

View from the North

by Gordon Best, Regional Director MPANI

At the start of this year no one could ever have imagined the impact that the COVID-19 emergency was going to have on our society, our family, our work and way of life. The shudders it has already sent through families, communities, businesses and supply chains at such speed and with such profound consequences serves to remind us that our interdependent and interconnected world, for all its strengths, remains susceptible to the unexpected and none of us can ever 'assume supply'.

This has underpinned our message to our local Government and key stakeholders for many years of the essential nature of our industry and we intend to push it even harder now and when this emergency is finally over. MPANI will continue to raise awareness of the features and benefits of essential and local mineral products and the contribution they make to the economy and our quality of life.

During the COVID 19 lockdown MPANI has worked closely with our colleagues in other business organisations, with MPA nationally and with a number of Government Departments our Members supply materials and contracting services to, to ensure that essential supplies chains operate effectively. Through these difficult times MPANI's top priority has been and remains securing and delivering a 'cash bridge' solution to protect businesses and jobs. The UK Chancellor's package of measures in March, including the "Coronavirus Job Retention Scheme", has been welcomed by businesses in Northern Ireland and across the UK. However, the focus is now and will continue to be on getting the conveyor belt of decision making moving and the pipeline of construction work flowing if a cliff edge drop off in work and economic activity is to be avoided in the Autumn / winter of 2020/21.

These are unprecedented and uncertain times and each day is bringing more news, increased uncertainty and making it increasingly difficult to operate business as usual. MPANI has been updating Members on a daily basis keeping the Industry informed and sharing good information as we receive it. We continue to seek clear, concise and useful advice from the NI Executive and the UK Government to help you navigate your way through this period. We have also been engaging with accreditation and awarding bodies to ensure that members and employees are not inconvenienced due to the impact of COVID-19 particularly in cases where training, assessments and audit deadlines run out during this period of unprecedented difficulty and challenge.

Away from the COVID 19 Emergency our other challenges haven't gone away. Brexit is done and we have a new working Assembly and Executive which at least, albeit it is early days, gives business here some certainty on the way forward.

Since the Withdrawal Agreement in 2019 and the General Election, the NI Business Community has continued to lead and have come together in an unprecedented way to ensure the best possible outcomes for NI ensuring unfettered access and equality for NI business in the UK Internal Market. As the withdrawal agreement passed through the House of Commons, then to the Lords and back to the House

THE HIGHER PRIORITY DEPARTMENTS FOR MPANI ARE:

Department for Infrastructure
Minister Nichola Mallon (SDLP)

Our priorities with Nichola will be to keep her informed of our MPANI objectives:

- Adequate funding for the maintenance of roads, water and sewerage infrastructure.
- A Mineral Planning review and the need for the establishment of an NI Minerals Forum.
- Delivery of outstanding infrastructure projects like the A5, York Street Junction and completion of the Strategic Roads Network.
- Making a positive decision on Lough Neagh Sand extraction.
- Procurement processes that support responsible operators

Department for the Economy
Diane Dodds (DUP)

Our priorities with Diane will be:

- Working with her officials in HSENI, Invest NI, GSNI and Minerals Branch to highlight the importance of our Industry to the wider economy within the Executive.
- Setting up a NI Minerals Strategy and Forum.
- Assisting in developing an Energy Strategy for NI and securing assistance for our Industry as we transition to a low carbon and eventually zero carbon economy.

Department for Agriculture Environment and Rural Affairs
Edwin Poots (DUP)

Our priorities with Edwin and his Department will be:

Better awareness from his officials within NIEA about our Industry and the needs of our Industry particularly ensuring speedy responses as a consultee to planning applications, developing strong relationships and compliance support in regards to air emissions, water management, biodiversity and responsible sourcing.

Promoting our "Good Neighbour Scheme".

Working to protect our supply of materials to the Farming and Agriculture.

Department of Finance
Conor Murphy (Sinn Fein)

Our priorities with Conor will be:

- Ensuring adequate investment in our infrastructure.
- Creation of multi-year budgets thus creating better planned investment.
- The devolution of Aggregates Levy to NI and ensuring a fair and transparent policing of the levy.
- Centralised delivery unit for major infrastructure projects.
- Fair, transparent and effective construction procurement process.

of Commons, the NI Business Group, in which I, on behalf of MPANI Members have played an active role, has come together with all of the NI MPs and Lords to support agreed amendments to the Bill in order to protect NI Businesses and Consumers. The Withdrawal Agreement and the NI Protocol is now a fact of life and negotiations between the UK and EU are ongoing to agree a comprehensive trade deal. From an NI Business point of view the work goes on, and indeed intensifies, to ensure that the interests and needs of the NI Economy and consumers are protected.

To be prosperous NI business needs a level playing field with the rest of the UK which includes unfettered access. The integrity of NI as part of the UK internal market is critical to our economic success. The PM and the Conservative manifesto said that there would be no disadvantage to NI and we would like that commitment from HMG and an explanation how to do that. There should be no additional costs on the NI private sector or consumer as a result of the implementation of the NI Protocol. The NI Business Group has been making it clear to HMG, MPs and Lords that friction and delays on trade either way will have huge implications for the just in time supply chain and for consumer choice and affordability. The NI ask is Derogation, Mitigation, Legislation from Government to support and protect trade and supply chains.

The re-establishment of the NI Executive and Assembly has been welcomed by the NI Business Community. As an Association we are known to many of the Ministers and have worked with them before. Obviously we work closer with some Departments than others. In January of this year MPANI published our Priorities for Government Paper that was widely circulated to decision makers and Politicians. In the paper we make a strong commitment as an Industry to do our bit to achieve zero carbon emissions by 2050. This is by no means an easy task but one that the Mineral Products Industry must commit to as we take this energy transition journey. Given the clear evidence from around the world, but mainly in the polar and equatorial regions, showing the impact of climate change the argument for doing nothing has long since passed. The ever-increasing speed of change of technology means we are at the beginning of a new Industrial Revolution driven by energy transition that will undoubtedly transform many traditional industries such as minerals and the manufacture of construction materials. The technology is now available and developing that will mean many industrial operations, including quarrying, can become energy independent and carbon neutral by using renewable wind not only to power its day time operations but then to use the wind energy at night to manufacture and store its own hydrogen energy by having an electrolyser on site. This on site produced energy can then be used to not only fuel other on site operations and mobile plant but also any transport fleet used to supply materials to customers. To those of you who are understandably sceptical I would say this, given the growing momentum of the calls for climate emergency and a zero carbon future from Governments, Local Councils, many renowned scientists and our young people, to ignore and not take this energy transition journey will leave you behind and potentially out of business.

2019 was a very busy year all round for MPANI and our Committees. Our Health and Safety Committee focus was very much on the "fatal 6" and a number of local Committee members played an active role in the fatal 6 working groups. The outcomes from these working groups have been impressive with the development of guidance for members such as LOTOTO for best practice in lock off and isolation, Guidance booklet on Vehicle & Pedestrian Management and Guidance on Machinery Guarding.

Across the UK and NI our work in keeping the public safe around cold water has continued through our annual Stay Safe campaign. Impressive collaborative work among our Member Companies has been done on Mental Health and on Managing Dust.

MPANI has also made significant progress on Planning through our work with all 11 Local Councils as part of Local Development Plan process. The coming together of local members with local council planners during our meeting to discuss the Draft Plan Strategies has created a greater understanding and the need for a joined up approach and partnership to ensure that locally we have the materials safeguarding, local supply and demand information to ensure as a local economy we have the resources we need to develop and maintain our infrastructure in the future.

Our product groups in Concrete and Highway Maintenance have been very busy also. Our Concrete

Development Group continued its work to ensure all suppliers in Northern Ireland are quality assured and we continue to push customers and clients to monitor the quality assurance of the construction materials they purchase. The MPANI Concrete Development Group, in partnership with the Concrete Society and MPQC held a number of training events throughout the year. We continued to promote concrete and masonry construction through our attendance at the annual Building Control Fire Safety Conference and by promoting the excellent information resources availability through MPA Concrete Centre. An important promotional resource will be the new UK Concrete Group and already its presence and influence in the Industry and on social media is being recognised and being seen as a challenge to our Industry competitors particularly timber.

Our Highway Maintenance and Construction Group again worked closely together through our MPANI/ DfI safety group and a number of social media initiatives to ensure road worker and road user safety. Throughout the year we worked closely with DfI Roads and Rivers officials to ensure adequate funding and delivery of road maintenance activities across Northern Ireland.

Our Lough Neagh Sand Traders continued their work to ensure a positive resolution to long term viability of sand extraction from Lough Neagh. We now await final permission from DfI for future sand extraction, all be it under strict planning conditions, and following a positive statement by the Planning Appeals Commission.

I am sure we all agree the most important resource we have is our people. However, those great people are getting older and we need to replace them at some stage. MPANI through our work with CITB, IAT, IoQ, Concrete Society and CIHT has and will continue to pull our resources together to promote careers in our great Industry for young people with the right attitude and work ethic. In late 2019 and early 2020 we have again been out and about speaking with Years 10,11 and 12 students about the importance of our industry and the great careers within it. We will hopefully resume this important work later in 2020 when the COVID 19 emergency is over. MPANI are currently carrying out an age profiling of the industry that will show us where we stand at present and if there has been any reduction in age profile since we began the survey in 2015. Importantly this year we have also asked members to list numbers of women working in their companies so we can benchmark what progress we need in making our industry more diverse.

It gives me great pleasure to congratulate Simon McDowell, Kilwaughter Minerals, on his appointment as MPANI Chairman for the next 2 years and indeed to Paul Brogan, Director at McQuillan Companies as he takes up his role as Vice Chairman of the MPANI and our leadership team.

May I wish IMQS and all Members well over the coming months and we look forward to sustaining our valued and important relationship through what are unprecedented times creating significant challenges for everyone.

Gordon Best
Regional Director MPANI

Activities of the Irish Mine Rescue Committee 2019-2020

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

All Ireland Mine Rescue Competition

2019 saw the return of the All Ireland Competition which was hosted by Irish Salt Mining and Exploration (ISME) at their Kilroot Mine. 3 teams took part representing ISME, Dalradian and Boliden Tara Mines. The teams responded to a simulated event underground that put their emergency response skills to the test.

The exercise was setup by the IMRC and was judged by Senior Inspector Pat Griffin from the HSA, HM Inspector Kevin Wilson from the HSE, and other UK mine rescue and St. John Ambulance representatives.

The home team from ISME were the winners on the day. All teams performed to a very high standard, demonstrating the high standards of training across IMRC members.

Captain Ryan Carroll prepares the winning ISME team to mask-up.

Training with the Irish Air Corps

As an aid to the Civil Power, the IMRC can call upon the Helicopter Wing of the Irish Air Corps to transport teams to other IMRC member mine sites in an emergency event requiring mutual assistance.

In June 2019, Boliden Tara Mine Rescue teams took part in a refresher training program with the Irish Air Corps. The training covered procedures for boarding the aircraft with breathing apparatus as well as inflight protocols.

2020 – A difficult year but still prepared

IMRC activities such as mutual training exercises are on hold for now but our members are taking measures to ensure emergency response is available in a safe manner. In-house training has restarted at some of the mines, taking place under each site's Covid-19 guidelines.

The 12th International Mine Rescue Competition due to be held in the USA in August has been deferred but it is hoped there will be Irish representation when the competition is rescheduled.

Despite the pandemic, mine rescue response across the island of Ireland remains in place.

Irish Mine Rescue Committee

Boliden Tara Mine Rescue disembarking the aircraft after a short flight.

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Update from the Irish Concrete Federation

by Gerry Farrell, Chief Executive of the Irish Concrete Federation

I would like to thank the Irish Mining and Quarrying Society for the opportunity to contribute to its Annual Review. In particular, I thank the Executive Secretary, Andrew Gaynor for the Society's regular support for ICF activities and events throughout the past year.

Happily, IMQS Past President and Council member Siobhan Tinnelly has kindly given me 'free rein' to decide upon the topic of my contribution to a review of this extraordinary year. The adage of "a week is a long time in politics" comes to mind when trying to encapsulate the last nine months in our industry and indeed, our country.

Similarly, I am sure that many of the contributors to this year's Annual Review may well have had to redraft their original contributions based on the events since March when few among us had the slightest idea of the scale of the tsunami that lay ahead both in our personal and business lives. At this stage there is little point in repeating what we already know. However, it seems to me that the virus was at the very least, a not so gentle reminder that we are all human and perhaps not as indestructible as we sometimes might believe we are.

I would like to highlight one word which has taken on an additional meaning for us this year - this word is 'essential'. Whether it was the uncanny foresight of our Planning & Environment Committee late last year when we launched our policy paper "Essential Aggregates – Providing for Ireland's Needs to 2040" or just mere coincidence, the fact is that if ever proof was needed that this industry provides an essential service in modern society, we got it in 2020.

While many industries legitimately claim that their industries are strategically important, coronavirus has clearly demonstrated the reality that society needs basic raw materials as evidenced by the extent to which our industry was called upon, with the support of suppliers, employees and customers to supply essential works to meet vital societal needs while most of society and business was shut down.

Despite society's reliance on essential aggregates and aggregate based products, the reality remains that few among policy makers and the general public make the link between the sustainable supply of aggregates and the provision of the built environment upon which society depends. Continuous supply is often assumed and rarely considered or questioned.

(L-R) Gerry Farrell – ICF, Caroline Quinn – Concast Precast and Minister Sean Canney TD.

"Essential Aggregates - Providing for Ireland's Needs to 2040" which was launched by the former Minister for Natural Resources, Sean Canney calls for a national aggregates planning policy to identify and protect our strategic natural resources of aggregates and to enable their use in a sustainable manner. The report proposes a range of recommendations for Government to build upon the recognition of the industry's role as outlined in the National Planning Framework of "Project Ireland 2040".

(L-R) Jim Holmes,Inspector Health & Safety Authority, Dr Sharon McGuinness, CEO Health & Safety Authority and Gerry Farrell – ICF.

However, it is not all down to government. Industry itself has a role to play in meeting its environmental and social responsibilities. Similarly, the regulatory enforcement and procurement functions of the state must ensure that only authorised operators supply the marketplace in order to underpin the community's support for their local quarries and concrete manufacturers on whom the provision of local social infrastructure depends.

With the memory of the recession of a decade ago still vivid, it is understandable that our industry held great fears on the likelihood of a similar type collapse in demand arising from COVID-19. To date this has thankfully proven not to be the case as, the seven-week shutdown period aside, demand for quarry-based products has been strong since May. At time of writing in late October, our industry is still actively supplying customers throughout Ireland as Level 5 restrictions are in place.

Budget 2021 has earmarked over €10bn for capital expenditure and while it is still too

early to say what the longer term holds, it is clear that our members will again be essential in maintaining employment and facilitating investment in our country's public infrastructure next year.

Indeed, we are thankful that our sector is not suffering the same fate as those in the hospitality and tourism sector whose livelihoods have been severely threatened. However, being an essential service is not simply about being permitted to continue to operate. It is a privilege and bestows a responsibility on all producers to continue to supply products and services by the safest means possible and to adopt any measure required to protect themselves, their families and the wider community.

Behind the production and delivery of essential products and services is a skilled and committed workforce. While COVID-19 has undoubtedly shaped our working lives since March, other safety concerns in our industry have not magically disappeared, a fact brought home tragically to us all in recent times by a fatal accident in our industry.

This is a stark reminder to all of us that we work in a sector with many dangers and the ICF's vibrant safety committee will continue to work with members and the Health & Safety Authority to raise the bar in safety from quarrying to ready mixed concrete and precast concrete manufacturing in the years ahead.

(L-R) Gerry Farrell, ICF and Dr Sharon McGuinness, CEO Health & Safety Authority.

In conclusion, I would like to congratulate all involved in producing this Annual Review and to wish all readers a safe and prosperous remainder of 2020 as we meet and overcome ongoing challenges and look forward to brighter times ahead.

How Can Mentors Help Shape Quarrying's Future?

by Julian Smallshaw, Head of Education and Standards at the Institute of Quarrying

Understanding what differentiates a mentor from a coach is key to unlocking the latent resource that lies buried within the existing mineral products workforce. That's according to Julian Smallshaw, Head of Education and Standards at the Institute of Quarrying (IQ).

The Institute of Quarrying is the industry body which champions the continuing professional development of quarry workers. The Personal Effectiveness segment of the IQ Skills Wheel explores how to evaluate personal strengths and weaknesses in order to develop individual career pathways. Mentoring is an important aspect of personal development for both the mentor and the mentee.

Julian explains: "A business mentor has first-hand experience of the mentee's line of work. Whereas a business coach doesn't need hands-on experience of the kind of work the coachee is engaged in. So in quarrying, we have an army of potential mentors who have years of experience quite literally at the rock face.

"Whilst many have seen the ageing demographic of our sector's workforce as a negative, the experience and expertise accumulated over a lifetime in quarrying is priceless. That's because mentoring is a long-term process based on mutual trust and respect. It's more focused on creating an informal association between the mentor and mentee, whereas coaching follows a more structured and formal approach."

A mentor at it's simplest is someone who offers their knowledge, expertise and advice to those with less experience. It's by leveraging experience and skills that mentors guide mentees in the right direction. A mentor helps mentees consider opportunities for career growth, gain confidence and improve interpersonal skills. The support is based on the mentor's own experiences and learnings, which makes them more reliable figures in the eyes of the mentees.

Making the most of experience

IQ is introducing formal mentoring techniques to the quarrying industry as part of a contribution to modernising methods of working with, and through, people. That is designed to utilise skills that enable the industry to match the changes in a modern environment.

Julian Smallshaw explains: "Mentoring is seen as a practical technique that operates both in isolation to and in conjunction with coaching as a modern approach to business leadership and management. Much can be learned as a theoretical background to what is, essentially, a practical skill, but there is no substitute for opportunities to learn practically with and from experienced practitioners.

"In other words, that's making the most of the people who have spent their careers learning first-hand what it takes to carve out a successful career in quarrying. Many professionals are already involved in mentoring without even knowing it, so it's our goal to tap into this wealth of resource. We also want to provide recognition to those who share their experience, rewarding them for their personal investment in improving opportunities for colleagues."

The Institute of Quarrying has already delivered a pilot mentoring workshop aimed at enabling mentors to mentor mentees. Further full-day workshops are planned for 2020. Julian Smallshaw concludes: "Every business wants to see productivity improved. Mentoring fulfils a positive contribution to developing a modern culture in the industry, as well as enhancing operational and personal effectiveness."

For further information visit www.quarrying.org

IQ mentoring programmes help to develop future industry leaders.

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Dalradian - Business and the Community

by Ciarán McCreanor, Community Relations Organiser

The economic contractions of the COVID-19 pandemic have, from a business perspective, exceeded those of the global recession of the early 2000's, impacting on all sectors including some of the world's biggest employers. The global COVID-19 pandemic has forever changed our experiences – as employees, customers and citizens – and our attitudes and behaviours are changing as a result.

A shockwave has been felt through society and disrupted much of what we consider to be normal. This has impacted business, charities and community groups alike, posing new and daunting challenges for many.

Businesses have made many adjustments, operationally and otherwise. For Dalradian, which is proposing to develop an underground gold-silver-copper mine in Tyrone, this response has included a more proactive approach to community support. Focus has been placed on our people, customers and suppliers, and orchestrating responses to supply chain disruption as felt by our colleagues in the frontline services.

Dalradian received a massive response to the early opening of its Community Fund, which prioritized organisations who were assisting the vulnerable or responding to Covid-19, but who were finding it difficult to fundraise due to the lockdown restrictions. The company also reshaped its business to align with a changing demand in society. Specifically, it recognised the strain placed on the care sector and acted. The shortage of Personal Protective Equipment (PPE) supplies – masks, visors, gloves, medical grade sanitiser and decanting bottles - across the care sector was extremely serious and widely reported.

Recognising that care homes needed a reliable local supply of PPE, Dalradian worked closely with fellow companies in the region to help identify or initiate new supply chains. Dalradian then funded and distributed these supplies at no cost to care homes. With the additional stress placed on the health service, the local Marie Curie issued an emergency appeal to help with running costs. Dalradian responded to this appeal by donating £50,000. The company also supplied Marie Curie nurses with 150 litres of hand sanitiser produced by Ion Distillery, linking the charity with a local business and further strengthening their supply chain.

Peter McKenna, Community Relations Manager at Dalradian Gold, presents £50,000.00 donation and 150 litres of hand sanitiser, produced by Íon Distillery, to Marie Curie.

Dalradian, in conjunction with partner groups and organisations, have succeeded in initiating supply lines using local suppliers for the provision of high-grade medical sanitiser, decanting bottles, gloves, masks and visors. Once sourced and procured locally, these can then be supplied at no cost to those who need it most. This constant supply line has alleviated concerns regarding either the purchase or supply of these materials, and most importantly has allowed Care Home and other frontline staff to do what they do best – providing the very highest level of service, care and comfort to our clients and their families in a time of real need.

Additionally, Dalradian also repurposed their own multi-purpose transport vehicle, and have secured rental on a similar vehicle, which is now at the full-time disposal of various health centres in the Tyrone and Fermanagh region. Driven by Dalradian staff, this enables the safe and controlled transport of frontline medical personnel to families who are shielding at home.

Coordinating the Dalradian response to the pandemic and helping to establish the local supply chain for the homes were Eugene Donnelly, Senior Geological Technician, and Ciaran McCreanor, Community Relations Organiser.

Eugene explained, "As the coronavirus outbreak began to unfold it soon became clear that there was a severe shortage of PPE in many local care homes.

"While we were unable to manufacture PPE for the homes ourselves, Dalradian

felt that we had an important role to play in connecting local manufacturers of PPE with care providers. Because our work activities were restricted, we had the manpower to deliver the PPE directly to hard-working frontline staff. Those of us who were making the deliveries had many heart-warming responses– making it all worthwhile!"

Continuing this theme of a new direction for Dalradian, Ciaran explained, "We worked closely with suppliers and distributors throughout the North West and Mid Ulster areas, to ensure that PPE manufactured by local companies benefitted care homes in the community. Knowing how some of these companies were struggling to remain in business and sustain employment was an extra incentive to help. This enabled us to maintain our commitment to boosting the local economy and develop new connections in the community. At present we are supplying in excess of 100 frontline establishments across the region and have received many, many messages of thanks. That reflects the agility and commitment of suppliers and the business community in general, and we're very grateful for their help."

Eugene Donnelly of Dalradian Gold delivering a supply of hand sanitiser to staff at Omagh Hospital and Primary Care Complex.

Dalradian welcomes public inquiry - Project reaches planning milestone

Earlier this summer, the Minister for Infrastructure, Nichola Mallon, announced her intention to refer Dalradian's planning application for an environmentally responsible mine to a public inquiry.

This is a welcome development that will offer another forum for the public to engage with the facts of the project and provide further independent scrutiny. The detail required by Northern Ireland's planning system for this regionally significant project is – quite rightly – meticulous. It has taken the best part of a decade to research and develop the project and progress the planning application.

The application was submitted in 2017 with further environmental information provided last year. The application includes a series of detailed reports looking at issues such as the environment, the economy, health, habitats and transport.

The planning process also requires ongoing engagement with the authorities to provide clarification and further information. So far, we've held around 100 meetings with a wide range of consultees such as the Public Health Agency, the Health & Safety Executive and the agencies responsible for environment, economy, roads and rivers.

Following the submission of further information last year, the majority of statutory consultees have now responded and no major issues with respect to human health, tourism or the environment have been raised. These responses are available on the Northern Ireland Planning Portal.

Robust Scrutiny

The purpose of the public inquiry, according to Minister Mallon, is to "allow for robust scrutiny of the application in a public forum".

We are confident that we have designed a world-class project which will bring economic and community benefits to the region – including some 1,000 direct and indirect jobs - whilst using modern technology and design that meets or exceeds Northern Ireland's strict environmental standards.

Ultimately, however, it is for the planning system to test whether the project meets the exacting standards demanded of it and the public inquiry is a key part of the process. We expect that the application will be referred to the Planning Appeals Commission for a public inquiry this year with a final decision being made in 2021.

Ireland - Think Zinc

by Brendan Morris, Managing Director, LTMS Limited

Zinc is a very important part of our lives particularly as a mineral for the body and in industry. Zinc is the fourth most common mineral resource to be mined worldwide.

In the body it plays main roles in the cell-mediated immunity, bone formation, tissue growth, brain function and growth of the foetus and child. Our bodies do not naturally produce zinc, so we need to ingest it in some form and normally do this through food products and supplements.

In industry, zinc is used in steel production, manufacturing and construction. Zinc is most commonly used to galvanize other metals: galvanizing is an industrial process in which metals such as iron or steel are covered with molten zinc in order to create a protective coating that prevents rusting. Automobile body parts and bridges are two common uses of galvanized steel. Zinc alloys and zinc compounds have several common uses. Zinc alloys are made of combinations of zinc and other metals.

Zinc compounds are formed when zinc combines with other elements and compounds. Brass is an example of a zinc alloy that is formed when zinc combines with copper. A wide array of items including pipe fittings, jewellery, and musical instruments such as tubas are made from brass. Two examples of zinc compounds are zinc oxide and zinc sulphide. Zinc oxide is used to make various products including make-up, rubber, and prescription drugs. Zinc sulphide can be found in x-ray equipment, fluorescent lighting products, and different kinds of paints.

Sphalerite (zinc sulphide) from Galmoy Mine.

Zinc batteries have been used for many years because zinc is an ideal energy source. There are several different types of zinc batteries including zinc-carbon, zinc-chloride, zinc-air batteries, and zinc-alkaline. Zinc-carbon and zinc-chloride batteries are often used for household items such as electronics, flashlights, and toys. Two main advantages of zinc-chloride batteries are that they last longer and have a more consistent voltage output than zinc-carbon batteries.

Zinc is a chemical element with the symbol Zn and atomic number 30.

Lisheen Mine – prior to closure.

Zinc is a slightly brittle metal at room temperature and has a blue-silvery appearance when oxidation is removed. It is the first element in group 12 of the periodic table and is the 24th most abundant element in Earth's crust. The most common zinc ore is sphalerite, a zinc sulphide mineral. The largest zinc reserves are in Australia, Asia, and the United States.

Ireland has in the past and the present been home to very successful zinc mines and is a very prospective country for zinc and produces 25% of Europe's total zinc production. Both the grade and quality of Irish zinc is extremely high in comparison to many other zinc prospective areas.

Ireland has a long history of zinc mining with recent operations such as Tara, Lisheen, Galmoy, Tynagh, and Silvermines. Ireland has attracted major zinc producers such as Boliden, Glencore and Teck who are currently active, and in the past Anglo American, Lundin and Vedanta. Along with this there are currently several exploration companies active in the search for the next zinc mine.

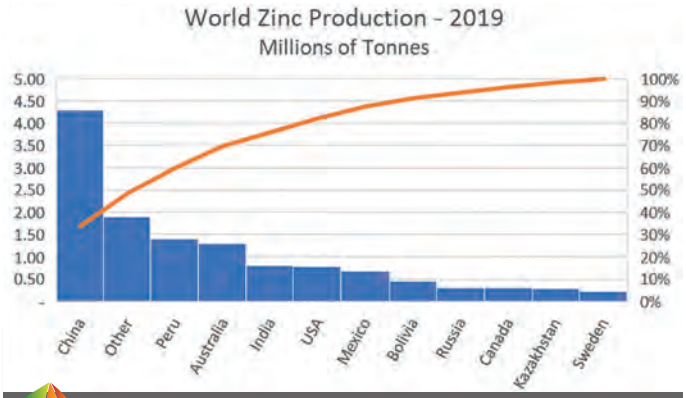
Zinc Production

Global zinc mine production in 2019 was estimated to be 13 million tonnes. The largest producers are China (34%), Peru (11%), Australia (10%), United States (6%), India (6%), and Mexico (5%), with Australia having the largest reserves. Zinc ore grades in mining normally range from 2% (very low grade) to 25% (very high grade), averaging 4-8%.

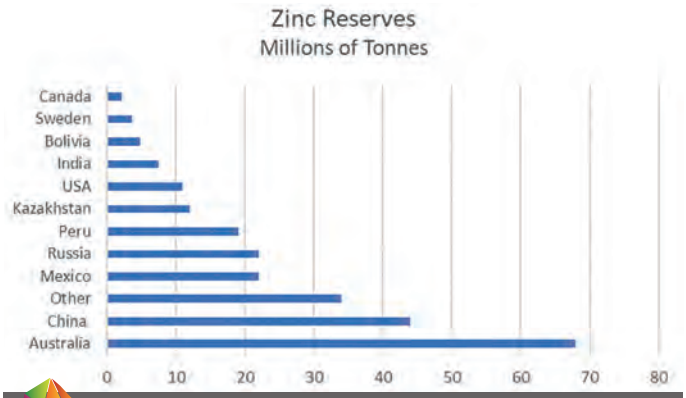
Zinc deposits have been exploited for thousands of years, with the oldest known zinc mine, located in Rajasthan, India, established nearly 2000 years ago. Interestingly, Hindustan Zinc Limited, based in Rajasthan, a subsidiary of Vedanta Resources (owners of the Lisheen mine in Ireland) is the second largest zinc-lead producer in the world.

Pure zinc production occurred in the 9th century and prior to that zinc was primarily utilised as an alloy of copper to produce brass. This was because the isolation of zinc metal from its ore was very challenging. Metallic zinc smelting started in the 9th century in India, followed soon by China 300 years later, and in Europe in 1738.

Lead and zinc are almost always associated in mineral deposits, so mines



Global Zinc Production Chart (Ireland produced approximately 122,000 tonnes of zinc in 2019).



Global Zinc Reserves Chart.

that produce zinc also produce smaller amounts of lead and vice versa. In 2019, 4.7 million tonnes of lead were produced at world level along with 13.4 million tonnes of zinc. According to the United States Geological Survey, there are more than 200 million tonnes of identified zinc ore reserves and 1.9 billion tonnes of identified zinc resources.

There is limited data on the average zinc grade in orebodies, but it is reasonable to assume that it is between 4-8% combined grade of zinc and lead as they are normally mined together. A high-grade zinc mine will have grades above 12%.

In basic terms, the grade is the percentage of zinc within the orebody, e.g. 6% zinc grade means that for every tonne (1,000kg) of ore, there is 60kg of zinc within the rock.

The ore is mined and normally processed onsite, where the zinc is liberated from the ore and a zinc concentrate is produced, normally in the region of 50-70%. Zinc concentrate is then transported to a smelter, where the zinc is extracted to approximately 99% pure zinc, which is then sold to industry.

Lead and zinc ores are mined mostly by underground operations as the most common form of mineralization are veins where an association of different minerals can be found. In general, lead and zinc ores are processed with differential froth flotation to produce separate lead and zinc concentrates, which are then smelted.

Zinc concentrates are most commonly refined using hydrometallurgy, although some 15%–20% of world zinc production is derived through pyrometallurgical techniques.

Zinc Reserves and Resources

A Mineral Reserve is the economically mineable part of a Mineral Resource and can only be defined following significant exploration, engineering, environmental and economic analysis. It includes diluting materials and allowances for losses, which may occur when the material is mined or extracted and is defined by studies at Pre-Feasibility or Feasibility level.

Globally there are significant reserves of zinc with approximately 250 million tonnes of zinc defined,

with Australia holding the largest share with almost 70 million tonnes. The global reserve would currently maintain supply at current rates for around 18 years, but there are also significant zinc mineral resources available which have the potential to be upgraded to reserves.

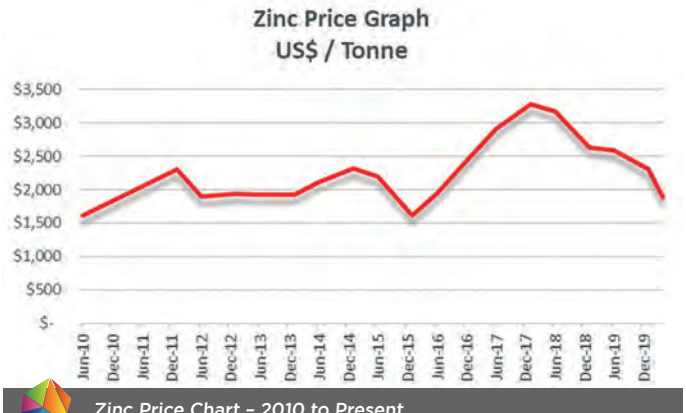
A Mineral Resource is a concentration or occurrence of solid material of economic interest in or on the Earth's crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction. Currently, the identified zinc resources of the world are approximately 1.9 billion tonnes. Advanced exploration of mineral resources may allow the resource to become a reserve if the volume, grade, continuity and other factors are favourable.

Australia has the largest zinc reserve with 68 Million tonnes and China is second with 44 Million tonnes. On the graph below Canada is in 11th place at 2.2 million tonnes, while Ireland has approximately 1.1 million tonnes and is included in the 'other' section.

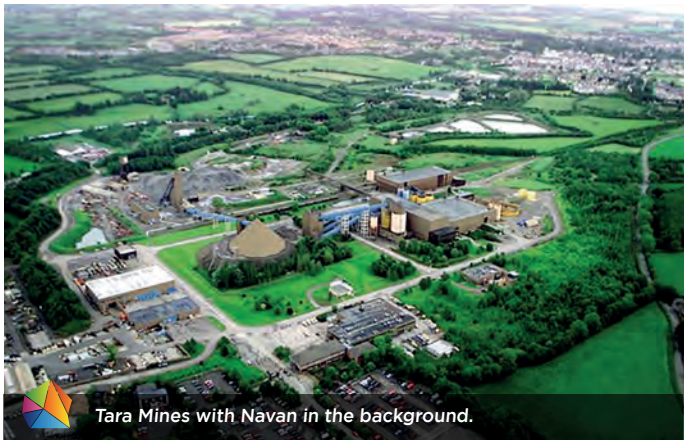
Uses of Zinc

As a base metal, zinc is a strong indicator of economic growth and as economies grow, the demand for zinc also grows. Increasing demand causes prices to increase and the price of zinc at any time is a function of demand, current global stockpile levels and prospective supply from existing and future mines.

The primary modern use for zinc is for coating iron and steel in order to prevent its corrosion (galvanising), with nearly 50% of worldwide zinc production going towards that purpose. Approximately 20% of the world's zinc is used in the production of brass, where zinc is alloyed with copper in between ratios of 20-40% zinc.



Zinc Price Chart – 2010 to Present.



Tara Mines with Navan in the background.

Of the remaining 30%, half is used in the production of other zinc alloys, where zinc is combined with varying amounts of aluminium, and magnesium. The remaining zinc is used in various other industries from agriculture as a fertilizer and human consumption as a supplement.

It is estimated that every human will need 330kg of zinc in their lifetime.

Interesting Facts about Zinc

- Research shows that zinc acetate lozenges can shorten the duration of a cold by up to 40%.
- Zinc oxide is used in sunscreens as it scatters UV light.
- Zinc is often used in skin creams for treating rashes and irritations.
- Studies show that poor zinc intake may be a risk factor in low quality of sperm and male infertility.
- Zinc is present in many foods such as oysters, egg yolk, lamb, beef, chicken and peanuts.

Zinc Price

At the time of writing this article in April 2020, the price of zinc is being challenged by the effects of the global pandemic, with the current price at $1,900 per tonne. Prices in the last two years have been falling from the high of February 2018, where the price of $3,500/t was at the highest point since 2006. Any longterm fall below €1,800/t will often be a challenge to higher cost mining companies.

Exploration and Mining of Zinc in Ireland

Ireland has a long history of zinc with small and medium sized mines operating over the last few centuries. In recent times, Boliden - Tara Mines has been producing zinc and lead since the mid-1970s and Galmoy and Lisheen mines operated in counties Kilkenny and Tipperary produced zinc from the late 1990s to the mid-2010s. When all three were producing, Ireland was the largest zinc producer in Europe.

Steel Galvanising with Zinc.

Ireland is an established zinc jurisdiction and has attracted significant interest from exploration companies, as it is very prospective but somewhat underexplored. The zinc ore found in Ireland is often high grade, easily processed, and has the benefits of a highly skilled population, good infrastructure and good access to European smelters. In addition, there are government systems which allow exploration and mining companies to easily navigate the Irish system.

While Ireland is highly regarded for investment, it also has very high standards which must be met for exploration, planning/permitting, operations and closure/aftercare. All prospecting and exploration activities are regulated and licenced by the Exploration and Mining Division of the Department of Communications, Climate Action and Environment.

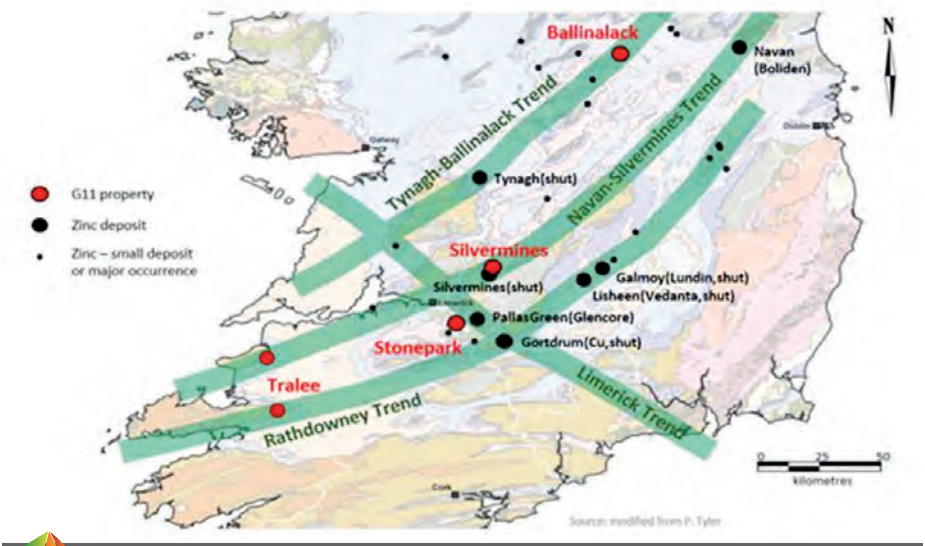
From a geological perspective, there are a number of geological trends where zinc is present, such as the Tynagh-Ballinalack Trend, Navan Silvermines Trend and the Rathdowney Trend, all of which have had associated mines and strong exploration prospects.

Some current zinc exploration projects in Ireland include:

- Boliden Tara Mines – Tara Deeps Extension
- Glencore – Pallas Green
- Group Eleven – Ballinalack and Stonepark
- Zinc of Ireland – Kildare Project
- Erris Resources – Abbeytown
- Arkle Resources – Stonepark
- Hannan Metals - Kilbricken

Ireland has in recent years been ranked very highly by Canada's Fraser Institute Annual Mining Survey for both Mining Investment Attractiveness and Policy Perception.

Following successful exploration projects, any potential new mine operator must apply for a Planning Permission (An Bord Pleanala & local Council), a Mining Permit (Department of Communications, Climate Action and Environment (DCCAE)) and an Integrated Pollution Control Licence (Environmental Protection Agency (EPA)). All of the application processes ensure that all aspects of potential new mines



Zinc map of Ireland.

are studied, well understood and the permitted with appropriate conditions. It also allows local communities and special interest groups to make submissions and objections at key stages of the application process. At the end of the process, all stakeholders will have had the opportunity to be heard and the authorities can then make the appropriates decisions.

Biannual mining inspections are made by mining consultants engaged by DCCAE. Mine Inspectors from the Health and Safety Authority regularly check each mine for compliance with the Statutory Instruments, such as Safety, Health and Welfare at Work (Mines) Regulations 2018. The EPA carry out routine inspections of mines and address any complaints or submissions by local stakeholders. The Department of Justice are responsible for storage and management of explosives on mine sites and carry out regular inspections. An Garda Siochana are responsible for the safe transportation of explosives to each mine site.

All of the agencies above work closely with mine owners to ensure that operations are carried out safely and to best operational, social and environmental standards and in compliance with Irish legislation.

Mining for zinc in Ireland is currently only carried out at Tara Mines in County Meath. Tara is the largest zinc mine in Europe and the eight largest in the world. The mine has been operating since 1977 and currently operates at 2.6M tonnes of ore per annum, producing more than 200,000 tonnes of zinc.

The mine has had ongoing exploration programmes and is now focussing on development of the Tara Deeps section of the mine, which is at approximately 1,400m below surface. The mine employs 590 people and brings significant additional employment to the area along with being a customer for many service providers and suppliers.

The next potential zinc mine in Ireland is the re-opening of the Galmoy mine, by an Irish company, Shanoon Resources, who have identified an economic zinc reserve. Shanoon are currently engaged in the planning process and the re-opening of the mine would offer significant benefits locally, where there is already a skilled mining workforce in place from both the Galmoy and Lisheen mines. The life of mine is expected to be seven years with the potential for further exploration to extend the life of the mine.

In recent years, the Lisheen mine operated from 1999 to 2015 when the resource was depleted. The mine operated at 1.5M tonnes per annum and produced 150,000 of zinc each year.

The Galmoy mine operated from the late 1990s until 2014 and at peak production it operated at 800,000 tonnes per annum. Both Lisheen and Galmoy mines were high grade mines producing both zinc and lead.

Zinc is one of the most important minerals to be mined globally and has many uses, including human health and many areas of industry. Ireland has great potential to be a global leader in the production of zinc and with the benefit of positive exploration results, Ireland may have new zinc mine operations in the next few years.

Brendan Morris is the Managing Director of LTMS Limited (Lisheen Technical and Mining Services), a company established following the closure of the Lisheen mine to provide mining services and training. Brendan is a Chartered Mining Engineer and has been engaged in the mining and quarrying industries, globally, since 1979. Brendan is a Past President of the IMQS.

The Sustainable Underground Mining Project at LKAB

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

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 Sandvik 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.

Work in year 2 of the SUM project (mid-2019 to mid-2020) has concentrated on getting the test-mine at Konsuln ready for production, developing the mine offices, and building the project team.

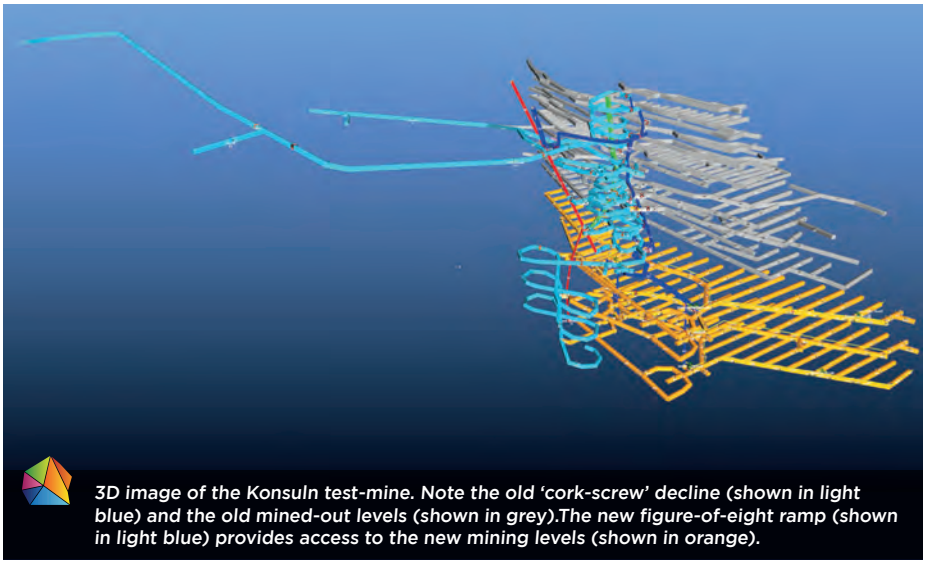
Update on progress in Konsuln test-mine

Development of the Konsuln test-mine has progressed really well in the last year.

LKAB's own development contractor LKAB Berg och Betong have been tunnelling at a rate of 420m per month. 436 Level and 486L have been completed, and the ramp has also reached its current stop position. 536 Level is under construction.

The current spacing between sub-levels in Kiruna and Malmberget mines is 30m.

Konsuln 436 Level will test sub-level caving stopes at 40m spacing, and 486 and 536 Levels will test sub-level caving stopes at 50m spacing. This test if successful has great cost benefits due to the greater amount of ore that can be extracted per metre of access development.



3D image of the Konsuln test-mine. Note the old 'cork-screw' decline (shown in light blue) and the old mined-out levels (shown in grey).The new figure-of-eight ramp (shown in light blue) provides access to the new mining levels (shown in orange).

The Epiroc Easer L. (Photo William Ekström).

Epiroc Easer L

The Easer L was delivered in summer 2019, and after a period of training started drilling test holes at the northern end of 436 Level. The purpose was to see if the machine could successfully drill 750m diameter holes to 50m depth, with the required accuracy. Trial blasts were then required to determine if 50m slot raises could be successfully opened. This phase of work has been encouraging, and the Easer L has now begun slot raise drilling at the southern end of 436 Level, where production will start in Q1 2021.

Update of progress in the test-mine offices

The project offices at the entrance to the Konsuln test-mine have been well established, with an area for the mining crews to assemble and change shift, a pulse meeting room, the Mine Operations Control (MOC), the Virtual Mine Lab, technical offices, and a conference room.

MOC (Mine Operations Control)

The MOC has been equipped with the latest control room equipment from ABB, one of the Alliance partners in SUM. The Extended Operator Workplace (EOW-i) is the centre-piece, and a Collaboration Table has also been installed. The Collaboration Table is

Konsuln test-mine offices in January 2020. (Photo Mike Lowther).

a very flexible unit that is used for round-table discussions, displays of multiple layers of information and 3-D models. It can also be used for crew-briefings.

Traditional mine control rooms are well established around the mining world. The SUM MOC is a concept of a distributed way of working as well as a physical space. The mine plan is visible to everyone in the mine, in the offices, and in remote locations in real time, enabling enhanced decision making. The right information gets to the right people at the right time. In this way the operation becomes more productive and efficient.

Covid-19

Like all mining operations the project has been affected by the Covid-19 pandemic. However, following strict guidelines from LKAB momentum has been maintained, and new ways of work have evolved. The next year promises to be extremely busy in the Sustainable Underground Mining project.

Latest news

In September 2020 Sandvik joined the SUM Alliance.

"In the coming years LKAB must have a solution in place to be able to mine iron ore at depths approaching or exceeding 2,000 metres in a cost-effective way by employing technology that is safe, autonomous, electrified, digitalized and carbon-dioxide-free. To enable this, collaboration with other leading industrial companies will be decisive. Sandvik's longstanding experience of producing underground vehicle systems will complement the ongoing work in an important way," says Jan Moström, President and CEO of LKAB.

"LKAB has used automated equipment from Sandvik for many years and we look forward to the opportunity to extend our collaboration and introduce new and advanced solutions that will set an industry standard," says Stefan Widing, President and CEO Sandvik.

Partners in SUM also include Epiroc, ABB and Combitech and the project has received funding support from the Swedish Energy Agency. The Volvo Group's earlier partnership in SUM will now take the form of other collaboration with LKAB.

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 31 billion in 2019 and employs about 4,300 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.

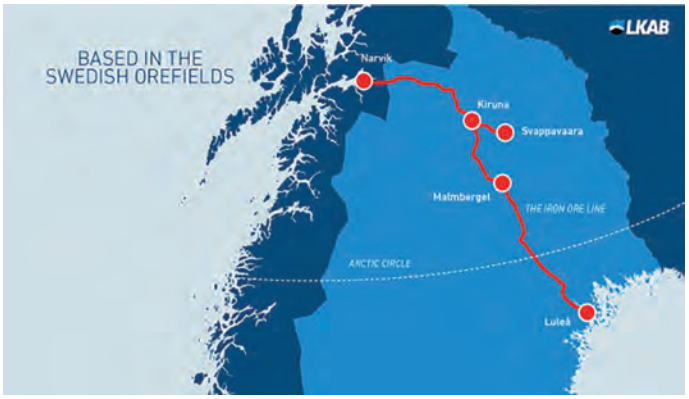
Sustainability is the core of LKAB's business, and the company's ambition is to be one of the most innovative, resource-efficient and responsible mining companies in the sector.

Websites and other links: www.lkab.com

www.sustainableundergroundmining.com

https://www.lkab.com/en/news-room/press-releases/sum-industrial-collaboration-strengthened-with-the-addition-of-a-new-partner/

The city of Kiruna and the mine site, midnight at mid-summer 2020. (Photo Mike Lowther).



Geoscience Ireland: Update on Activities

by Andrew Gaynor, Business Development Manager, Geoscience Ireland

Geoscience Ireland (GI) is the geoscience business development cluster which assists Irish companies in winning business in international markets. GI is sponsored by Geological Survey Ireland (a division of the Department of the Environment, Climate & Communications) and is supported in its ambition to win business overseas by Enterprise Ireland and the Department of Foreign Affairs.

The member companies of GI 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.

GI comprises 41 members and, since last year's IMQS Annual Review publication, has welcomed two new members including **Entrust Planning & Environmental** (a specialist consultancy service in infrastructure and energy) and **TQS Integration** (a tech company providing leading data integration and automation solutions to the mining sector).

In summer 2020, GI members reported a record **€1.23 billion** in turnover (for 2019), over 40% of which was generated in overseas markets. There was a modest **job creation figure of +51** reported for the first half of 2020; this was indeed tempered by the impacts of corona virus given domestic sites shut down for a period and international travel effectively ceased.

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.

Sean Canney TD, Minister for Natural Resources opening Ireland forum at PDAC conference, March 2020.

GI employs the 'cluster' model to engage industry, academia and government agencies in order to assist in the development of Ireland's geoscience sector. 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 connections and research agencies and institutions.

The GI initiative is led by **Sean Finlay**, Director, and business development activity is supported by **Andrew Gaynor**, Business Development Manager.

Trade Missions, Market Study Visits and participation at overseas events remain an important route to market for GI companies. Since last year's IMQS publication, GI and its members have participated on/at:

- **Mining Ireland (Oct2019)**; GI was delighted to have worked with the IMQS in delivering the 'Mining Ireland' conference which opened by then-Minister for Natural Resources, Sean Canney TD; the conferenced comprised updates from mineral exploration projects across the island of Ireland, a panel discussion focused on sustainability across the supply chain and case studies of international projects involving Irish companies.
- **The Mining Show, Dubai** (Nov2019); GI shared a pavilion with Invest Northern Ireland and was joined at the show by its members **Mincon, CDE Global** and **Aurum Exploration**.
- **Trade Mission to Kenya** (Nov2019); Enterprise Ireland and Foreign Affairs coordinated a TM led by then-Minster of Business and Enterprise, **Heather Humphreys TD**; GI member company **Designer Group** announced the opening of two offices in the region during the TM. GI travelled to neighbouring **Ethiopia** meeting with its **Minister for Mining, Dr Samuel Urkato**, and laid the ground work for a Memorandum of Understanding which was signed in autumn 2020.
- **AME Roundup, Vancouver (Jan2020)**; GI and the Irish Centre for Research in Applied Geosciences **(iCRAG)** shared an

GI presenting CDE Global with its Certificate of Membership at Dubai Mining Show, November 2019; (l-r) Dermot Reidy, Enterprise Ireland; Adam Holland, CDE Global; Ambassador Aidan Cronin and Sean Finlay, Geoscience Ireland.

Andrew Gaynor moderating panel session at the Dublin Mining Convention, December 2019.

Andrew Gaynor and Sean Finlay of GI at the Dubai Mining Show, November 2019.

Ambassador Fionnuala Gilsenan with Andrew Gaynor and the Enterprise Ireland team at the Mining INDABA conference in Cape Town, February 2020.

exhibition booth at British Colombia's premier mining show. The Irish Consulate in Vancouver hosted an Irish breakfast briefing which was attended by over 40 delegates. Several GI members were represented over the 4-day conference including **Mincon, SLR, Aurum Exploration, Golder, ERM** and IMQS corporate member **Equity Exploration**.

- **Mining INDABA, Cape Town (Feb2020)**; the INDABA is Africa's premier mining show and Ireland continues to grow its presence at the show. Ambassador Fionnuala Gilsenan and facilitated an Irish networking event and worked closely with GI and Enterprise Ireland in bringing together Irish companies including GI members **PW Group, CDE Global, PW Ghana, SLR and ERM. Priority Drilling** also participated at the show.
- **PDAC, Toronto (March2020)**; Ireland has been represented at the PDAC show for 30 years and last March saw the inaugural "Innovation and Industry" exhibition space led by iCRAG and partnered with Geoscience Ireland, Enterprise Ireland and GI companies **BRG, CDE Global and PW Group**. The Irish delegation was led by then-Minister for Natural Resources, Sean Canney TD. Other exhibitors included Aurum, Mincon, QME, Priority Drilling and the international offices of SLR, ERM and Golder. The "Ireland – Open for Business" forum welcomed updates from mineral exploration companies operating in Ireland and key stakeholders and companies.

Stephen D Walsh, Senior Market Advisor, and **Jessica Allen, Market Advisor,** provide the platform for member companies to target and track international projects and tenders. The common vision and ambition of GI and its members 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, establishing networks and access points in target markets, and joint bidding on commercial projects.

Some recent developments include:

FLI Group acquired Cadegeau – a French environmental consultancy.

ByrneLooby acquired Cuthbert Environmental – a Cork based environmental engineering company.

SLR acquired RPA Inc. – a leading mining advisory firm.

Nicholas O'Dwyer was acquired by RSK Group – an integrated environmental, engineering and technical services firm.

PW Group was acquired by BUA – a leading Nigerian conglomerate.

GI led the successful bid to the European Commission for funding of the second phase of the **Geo Energy Europe (GEE)** project. GEE is a 'super-cluster' comprising European project partners and is focussed on assisting European companies access the global supply chain for geothermal energy.

The two year project formally started in September and the project partners are based across Europe, with participants in France, Spain, Germany, Belgium, Turkey, Italy and Hungary.

The **Geo Drilling Apprenticeship** was successfully launched by Damien English TD at Tara Mines in November 2019 and is now welcoming its second intake of apprentices at the Institute of Technology Carlow; Geoscience Ireland and the IMQS are strong supporters of the programme. Stephen Walsh, its Industry Liaison, provides some insights to the apprenticeship in this publication.

Brexit remains a key consideration for GI and, indeed, the economies of both Ireland and the UK. Over 50% of GI members are active in the United Kingdom and remain concerned as to the potential impacts of Brexit. One hopeful sign is that the UK Government has reiterated its commitment to infrastructure spending and this policy has all-party support. The **Programme for Government in Ireland envisages a number of North-South infrastructure initiatives** such as upgrading the Belfast-Dublin rail line and the North-South electricity interconnector. The progression of these projects will be a key source of commissions for GI's member companies. Another is that bilateral agreements between Irish and UK professional bodies for engineers and geoscientists should ease any problems relating to mutual recognition of qualifications.

A knock-on from the uncertainty arising over Brexit has been the frequent drops in the value of the Pound Sterling versus the Euro. Tariffs and customs that may emerge for goods and products should be manageable, contingent on these tariffs being negligible in the case of Irish contractors bringing equipment to and from commissions in the United Kingdom to the Republic of Ireland and vice versa. Nevertheless, the continuing uncertainty surrounding the eventual outcome of the Brexit process is not welcomed by GI member companies and an added complication for many businesses here and in the UK.

Outlook 2020/2021 & 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. The impacts of corona virus will inevitably impact national budgets and investment decisions. GI is encouraged to see some strong government responses including supports for SMEs and its commitment to infrastructure spending programmes.

It is evident that several overseas markets have similar plans and ambitions, and we look forward to the prospect of safe and responsible travel in the future. Internationalisation and building resilient firms are key objectives of Enterprise Ireland. GI will continue to work closely with EI in engaging **International Financial Institutions** and will collaborate with EI, Dept of Finance and Dept Foreign Affairs in connecting Irish companies with the African Development Bank, the Asian Development Bank and the European Bank for Reconstruction and Development Bank in the coming months.

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

Cementing the Green Deal

A 2050 Roadmap for Carbon Neutrality along the Cement & Concrete Value Chain

by Richard Bradley, Irish Cement

On December 11th 2019 the European Commission presented the European Green Deal – 'a roadmap for making the EU's economy sustainable by turning climate and environmental challenges into opportunities across all policy areas and making the transition just and inclusive for all'.

Introducing the European Green Deal President Ursula von der Leyen said: 'The European Green Deal is our new growth strategy – for a growth that gives back more than it takes away. It shows how to transform our way of living and working, of producing and consuming so that we live healthier and make our businesses innovative. We can all be involved in the transition and we can all benefit from the opportunities. We will help our economy to be a global leader by moving first and moving fast. We are determined to succeed for the sake of this planet and life on it – for Europe's natural heritage, for biodiversity, for our forests and our seas. By showing the rest of the world how to be sustainable and competitive, we can convince other countries to move with us.'

The European Green Deal covers all sectors of the economy, notably transport, energy, agriculture, buildings, and industries such as steel, cement, information & communications technology, textiles and chemicals.

In response to the Green Deal CEMBUREAU, The European Cement Association has developed a Carbon Neutrality Roadmap, setting out its ambitious target to reach net zero emissions along the cement and concrete value chain by 2050.

5C approach

For decades the cement industry has been working steadily to reduce carbon emissions; with the focus largely on investments and improvements implemented inside the cement factory gates. On this basis the industry in Europe has already reduced emissions by 15% since 1990. Last year, in these pages, we wrote about CEMBUREAU's '5C' approach which looks at how carbon emissions can be reduced by acting at each stage of the value chain: clinker, cement, concrete, construction, and (re) carbonation. The new Roadmap 'Cementing the European Green Deal' follows the '5C' approach to achieve zero net emissions by 2050. It quantifies the role that each technology can play in providing CO2 emissions savings, and makes policy and technical recommendations that will be required to support this objective.


Kölnbrein Dam - Hydroelectric Power Station, Austria. Image credit - iStock.

2030 target

The path to carbon neutrality by 2050 requires intermediate targets. For 2030, CEMBUREAU aspires to be in line with the Paris Agreement's two degrees scenario, by reducing gross emissions across the value chain by 40%. This includes a reduction of 30% at the cement manufacturing stage.

The chart above summarises the technical pathways to achieve a 40% gross reduction in CO2 emissions compared with 1990. The technologies identified to achieve 2030 targets are well understood but significant efforts are required to ensure their widespread adoption. As is the case for the 2050 objective of carbon neutrality, this target is subject to a robust policy framework being in place which facilitates the necessary investments and the rapid implementation of these technologies.

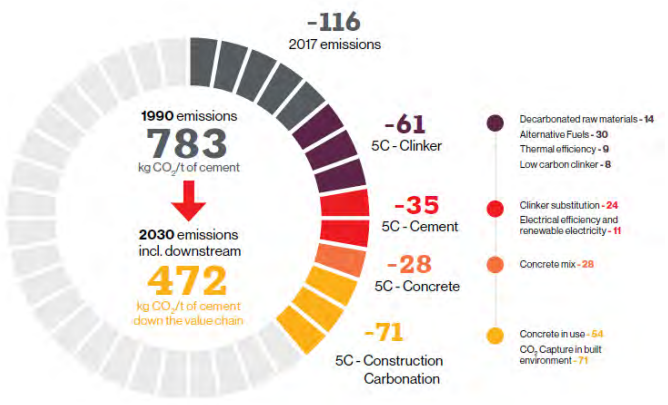
2050 – Ambition to achieve Carbon Neutrality

As we move beyond 2030 to 2050, technologies that are currently in earlier stages of development must come on stream to achieve the ambition of carbon neutrality. These technologies include Carbon Capture, Utilisation and Storage (CCUS), alternative thermal energy sources such as kiln electrification, plasma or solar heating, new types of cement, and significant improvements in concrete technology. It is also assumed that by 2050 electrical energy will be produced from renewable sources and that transport will be electrified. As is the case for other industrial processes it is expected that electrical demands will increase; for example electrical consumption at a cement plant that incorporates Carbon Capture technology is expected to double.

Developments of this scale and complexity will require enormous effort and significant investment by industry. EU investment will also be required and the European Green Deal includes a plan to mobilise €1 trillion over the next 10 years through a variety of direct and indirect measures. To enable the ambition of the sector, the CEMBUREAU Roadmap clearly

CEMBUREAU 2030 roadmap

CO_2 reductions along the cement value chain (5Cs: clinker, cement, concrete, construction, re-carbonation)



CEMBUREAU 2050 roadmap

CO_2 reductions along the cement value chain (5Cs: clinker, cement, concrete, construction, re-carbonation)

identifies the key policy supports that will be required in addition to funding mechanisms.

Concrete – Enabling Carbon Reductions in Society

In drafting the Roadmap, CEMBUREAU only considered the reduction in emissions that can be achieved by the cement, concrete and wider construction industry. It is important to underline that concrete, as a construction material, enables significant savings in carbon emissions during its use in both buildings and infrastructure.

As a heavyweight material, concrete provides thermal mass in a building, allowing the storage of energy which is later released. By incorporating this property at the design stage, the building can itself behave like a large storage heater, providing comfort for the occupants. Concrete is also the material of choice for renewable energy infrastructure and mass transport systems. These additional savings are not accounted for in this Roadmap, but will be essential if all sectors of our economy are to deliver the new Green vision for Europe.

Richard Bradley is Technical Marketing Manager with Irish Cement and is Chair of the Environmental & Technical Committee in Cement Manufacturers Ireland (CMI).

An overview of activities by the Institute of Geologists of Ireland (IGI)

by Mairéad Glennon, 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.

Dr. John Ashton receiving his IGI Medal of Honour from President Mairéad Glennon.

Activities in 2019 - 2020

Undoubtably the highlight of the last year was the IGI 20th Anniversary celebrations. Over 100 of our members gathered in the Sheraton Athlone Hotel on 11th October 2019 for a day of celebration, learning and networking. Our ten founding Board Members were honoured at the start of the day and the current Board were especially delighted to welcome Mrs. Margaret Daly who represented her late husband Eugene.

A thought-provoking and challenging series of talks were presented during the technical sessions covering topics on 'Climate Emergency and the Role of the Geoscientist' and 'Community Relations – how can we do it better'. A Networking Session and Wine Reception followed where geoscientists across all disciplines and career stages were encouraged and facilitated to make contact.

Many of our early and middle career stage members reported enjoying this session as it allowed them the opportunity to chat with our senior and retired members, particularly those from different disciplines, with whom they wouldn't normally cross paths. A Gala Dinner finished what was a most enjoyable and memorable day.

The 20th Anniversary Conference also saw the launch of the new IGI Strategy

The IGI Founding Board Members with IGI President Mairéad Glennon at the 20th Anniversary Conference.

which sets out Strategy Goals and Priority Actions for the organisation for the period 2019 – 2024.

The IGI Medal of Honour was presented to Dr. John Ashton following his retirement from Boliden Tara Mines. Dr. Ashton was chosen as a most worthy recipient of this award in recognition of his many and varied achievements throughout his career. The award ceremony took place in October 2019 and was followed by a very well attended, and much enjoyed, lecture evening in January 2020 during which John spoke about historical and recent exploration at Tara Mines, in Navan.

In March 2020 the IGI hosted a workshop on Aggregates Standards, which was very well attended by IGI members and non-members alike.

The Covid-19 public health emergency brought a sudden change to IGI activities in the Spring of 2020, but the organisation has adapted well and continues to offer support to our members during these challenging times. Whilst a small number of events have been postponed, we have continued to offer courses, workshops and lectures via the medium of Zoom.

A one-day course in May on QGIS, which was co-hosted by the GSI and presented by their GIS consultant Shane Carey, was incredibly popular with a waiting list longer than the number of places available at the event itself! Dr. David McNamara presented a fascinating talk on Geothermal Geology during June and in July, Dr. Mike Mlynarczyk delivered a short course on Stakeholder Engagement.

The last year saw two new Working Groups form; the Minerals Information Working Group (MIWG) and the Petroleum Geologists Working Group. The role of the MIWG is to support the IGI in better informing policy makers and addressing misinformation and public perception problems surrounding mineral exploration and mining in Ireland.

The Petroleum Geologists Working Group (whose name is currently under review) aims to support petroleum/energy geologists in their careers and to help the IGI develop initiatives that will properly support petroleum/energy geologists to harness opportunities and cope with challenges associated with the energy transition, e.g. tailored training, networking opportunities, highlighting the importance of petroleum engineering in the fuel mix and their particular skillset to other sectors etc.

Members of the IMQS have been invaluable in the formation and early stages development of both these working groups.

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 33 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.

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).

Geological Survey Ireland Programme Updates

Tellus Programme 2020

by Jim Hodgson, Senior Geologist, Tellus Project, Geological Survey Ireland

The Tellus Programme; Ireland's ground and airborne geoscience data acquisition programme, collecting geochemical and geophysical data, like many projects has had an interesting year resulting from the changing circumstances of a global pandemic.

Tellus Survey aircraft.

Soil sampling operations.

Back in February 2020, Tellus, managed by the Geological Survey Ireland (GSI) released the latest phase of geophysical data at the Irish Geological Research Meeting (IGRM). This latest magnetic, electromagnetic and radiometric data was released for survey block A7 which covered the southeast of the country and showed in great detail the interesting and complex geology over Wicklow and Wexford. Also released that day was ' Tales from Tellus' a series of photographs collected from the aircraft or samplers on the ground showcasing Ireland's natural and geological beauty.

Not long after the IGRM, Ireland and the world faced a new reality, as we all went into lockdown. Working from home the Tellus team adapted well to the new situation but delays to planed survey activities were inevitable. New health and safety procedures along with the development of a new digital data capture system for geochemistry sampling, which we could not get out and test, resulted in a delayed start to new soil sampling in the east of the country. The airborne survey was also significantly delayed as the crew and aircraft struggled to travel to Ireland from Canada. Eventually the small survey plane, which has to cross the Atlantic in a series of short hops, obtained permission from Greenland authorities to land and refuel at an airfield (although the pilots were not allowed to leave the aircraft). Eventually in September surveying commenced over a south-central block covering parts of Tipperary, Laois, Offaly and Kilkenny.

Despite these delays the team have continued to work with the data. New soil geochemistry data from the north midlands is now available for release. This is an important milestone as it marks 50% coverage across the country. New electromagnetic inversion data has also been released for previously surveyed blocks in Waterford and west Cork.

Work on the Terra soil project in conjunction with Teagasc has continued and we look forward to receiving the first reported analysis from the soils being tested in the Johnstown laboratories. The project represents a new, multidisciplinary approach to smart agriculture and brings together geologists and agronomists to meet the challenges of increasing agricultural productivity. Work has also begun on a new mineral prospectivity mappingproject involving members of the Tellus and Minerals teams in GSI.

Many thanks must go to the Tellus team who have adapted so well to the new way of working and have ensured that the project continues. We have also taken on new team members, who we have yet to meet in person, but already contributed significantly and have become key members of the Tellus team.

Further information regarding the Tellus survey can be found at the project website www.tellus.ie

Minerals Programme

by Eoin McGrath, Head Of Minerals, Geological Survey Ireland

GSI's minerals programme is currently working across the entire value chain of minerals and raw materials. In support of the exploration industry, a large Mineral Prospectivity Mapping project is underway which links in to the newly released Tellus data and recent bedrock drilling in the north west of the country.

This project is also supported by a joint research project with iCRAG which is bringing Mike Philcox's seminal "Blue Book" up to date with over 30 years of additional drilling, exploration and mapping from across the industry.

Further along the value chain, GSI will be increasing work in the aggregates sector, including providing geological and technical support to ongoing market surveillance issues across construction products. The minerals programme is also engaged in identifying Ireland's strategic minerals needs for the medium to long term, including the raw material requirements for Project 2040 and the green transition. Decarbonising our energy and transport sectors will be key features of Ireland's actions on climate breakdown and this will require ever increasing quantities of metals.

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Nigeria | PW Group operating at its quarry in Plateau State

England | Priority Drilling drilling boreholes in West Cumbria

Kazakhstan & Siberia | LTMS delivering mine safety training

The Geoscience Ireland (GI) network comprises over 40 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 is supported by Geological Survey Ireland (a division of the Department of Environment, Climate & Communications) and works closely with Enterprise Ireland and the Department of Foreign Affairs which provides unique access to international markets.

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

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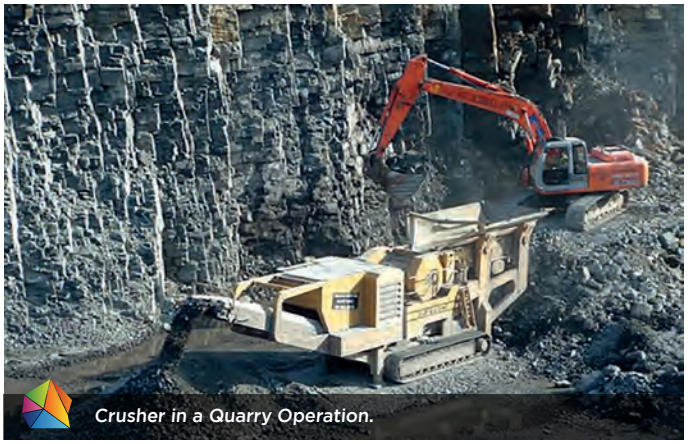
Why Do We Need Mining and Quarrying?

by Brendan Morris, Managing Director, LTMS Limited

Mine shaft in South Africa.



Crusher in a Quarry Operation.

Everything is either grown or mined!

This photo shows a typical city scene where there are many metals clearly obvious and some examples are given:

- Copper, in cabling for power and in cars
- Iron ore, in the steel used in buildings, cars & bridges
- Zinc, in steels for cars and construction
- Lead in car batteries
- Aluminium, in cars, buildings, construction materials
- Lithium, in car batteries and mobile phones
- Nickel, in construction, buildings, power generation
- Gypsum, used in the production of plaster and plasterboard
- Aggregates from quarries used for road and concrete construction
- Cement is made from quarry products
- Oil and petroleum products are extracted from the earth
- Gold, mercury, titanium, palladium and many rare earth metals can be found in normal life products

Cars and mobile phones are made of many products such as plastics, metals, rare metals. Without metals and other products extracted from the earth, cars or phones would not be available.

Construction of houses requires products from mining and quarrying. Concrete blocks, cement, tarmac, window frames and other items all need to be extracted from the earth. We need these products to live in the lifestyle that we have become accustomed.

Types of mining and quarrying

Metals are extracted from the earth in a variety of ways. The metals are normally distributed within the rockmass in minute quantities and therefore the rock needs to be crushed and processed to release the metals. An example of a typical gold ore is 10g/tonne, which means that in order to get 1 Kg of gold, 100 tonnes of gold ore must be mined and processed.

Placer mining takes place to extract metals from the earth, which are available close to the surface in soils, silts and rivers. The Klondike Gold Rush in the 1850's in Canada is an example of when miners found gold nuggets in riverbeds and this caused a major influx of people in search of the valuable metal. Gold continues to be mined in the Yukon in underground mines and at placer operations. The Discovery Channel shows a programme called Gold Rush which shows placer mining operations in the Yukon and Alaska.

Open Pit Mines are used to extract metals from near surface, where the cost of extraction is less than using underground means. Overburden is stripped off and waste rock is then removed so that the ore (rock with metals) can be accessed and extracted.

Millions of tonnes of ore can be extracted from Open Pit mines, depending on the size of the pit, types of equipment used and extent of the orebody.

Underground mining is carried out when the ore is found in deep deposits and is accessed by either a shaft or a decline ramp drive from the surface. Ore is normally crushed and taken to surface by shaft, conveyor or truck.

Sometimes ore bodies are started with mining of open pits and then transition to more expensive underground mining as the depth of the orebody increases. An example is a Kimberlite pipe, which often host diamonds and can be very deep.

Brine mining is normally carried out in the 'Lithium Triangle' in South America where lithium is extracted from precipitated salts.

Quarrying is extensive across the globe and is the removal of rock, sand, gravel and other products from the ground for use mainly in the construction industry.

Common metals and products which are mined and extracted

Some of the most recognisable mining products are listed below.

Coal is the most common product mined by volume and is used for the production of electric power, steel, cement and for many other general heating purposes. Total world production is approximately 7.5 Billion tonnes per annum. China is the largest producer at 45% of the production. Climate change practices are resulting in the substitution of coal and this will eventually impact the production levels and requirements.

Iron Ore is used for steel production as it is in abundant supply and has even heating properties. China is the greatest user at 40%+ of the world's production. Australia (880Mtpa) and Brazil (440Mtpa) are the largest producers. Approximately 2.2 Billion tonnes of ore were produced in 2017

Aluminium – Bauxite is a sedimentary rock with a relatively high aluminium content. Aluminium is used in cans, foil, aircraft and is the most flammable and hottest when burning. Australia is the largest producer at 88Mtpa, followed by China at 68Mtpa and Guinea at 45Mtpa. Total bauxite production in 2017 was 300Mt.

Copper is a metal that is easy to work, is a good electrical conductor and is used in the production of pipes and cables. Chile, China and Peru lead the production table, with total copper production in 2016 at 20Mt.

Zinc is a hard, anti-corrosive metal, used in iron and steel production. China (5.1Mt) is the largest producer, followed by Peru (1.4Mt) and India (1.3Mt). In 2019, approximately 13.0Mt of refined zinc was produced

Gold is a soft and malleable metal with wonderful colour and lustre, it is used for jewellery, finance (bullion & coinage) and in the electronics and medical industries. China (426t), Australia (295t) and Russia (270t) are the largest producers. Worldwide production of gold in 2016 was 3,150 tonnes.

Lithium is a soft silvery white metal, which is the lightest in the periodic table and is in increased demand recently. Lithium is a crucial ingredient of lithium-ion batteries and is also used in aircraft alloys. Lithium

has recently grown in demand with Australia leading ore production at 51,000 metric tonnes of zinc content in 2018, followed by Chile 16,000 metric tonnes and China at 8,000 metric tonnes.

Quarry Products. The extractive industry includes both mining and quarrying. The quarry industry produces vast amounts of rock in various forms. Rock for cement production, aggregates for concrete and road materials are some examples of the primary uses of quarry products. There are approximately 500,000 extraction sites for quarry products worldwide, producing up to 50 billion tons of aggregates, with Asia leading the production.

While the world is going greener, we still need metals and quarry products, but we must also develop new ways to extract products from the earth in a more environmentally and socially responsible manner. This is happening in many jurisdictions across the globe where mining and quarrying companies are working with regulators and specialist companies to provide a more sustainable future.

Most Expensive Metals

While metal prices vary depending on supply and demand, there are some metals which maintain high demand and high price. The following metals with approximate cost per cost per ounce (US$) are currently the most expensive. The price for the metals fluctuate on a regular basis.

Rhodium ($3,000) is extremely rare with high reflective properties, used in searchlights and mirrors

Palladium ($2,100) is malleable and stable under hot conditions, used in catalytic converters and electronics

Gold ($1,700) is desirable, durable and malleable and used in jewellery and for industrial applications

Iridium ($1,500) has a super high melting point and high density and is an ingredient in medicine and electronics

Platinum ($800) is malleable, dense and anti-corrosive and used in jewellery, dentistry and weaponry

Osmium ($400) is hard, brittle and has a high melting point and used in electrical contacts and filaments

Mining in Ireland

There are only a few mines in Ireland, extracting zinc, lead, gypsum and gold. In the past copper, silver and coal were also mined. The largest mine is Boliden Tara Mines in County Meath, which has been extracting zinc and lead since the mid-1970s and operating in harmony with the local community. Gypsum is mined in County Monaghan and gold is mined in County Tyrone. The next potential zinc mine in Ireland is the re-opening of the Galmoy mine, by an Irish company, Shanoon Resources, who have identified an economic zinc reserve.

There are many mining exploration projects in Ireland, carrying out soil, river and drill hole sampling in search of new mining potential.

Ireland is considered a very good location for mining with the Fraser Institute annual results showing that Ireland is 2nd of 76

Typical Building Site.

Placer Mining Operation.

mining jurisdictions worldwide for Policy Perception and 7th for Mining Investment Attractiveness. Factors examined include environmental regulations, the legal system, taxation regime, political stability, labour regulations, quality of the geological database, security, and labour and skills availability.

Mining and quarrying provide good employment, opportunities for local service providers and with a 3:1 ratio of local jobs per mining job, this provides a significant boost to the local community for suppliers, contractors and small businesses.

Mineral Exploration

Mineral Exploration or Prospecting is the process of investigating the subsurface to ascertain if there are economic quantities of minerals present. In Ireland it must be conducted in accordance with best practice and respect for the environment.

It can be undertaken using many different techniques under guidelines published by the Exploration and Mining Division (EMD) of the Department of Communications, Climate Action and Environment (DCCAE). Exploration projects may include geological mapping, geochemical sampling, geophysical surveys and drilling. Most exploration projects do not discover sufficient quantities of minerals to make an economical mine.

Every exploration project requires a Prospecting Licence from the EMD, prior to exploration taking place and each application undergoes close scrutiny by the department's team of geology experts. There are many exploration projects currently taking place in Ireland, in search of minerals such as zinc, lead, gold, lithium, etc.

There is a statutory requirement to apply for separate planning permission after the exploration/ prospecting phase, if it is deemed that there is sufficient mineral potential in the area of interest.

Open Pit Mine.

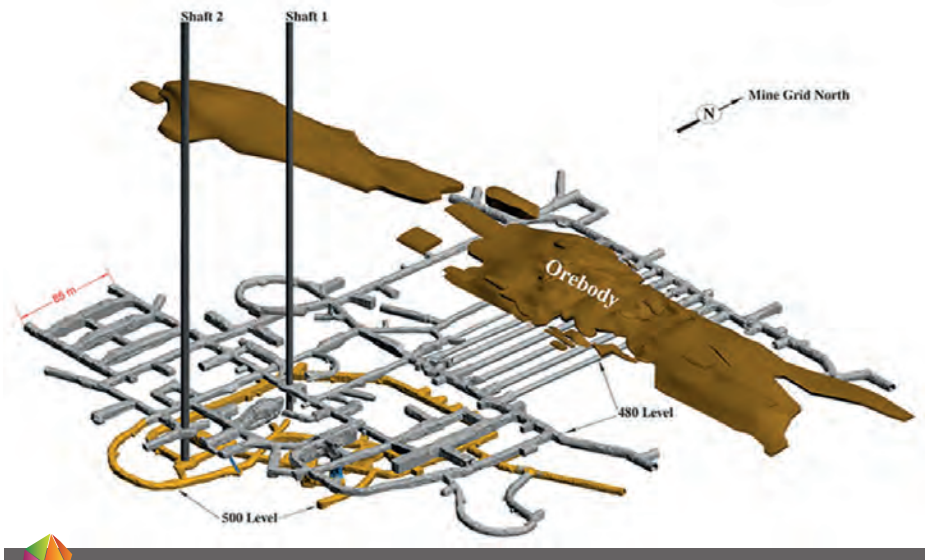
Mining cannot take place without planning permission.

Permitting for Mining in Ireland

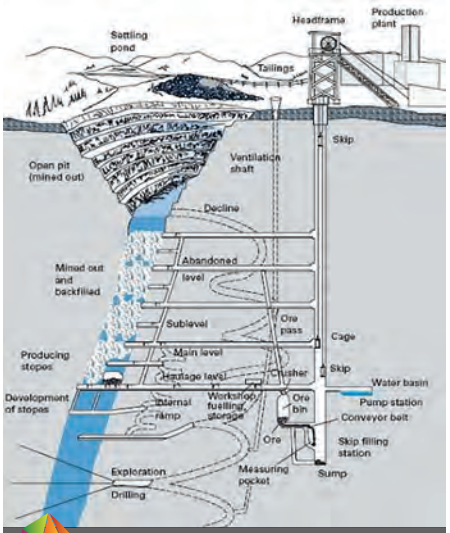
In Ireland there is a three-stage permitting system for mining projects. This usually follows a successful exploration project, with a feasibility study indicating an economic mineral deposit.

1. **Planning Permission** is required under the Planning and Development Act 2000 and may be granted following the completion of a significant application process which includes investigation of a broad selection of topics including but not limited to site location, water, environmental management, local community and waste management. Planning permission is issued by An Bord Planeala and the local county council.
2. An **Integrated Pollution and Control (IPC)** Licence includes conditions based on various EU Directives and Irish Regulations. Depending on ancillary activities a mine may require an Industrial Emission (IE) Licence rather than an IPCL. IPC licences normally include very strict conditions on the management of environmental issues. This licence is issued by the Environmental Protection Agency (EPA).
3. A **State Mining Lease** for minerals in State Ownership under the Minerals Development Act 1940 or a State Mining Licence if the right to work minerals is vested in the Minister under the Minerals Development Act 1979. The lease is issued by the Exploration and Mining Division of the Department of Communications, Climate Action and Environment.

At all stages during the permitting process, there are opportunities for the public and special interest groups to make submissions and objections to the process. Following this rigorous process, if permission is granted, it would be normal for a mine to have a series of conditions relating to operations, environmental management, social and community issues.



3D Visual of an underground mine.



Transition from Open Pit to Underground Mining


Loading a truck in an underground mine.


Precipitated salts.

Human Need for Metals

It is estimated that the average use of minerals and metals by a human during their lifetime is

- 330kg of zinc
- 360kg of lead
- 680kg of copper
- 1,600kg of aluminium
- 12 tonnes of clays
- 13 tonnes of salt
- 15 tonnes of iron
- 562 tonnes of stone, sand, gravel and cement

Demand for responsible mining practice

The legacy for mining worldwide is not good, with many mining operations abandoned following closure. Avoca is an example of an abandonment legacy with contamination of the local landscape and river. This legacy has been changing for the better in recent times, with some very good examples of well executed mine closures completed at Galmoy Mines in Kilkenny and Lisheen Mine in Tipperary.

As the world moves toward a greener environment, mining requirements are changing. Mining companies must mine in a more socially and environmentally responsible manner. This requires enhanced engagement between mining companies, local communities and regulators. Mining applications are now very rigorous and demand a very high level of expertise to ensure that the highest operational standards are set out in advance and then met during operations and closure.

Unlike other types of industry, mining must happen where the orebody occurs and as such the planning and design of a mining environment must be developed on a site-specific basis.

While mineable orebodies are not always located in preferential locations, modern mining techniques and environmental management systems allow good mining practice to be possible in almost any location.

The option to not mine a good potential mine may result in:

- The loss of an opportunity for the local community to benefit from employment and small business development
- The promotion of mining in less developed parts of the world where poor social, environmental and mining practices are often in place

The Cost of Mining

Constructing a mine is very costly and as an example, the Lisheen Mine in County Tipperary was built in the 1990's at a cost of €325 million. The closure of the mine took place following closure in 2015 at a cost of €25M with an additional €3M in place for aftercare. The mine employed 390 full time employees and provided €30M per year in direct salaries. The additional spin off employment and services was significant and the area benefited significantly from the mine. The owners, Vedanta Resources and the local community worked in harmony throughout the whole cycle of mining and this is a good example of how mining can be an integral part of the community.

While metals have been mined in Ireland for hundreds of years, Ireland does not have any mining companies with the financial capacity to set up and operate a medium or large scale mine and as a result any mining must be carried out by foreign mining companies. Tara Mines has been owned and operated by a number of different mining companies since operations started in the 1970s.

Summary

While the terms mining and quarrying are not always favourably reported and accepted, recent developments have resulted in much improved mine and quarry site management. Mines and quarries can provide significant benefits to local communities and the local economies.

We need mining and quarrying products to provide the very basic needs of our lives and we should always demand a high level of social and environmental management of operations in our country.

Brendan Morris is the Managing Director of LTMS Limited (Lisheen Technical and Mining Services), a company established following the closure of the Lisheen mine to provide mining services and training. Brendan is a Chartered Mining Engineer and has been engaged in the mining and quarrying industries, globally, since 1979. Brendan is a Past President of the IMQS.


Loading in a quarry.


Tara Mines with Navan.

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PAT O'CONNOR: COMMITTED AS EVER TO HIS CUSTOMERS THROUGH DIFFICULT AND CHALLENGING TIMES

One thing his customers appreciate above all else is that Pat O'Connor is 100% committed to providing a service that is unrivalled; it is how he has built a successful business over the past 30 years or more.

In learning all there is to know about the quarry industry without having to return to college was a big undertaking, but today he has a wealth of knowledge that is as deep as it is broad, and being a member of the Irish Mining & Quarrying Society since 1990, he remains every bit as passionate about the industry as he was back then.

Not surprisingly, there are few in the industry who haven't heard of Pat O'Connor or who haven't availed of his services – and despite the Covid-19 pandemic and subsequent lockdown, he strives hard to keep as busy as ever, supplying a wide range of customers in the quarrying and mining sectors across the island of Ireland with all types of conveyor belting and associated products.

"Even though we are living in difficult days, the needs of my customers come first, no matter the time of day or night; I am 100% committed to providing a quality service 24/7," says Pat who, although past retirement age, has no intention of taking life easy just yet.

"When I began I hadn't two coins to rub together," recalls Pat, "and there were many challenges in those early days, but taking the view that 'every good businessman runs a well calculated risk' I not only survived, but thrived."

That approach, coupled with the

loyalty of his core customer base, certainly helped Pat's business through the unprecedented and tough trading conditions of the last prolonged recession which hit the Republic of Ireland's construction and quarrying industries particularly hard. Now he is having to do it all again, thanks to Covid-19.

"The last few recent years have been among the busiest I have ever been, although there is currently something of a pull back because of the pandemic, but I remain optimistic about the future," adds Pat, whose very first customer back in 1989 was Roadstone; today, his client base reads like a 'whose who' of the quarrying and mining sectors.

For Pat, it all started in 1970 when he was studying at Bolton College of Technology, taking a Diploma course in transport technology. There he undertook a maintenance cost factor study of running a large bus company. The tyre bills were so enormous, he was tasked with finding a way to reduce those costs.

"I had to take into account every aspect of the business, down to tyre types and rubber compounds, coach sizes, number of passengers carried, types of journeys and route condition encountered and so forth to find a satisfactory solution.

"Using my knowledge of tyre types on rally cars and working out some bus routes were primarily on straight stretches of road, I recommended standard cheaper tyres for vehicles on those route, and for buses on routes that were more challenging, with twists and turns, I recommended using the best dearer priced tyres; it was an enlightening exercise," says Pat who, incidentally, came top of the class. His reward? A free bus pass home from college! Yes, life was tough in those days!

Pat is passionate about everything he does both inside and outside his highly successful business which he runs single-handedly from a six acre site just off the N7 Dublin to Naas motorway.

As customers will readily tell you, his friendly, accessible and professional approach to business is just one of the secrets of his success.

Pat is most definitely a 'people' person, putting the interests of others before his own, which is why he often finds himself on the road criss-crossing Ireland for 24 or even 48 hours without a break, providing his customers with what really is an unrivalled service – a service that is backed up with quality belting, sourced from GB Conveyors in Doncaster, and other products that include fasteners, scraper blades, rollers and skirting rubber.

A couple of years ago he acquired the 32 Counties agency for Kraiburg hot jointing products which has put him in touch with vulcanisers throughout the country. A German / Austrian company, Kraiburg has been developing, producing and selling high quality rubber compounds since 1947. Their proven products are used in the vast majority of conveyor belt jointing in all static and mobile plant; hot joints have always proven best for Ireland's changeable climate!

So, what of the future? "I don't plan to slow down," says Pat, and that should come as a relief to his many customers.

Outside of his business activities, Pat is also widely known among motor rally enthusiasts having raced his way to no less than seven Circuit of Ireland Rally titles in his younger days. "I have a keen interest in race horses and aim to have a legend winner sometime in the future," adds Pat, who is also planning to open a restaurant in the beautiful Royal Canal harbour village of Ballynacargy in County Westmeath, restoring old canal buildings on the quayside.

EFEE (European Federation of Explosives Engineers)

by Alan Dolan Mining Engineer Boliden Tara Mines, Vice President and Honorary Secretary (IMQS)

EFEE was founded in 1988 and has 25 National Associations. 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 11th EFEE World Conference on Explosives and Blasting will be held in Bucharest, Romania between Sunday 12th and Tuesday 14th September 2021. More details at www.efee2021.com.

The IMQS, in conjunction with Tyler Events Ltd (a Professional Conference Organiser), will host the 12th EFEE World Conference on Explosives and Blasting in Dublin in 2023. For more information of this prestigious event visit our communications platforms.

One of EFEE's primary projects has been PECCS (Pan-European Competency Certificate for Shot Firers / Blast Designers). In Europe, there is no minimum training standard to be 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 remedy this, EFEE has created PECCS. This project facilitates the transfer of shotfiring and blast design skills within European member states.

The PECCS course was launched in August 2019. EFEE are looking for training authorities in each EU country to administer the training. For more information on this innovative project or if you would like to teach the course, visit **www.shotfirer.eu**.

From left; Doru Anghelache (EFEE Vice President), Alan Dolan (EFEE Council Member), John Francis (IMQS President), Nicola Nixon (IMQS Vice President), Jari Honkanen (EFEE President), Brendan Morris (IMQS Past President).

Update on the Curraghinalt Project

Earlier this summer, the Minister for Infrastructure, Nichola Mallon, announced her intention to refer our planning application for an environmentally responsible mine to a public inquiry. This is a welcome development that will offer another forum for the public to engage with the facts of the project and provide further independent scrutiny. The detail required by Northern Ireland's planning system for this regionally significant project is – quite rightly – meticulous. It has taken the best part of a decade to research and develop the project and progress the planning application. The application was submitted in 2017 with further environmental information provided last year. The application includes a series of detailed reports looking at issues such as the environment, the economy, health, habitats and transport. The planning process also requires ongoing engagement with the authorities to provide clarification and further information.

So far, we've held around 100 meetings with a wide range of consultees such as the Public Health Agency, the Health & Safety Executive and the agencies responsible for environment, economy, roads and rivers. Following the submission of further information last year, the majority of statutory consultees have now responded and no major issues with respect to human health, tourism or the environment have been raised.

The purpose of the public inquiry, according to Minister Mallon, is to "allow for robust scrutiny of the application in a public forum". We are confident that we have designed a world-class project which will bring economic and community benefits to the region – including some 1,000 direct and indirect jobs - whilst using modern technology and design that meets or exceeds Northern Ireland's strict environmental standards. Ultimately, however, it is for the planning system to test whether the project meets the exacting standards demanded of it. We expect that the application will be referred to the Planning Appeals Commission for a public inquiry this year with a final decision being made in 2021.

2019 Carbon Neutral Status

We have also recently announced that we have achieved net zero carbon neutral status. This is an important milestone toward realising Dalradian's commitment to building and operating a carbon neutral mine, the first in Europe.

The Company completed an assessment of its carbon footprint for 2019 that has been independently verified. We have achieved carbon neutrality to PAS 2060 standards for 2019 by developing a carbon management plan and offsetting all carbon emissions by supporting a water purification programme in rural Cambodia. We worked with Carbon Footprint Ltd, a leading sustainability & climate change solutions provider. Dalradian is committed to minimise its emissions and offset the remainder via offsetting to render all its operations as net zero carbon (i.e., carbon neutral).

This process has followed the stringent requirements of BSI PAS 2060, a specification produced and published by the British Standards Institution with the objective of increasing transparency of carbon neutrality claims by providing a common definition and recognised method of achieving carbon neutral status.

Water Purification project in Cambodia

To render its carbon emissions 'net zero', Dalradian has chosen to support a Water Purification project in Cambodia. This provides clean water to rural developing communities and, as well as reducing carbon emissions, the project significantly reduces illness due to waterborne diseases and has further benefits to respiratory health (as indoor wood fire water boiling causes air pollution). In addition, purifiers are locally manufactured and therefore provide an economic benefit to Cambodia. The project is certified to the international Gold Standard.

The solution to climate change cannot be provided by one part of the world, we must take a global approach.

From pencil and paper to drones and satellites

Geological Survey Ireland Celebrates its 175th Birthday

by Dr Siobhan Power, Geologist, Geological Survey Ireland

July 31, 2020 marked the 175th anniversary of the Act of Parliament that created the Geological Survey in Ireland.

The Act was to facilitate the Completion of a Geological Survey of Great Britain and Ireland, under the Direction of the First Commissioner for the time being of Her Majesty's Woods and Works. The original need for a Geological Survey was to map the bedrock and overlying sediments to look for coal and other economic minerals on the island of Ireland.

Time, history, and world affairs have shaped the Geological Survey since its inception and have altered its work focus. Geological Survey Ireland is now a division of the Department of Communications, Climate Action and Environment and has evolved into a world-standard national Earth science center with a staff of over 100 scientists, cartographers and support staff working on national and international projects. Its work supports the economic, social, and environmental development of Ireland as we face challenges due to climate change, increased pressure on land use, and the need for secure renewable energy sources.

Geological mapping in the 1800s was carried out by a small group of surveyors walking the land and recording information on the then 'new' Ordnance Survey 6 inch maps. Today, Geological Survey Ireland's work includes mapping and understanding our soils, marine territory, geological heritage, groundwater systems, underground minerals resources, and aspects of climate change. It uses a range of modern and innovative technologies including a fleet of research vessels, geophysical equipment mounted on a plane, drones, satellites and drill rigs to carry out its work.

Geological Survey
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175 years | bliain 1845-2020

These tools support modern field and laboratory work and modeling methods to refine the geological maps and data. Its largest projects are INFOMAR, the national marine mapping programme carried out in conjunction with Marine Institute; and Tellus, Ireland's airborne and ground sampling environmental baseline mapping project, both of which are internationally renowned.

To support Ireland's climate change policies, Geological Survey Ireland is developing a roadmap for using Ireland's geothermal potential, monitoring the coasts with respect to sea-level change, using soil geochemistry data to assist with improving farming methods, supporting the Just Transition in the midlands for our move away from peat, gaining a better understanding of groundwater systems and looking at sustainable processes for the extraction and management of economic mineral resources.

The geoscience sector was worth €3.28 billion to the Irish economy in 2017. Geological Survey Ireland supports economic development through high quality, free data for all stakeholders. It promotes the Irish geoscience sector through the Geoscience Ireland business cluster and provides financial and technical assistance to the Irish UNESCO Global Geoparks. It contributes to Ireland's geoscience research and education through funding and through national and international research projects.

Minister Eamon Ryan TD, Minister with responsibility for Geological Survey Ireland congratulated it on the anniversary. He said: "It is my pleasure to mark this special occasion of the 175th anniversary of a Geological Survey in Ireland. A robust understanding of our rocks, soil, water, and onshore and offshore physical features is the basis of planning for a sustainable future. We need to continue to build on the good work of the Geological Survey and use their data, maps, science and expertise to make informed decisions on energy sources, smart farming, water protection, planning, and resource management. Ireland has been, and can continue to be, a world leader in geoscience data acquisition and I look forward to seeing the future work of Geological Survey Ireland."

Koen Verbruggen, Director of Geological Survey Ireland, said: "I'm proud to be part of such a dedicated team of people who are working hard to further our understanding of our natural systems for the benefit of all aspects of society. As we face the challenges of climate change, the need for the transition from fossil fuel to more sustainable sources such as geothermal and offshore renewables, and the need for protected sources of water, the staff at Geological Survey Ireland is ready to meet these challenges through our expertise, high quality data collection, national and international collaborations, and innovative solutions."

To mark 175 years of the Geological Survey in Ireland, a joint Geological Survey Ireland and National Museum of Ireland exhibition is due to open in Collins Barracks, Dublin, at the end of 2020, and a series of events including a television series celebrating Ireland's rich geology being planned.

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Geological Survey Ireland is the knowledge centre of Irish geoscience, providing geoscientific advice and information, databases, maps and reports. Our programmes supply free, impartial, high-quality national, regional and local data on all aspects of geoscience, from landslides, minerals, groundwater, and soils, to geoheritage, planning, and education, to all sectors and the public.

Some relevant services

Minerals: Supporting the sustainable development of our natural resources.

Core Store Scanner: Hyperspectral analysis and mineral mapping of Irish drill core.

Tellus: A world class national airborne geophysical & geochemical mapping programme.

Online Mapping: Full suite of maps and data available free on our website *www.gsi.ie*

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GeolSurvIE

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

Flying the Finning Flag

From Cork to Vegas

by Peter Seaman

Tommy Murphy, a machine operator from County Cork, flew the Finning Ireland flag at the 2020 Cat® Global Operator Challenge earlier this year, and came tantalizingly close to becoming a world champion.

More than 10,000 machine operators from 30 countries took part in the epic annual challenge. The three-part event began with the UK and Ireland heats that took place at the Caterpillar® manufacturing facility in Desford, Leicester. The winners were then flown over to take on the best operators from across Europe at the Caterpillar Demonstration and Learning Centre in Malaga. It was here that Tommy led the field and secured himself a place at the global finale in Las Vegas.

Tommy had always dreamed of becoming a machine operator, digging out footings for his first house when he was just eight-years-old. As soon as he left school, he joined the family construction firm that was set up by his grandfather in 1961. When the recession hit Ireland, work dried up. So Tommy decided to travel and headed to Australia where he lived for seven years, working his way around, picking up machine operating jobs in mines and quarries across the country.

"I'd only been back in Ireland for a few weeks when the local Finning sales rep, Brian Roche, called to ask me and my brother, Maurice, if we'd be up for the Cat Operator challenge," explained Murphy.

"Neither of us believed we had a chance of winning, but It sounded like good craic; an all-expenses paid trip to the UK to operate different Cat machines, it would have been rude to say no!"

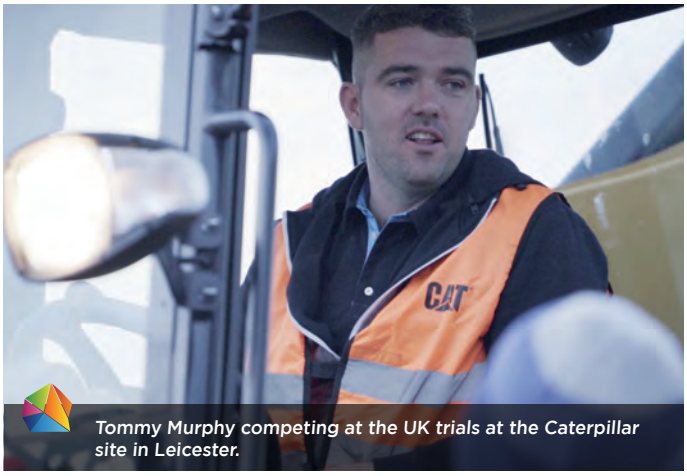
Tommy narrowly missed out on the title but he's a winner none-the-less in our eyes.

In Leicester, Tommy and Maurice competed against hopefuls from across the UK and Ireland over two days, taking part in three timed challenges designed to test operator skills and techniques in a range of machines.

The first involved navigating an obstacle course in a Cat 259 compact track loader skid steer and picking up an H-frame before carefully placing it in a stand. The second challenge called for the competitors to manoeuvre a Cat 203 mini excavator through a tight coned track, really putting their joystick and control skills to the test. The third and final challenge required exceptional operator precision and control. Competitors were tasked with operating a Cat 320 GC, steering it around site to pick up strategically placed tyres before carefully placing them at another point on the site in a pyramid structure.

Tommy's combined score across all three challenges was 6 minutes and 55 seconds, putting him in second place, with his brother, Maurice, coming third and both securing a place in the European leg of the event that took place in October 2019.

Murphy continues: "Competing at



Tommy Murphy competing at the UK trials at the Caterpillar site in Leicester.

Tommy preparing himself for the grand finals at CONNEXPO, Las Vegas.

the European operator challenge was awesome. The weather was amazing, and the Caterpillar facility was like nothing I'd ever seen before.

"We competed in a purpose-built arena with hundreds of people watching and cheering us on. It was all a bit surreal. Each stage of the competition really pushed me out of my comfort zone. I found the dozer challenge by far the hardest because I've never operated one before so was unsure how I'd do. But it's like driving a different type of car, the overriding principle is the same, the controls and responsiveness are just different."

The final took place in mid-March 2020 on the opening morning of CONEXPO-CON/AGG 2020 which is North America's largest construction trade show. Tommy competed against seven other operators, all winners or runners up from the four continental heats.

The first of the final challenges was called load and carry. Competitors were required to operate a Cat 962M wheel loader using its production measurement technology to load and move material to different locations in the arena.

The next challenge, control-to-a-tee, called for the challengers to tee-off using a Cat 302 mini excavator and navigate an uneven course before putting a golf ball in a hole at the end. The final challenge called for operators to show off their trenching skills using a Cat 325 excavator equipped with 2D grade technology.

Tommy receives the runner-up trophy.

Tommy's combined score after the first two challenges put him in pole position going into the final event. However, he was pipped to the post by Jaus Neigum from Canada on the last challenge. The scores were calculated based on speed, accuracy and operating best practices with penalties imposed for errors.

Murphy concludes: "The final in March seems a bit of a surreal experience now, with everything that's happened since. The whole experience from start to finish was incredible and something I'll remember always."

advertorial

MDS REACTS TO THE NEW NORMAL

INTRODUCING MDS M518R - RECYCLING TROMMEL LIKE NO OTHER

by Raheel Qamar, Marketing & Sales Manager at MDS International

The current pandemic has brought about changes in all aspects of life and business, it has revealed a lot about the damage man has constantly put to the environment throughout the years. All this forcefully came to a halt with the pandemic. Just in the past months of lockdown, record low levels of pollution (Especially NO2 and CO2 emissions) have been recorded and the natural environment has been recovering slowly. We as a society now need to ensure this continues so that we leave a clean planet for generations to come.

We at MDS passionately believe that we should do what is right for the environment and build products that help towards a sustainable future. This year we have pushed our focus towards recycling. We have already tuned our bestselling models of M412, M413 and M515 to handle various recycling projects and have them working in demolition recycling, general waste and steel slag waste,

and most importantly have introduced a new recycling Trommel, the MDS M518R!

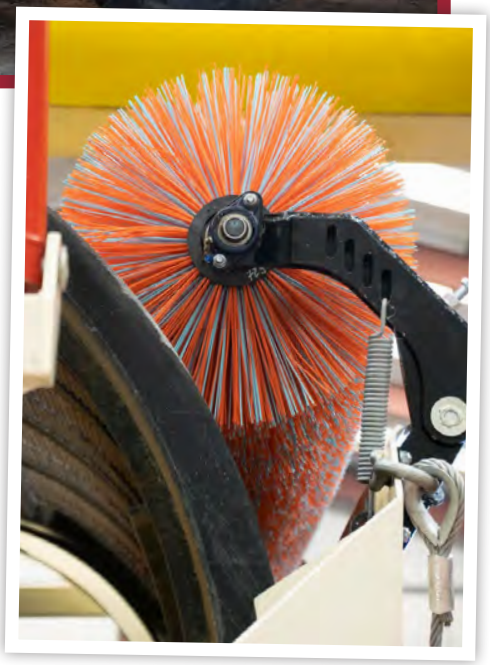
The market for recycling trommels is quite saturated with many options available out there but the MDS M518R clearly stands out from the crowd. This is because this recycling trommel is unlike its competitors and follows the MDS brand philosophy! From a distant, it is visible that this is an MDS product and not any other recycling trommel in yet another colour!

MDS used its vast experience from its heavy duty trommel range to build this recycling trommel that does not compromise on quality. MDS kept its long line of customers all the way from Australia, Europe and USA in the centre of its design process and continued consultations to produce this trommel. This trommel is made with customer in its mind.

First off the MDS trommel design offers an overall reduced height at 3.14m which allows it to be hauled on regular low body trailers without having to attain special permissions for movement within UK and Europe. MDS was able to achieve this by having a minimal but sleek design with a low centre of gravity yet having the ability to achieve high stockpile heights.

The M518R is built to allow easy change of configuration of its drums so that the customer can make different grades of product using the same unit. The machine is equipped with hydraulic drum removal system that brings the drum out of the side and is easily changed using a standard forklift. This

advertorial



whole process completes within 30 minutes! This ensues the customer has minimal downtime while changing configurations. MDS ensured that the customer can use their Doppstadt 518 and other similar no OE equipment drums of same dimensions into the M518R. In addition, MDs offers 3 different styles of drums that will cater for different applications. This makes the M518R very versatile as it can have drums with openings from 1mm to 150mm. The drums are made as frames onto which different sized meshes can be fixed.

The unit has been running on demos in the UK and Europe and has received high praise. Customers have reported that the unit has been achieving processing rates far exceeding those from their existing trommels and screeners. The ability to change the drum speed allow for them to alter their setup and process material better. The M518R runs on CAT 2.2 Tier 4 Diesel Engine and delivers an economical fuel efficiency of 7 litres per minute.

The M518R will be especially useful in processing General waste, compost, soil, woodchip, rubber, and plastics. MDS believes this trommel will revolutionise the recycling industry and make the machine more accessible to many recycling centres due to its cost benefits and ease of access and use. Get in touch with MDS or its official dealers to get more info about this great product.

MDS

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Drummond Mine/Knocknacran Open Pit Mine: Saint-Gobain Mining (Ireland) Ltd 2020 Update

by Benson Plunkett, Mine Manager, Gyproc, Ireland

This year for Drummond Mine and Knocknacran open Pit Mine – like all industries – has been a turbulent year due the Covid 19 pandemic. In spite of this Saint-Gobain Mining Ireland (SGMI) has satisfied the Construction Industry's demand for both plaster board and bagged plaster and continues to do so.

Gypsum rock is produced from surface and underground and the beginning of 2020 saw the completion of Phase 2 of Knocknacran Open Pit extension which will, along with the Drummond underground Mine, secure raw material for the Plasterboard and Plaster markets. During this phase 2.6 million tonnes of soil material was placed in line with final site remediation.

Following a subsidence event in 2018 in a nearby long closed mine and unrelated to ongoing activities, SGMI continue to work closely with the DCCAE, EPA and Monaghan County Council on a number of topics.

Completed Extension to the Knocknacran Open Pit Mine (Phase 2 completed February 2020).

Looking to the future, Gyproc are studying the possibility of a future surface mine – Knocknacran West Open Cast Mine - 1km from its existing site to ensure supply to the Construction Industry long into the future.

The 'Red' Gypsum rock of the Upper Gypsum Seam can be vividly seen, stockpiled and ready for blending with Lower seam and underground gypsum rock.

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

GSNI Geological Survey of Northern Ireland
www.bgs.ac.uk/gsni

Quarrying or Mining in Northern Ireland?

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

Data and Services

GSNI collects, interprets and provides geological data, research and advice to central and local government, industry, academia, NGOs, schools and the public. GSNI maintains extensive digital databases and paper archives that are accessible online and through our enquiry service.

The data held by GSNI include:

- Modern and historical geological maps including 1:10k vector map data
- Borehole and site reports
- Tellus geochemical and geophysical datasets
- Mineral and hydrocarbon exploration licence database and open-file reports
- Mineral occurrence database
- Abandoned mines database
- Quarries database
- Groundwater data repository
- Mineral resource maps

Online data access:

- GeoIndex & GeoRecords
- Historical maps archive
- Digital photo archive
- Ground Source Heat Pump reports
- Mine abandonment plans
- Open Data NI & Spatial NI

A geological report writer service is also now available.

www.bgs.ac.uk/gsni/data
www.geologicalmaps.net

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A social, environmental and economic assessment of Galmoy and Lisheen Mines (AECOM Report 2020)

An evidence-based assessment of the impacts on local communities from the lifecycle of two Irish mines, commissioned by the Exploration and Mining Division

by EurGeol Paul McDermott PGeo, Senior Geologist, Exploration and Mining Division, Department of the Environment, Climate and Communications

At the iCRAG 'Resources for a Sustainable Future Conference' in 2019, Dr Geertje Schuitema was asked a question on her talk about public perception and the acceptance of the extractive industry in Ireland. The question was basically, how do we get local communities to realise that minerals are essential for our society?

However, Dr Schuitema switched the question and threw it back to the extractive industry, "Industry needs to ask, how it can understand why people think mining is dangerous. The public thinks about how bad things can be and of the consequences of mining, not the probabilities". It is a very valid point, a mine has a finite life but its impact on a local community can span generations. Ireland has numerous examples of this; we only have to look at the continuing issues at Avoca or Silvermines.

The Exploration and Mining Division (EMD), of the recently renamed Department of Environment, Climate and Communications, has always sought to operate using an evidence based approach. We understand the need for people to have the facts available to them, so they can form their own opinions based on actual evidence and real data.

To quote the American author Richard Wright "Don't leave inferences to be drawn when evidence can be presented". So back in 2018 we saw an opportunity to get an independent objective assessment of the impact of mining on two local communities.

Using the closures of Galmoy Mine, Co Kilkenny (2012) and Lisheen Mine, Co Tipperary (2015) as case studies we wanted an independent assessment of how the mines opened, operated and closed under modern Irish and European legislation. With both mines closed for a number of years it was an opportunity to look at the full mining life cycle from construction, operation, closure and rehabilitation. The perception around both mines was that they had operated and closed to a relatively high standard. However, perception is not sufficient, people need facts.

Figure 1 Capitals approach with examples of impacts and dependencies. Source AECOM.

'Capitals' Approach

EMD sought proposals for an independent critical analysis of the impacts of both mines on their respective local communities. This was won by AECOM Ireland Ltd who proposed using a 'Capitals' approach to assess the impacts of the mining.

A capitals approach is based on the concept that there are several types of capital from which people derive the goods and services they need to improve quality of life and which are not just limited to financial capital or flows of money. For this evaluation the capitals chosen were social, human, intellectual, natural, manufactured and financial. The methodology provides a means to identify the potential range of impacts and dependencies that might arise on the different 'capitals'. Figure 1 below illustrates the six capitals and provides examples of impacts and dependencies that could be considered.

In the context of this study:

- Social effects align with social, human and intellectual capital;
- Environmental effects align with natural capital; and
- Economic effects align with financial and manufactured capital.

In practice, there is often overlap between the different capitals and the approach can also identify trade-offs between different capitals. For example, the construction of a link road to a mine might enable better transportation and enhanced connectivity which could, in turn, deliver economic and social benefits. However, it would also necessitate land take which would affect existing natural capital assets (habitats) and the benefits ('ecosystem services') they deliver. These trade-offs can be helpfully revealed when a capitals approach is adopted.

Social Effects

The biggest social impact at both mines was the impacts associated with the injuries and fatalities which occurred at the mines. Mining is a hazardous occupation with significant risk associated when challenging Nature. While both mines prioritise the safety of their employees there was still significant social impacts from these workplace injuries and fatalities.

There were a total of five fatalities over the lifetime of the two mines, four at Lisheen and one at Galmoy. There were also a number of other injuries and lost time accidents. These fatalities and injuries had a significant negative effect on the victims, their families, colleagues and communities, and some of these effects continue still today.

Another of the social effects from the mines was the employment provided locally and the skills gained by these employees. However, mining jobs are finite; Galmoy operated for approximately 15 years and Lisheen approximately 16 years. As both mines were aware of the depletion of their reserves they were able to implement a "Just Transition" programme for their staff. The report found that both mines offered training and up-skilling programmes to prepare employees for alternative employment once the mine closed.

There was also a generous redundancy package in place. AECOM found there was "significant evidence that these programmes enhanced workers' employability and resulted in relatively high rates of employment among former workers. While job losses in general are certainly a negative event, the evidence in the case of Galmoy and Lisheen suggests that the effects of unemployment on a community can be mitigated by well-planned training and up-skilling programmes. This is a significant finding not only for the mining industry, but for any industry based on the extraction of finite resources".

Other social effects included substantial upgrades to local infrastructure on and around the mine sites, particularly road, energy and water infrastructure. This resulted in positive social effects for members of the local community who benefitted from improved infrastructure and services, but it also represented a permanent asset for other businesses following closure. Both mine sites have attracted additional investment and jobs, and in the case of Lisheen, the National Bioeconomy Campus (https://bioeconomyfoundation.com/) was developed which is considered to be of national importance. The mine also established a wind farm on the site which was later expanded independently of the mine. At Galmoy, an environmental waste services company has established its offices on the site making use of the mine buildings and infrastructure.

Environmental Effects

The report identified a number of negative and positive environmental effects relative to the pre-mining situation, some of which were considered to be significant.

Due to the high energy requirements for mining, the two mines were some of the largest users of energy in Ireland. Galmoy mine consumed over 40,000 megawatt hours (MWh) annually of electricity and fuel, the equivalent of the consumption of over 2,000 households and generated an average of 26,409 tonnes of carbon dioxide (CO2) each year.

Lisheen, the bigger of the two mines and with a significantly higher pumping requirement, consumed more than three times the amount of energy as Galmoy. Lisheen's electricity use per year was equivalent to the amount of energy used by 6,600 households, making it one of the largest users of energy in the country at the time, and it generated approximately 76,737 tonnes of CO2 each year of operation.

While Lisheen's carbon footprint was significant it commissioned and built a wind farm on the mine site, which was later expanded within the local area to include a total of 30 turbines. This wind farm now produces enough energy to fully power 14,200 homes. By investing in renewable energy in the form of a wind farm, Lisheen Mine was able to offset its emissions in later years, and the wind farm continues to generate renewable energy for the national grid.

There were also two land subsidence events at Galmoy. The first occurred in 2002 when cracks appeared in a local minor road following the collapse of a stope (underground mining area) in the mine. This led to the temporary closure of the affected section of road until it was repaired. The cost of the repair of the road was covered by the company.

The second occurred in 2014, when a sinkhole appeared on the farm of a local landowner after a period of heavy rainfall. Again the company paid for the rehabilitation of the land. While there were no injuries in both cases the subsidence and subsequent effects had a negative impact on the local communities.

As an example of a trade-off between 'capitals' both mines resulted in a change of land use from farm land to industrial use. While farming continued on parts of each site at different times, it represents an overall loss of farmland and agricultural output during the operation of the mines. However, compared to the increase in Gross Value-Added by the mines, the effect of this is considered to be minimal from an economic perspective.

Much of the land has now been rehabilitated to an agricultural end-point. In addition, at Lisheen there was also the loss of peatland. As the peatland itself was being worked or had been worked prior to the mine it was already considered degraded, meaning that the effect of the mine wasnot significant. As part of the mine rehabilitation, the mine sites have been de-contaminated and a number of buildings demolished.

However, some key buildings and infrastructure have been preserved and these represent a permanent manufactured capital asset. These very capital assets have allowed for the continued industrial activity at both sites.

One of the crucial issues with the closures of Avoca and Silvermines was that when the time came to actually close the mines the companies did not have the funds in place to rehabilitate the sites. As a result, when both Galmoy and Lisheen opened, the authorities required the companies to prepare a Closure, Restoration and Aftercare Management Plan (CRAMP) and to set aside the required funding to cover the cost of each closure.

This funding remained in the control of the three key authorities, the Local Authority, EPA and EMD for the life of the mines and beyond into aftercare. The CRAMP and associated funding remained dynamic

and both mines carried out a number of revisions during the operation of their respective mines.

With regard to the rehabilitation of the mines AECOM concluded, based on available evidence: "that the rehabilitation works required by the CRAMP were carried out to a high standard and to the broad satisfaction of the authorities and local communities. As the first mine in Ireland to close under the EU Mining Waste Directive, the works carried out at Galmoy, such as the creation of new wetlands and resulting benefits for water quality and biodiversity, have been noted as examples of best-practice and fed into the closure plans of other mines, including Lisheen. In the case of Galmoy, it was awarded the 'International Green Apple Award for Environmental Best Practice' in relation to the restoration of the TMF (Tailings Management Facility)".

With regard to both surface and groundwater, and despite the significant amount of data from the mines, it was not always possible to distinguish between the impacts of the mines and that of other external environmental influences. Nevertheless AECOM noted: "that water quality in particular was strictly monitored, and where significant issues did arise however, authorities and mining companies took action to remedy them and limit the impact on wider ecosystems".

Economic Effects

The overall economic impact of both mines on the local communities was positive. This effect was not just felt by the local economy but also the national economy. The mines generated billions (bn) of euro worth of spending in the local and national economies and hundreds of millions of euro worth of tax, royalties, rates and other contributions for the State and Local Authorities. In general, Lisheen had the larger economic impact of the two mines as it earned more revenue, had higher expenditures and paid more in taxation due to the greater size of the deposit.

AECOM estimated that the combined Lisheen and Galmoy operations generated turnover of approximately €3.4bn. It is estimated that this led to total lifetime expenditure of approximately €7.5bn, comprising approximately €3bn direct spending, €2.5bn indirect spending and €2bn induced spending.

The mining operations supported 563 jobs directly and a further 518 indirectly. It is also estimated that a further 275 jobs were induced from their activity.

In terms of contribution to public finances, it is estimated that combined payments of approximately €300m were made to the various authorities. These comprised royalties of €78m, Corporation Tax of €56m and, on the employment side, PRSI of €51m and PAYE of €108.3m (paid by employees). On a regional basis, the contributions to Local Authority Rates are estimated at €19.7m, while Development Contributions are estimated at €79m.

In total, the combined Gross Valued Added to the Irish Economy of both mining operations is estimated at approximately €1.6bn. These figures are summarised in Figure 2 below, and individual estimates for the mines can be found in the infographics of Figures 3 and 4.

AECOM also noted that as well as these more traditional economic metrics, "one of the most significant economic effects examined was the increase in manufactured capital. There were substantial upgrades to local infrastructure on and around the mine site, particularly road, energy and water infrastructure.

This resulted in positive social effects for members of the local community who benefitted from improved infrastructure and services, but it also represented a permanent asset for other businesses following its closure. Both mine sites have attracted additional investment and jobs, and in the case of Lisheen, a development of national significance on the site with the development of the National Bioeconomy Campus".

Economic Indicator	Total
Sales and Turnover	
Value of Sales (Turnover)	€3,401,020,000
Total Lifetime Expenditure Effect	€7,527,904,660
Direct Expenditure Effect*	€2,965,864,000
Indirect Expenditure Effect	€2,529,884,830
Induced Expenditure Effect	€2,032,155,830
Average Total Jobs Supported	1356
Average Direct Employment	563
Average Indirect Employment	518
Average Induced Employment	275
Contribution to Public Finances	€293,156,179
Royalties	€78,056,179
Corporation Tax	€55,900,000
PRSI	€50,900,000
PAYE (paid by employees)	€108,300,000
Local Authority rates	€19,700,000
Development Contributions	€7,892,122
Gross Value-Added to the Irish Economy	€1,591,290,000

Figure 2 Summary of the combined economic indicators for Galmoy and Lisheen.

What now?

The AECOM report has provided us with an evidenced based critique of modern day hard rock mining in Ireland. The independent assessment places before us all the available facts on the opening, operation, closure and rehabilitation, under modern Irish and European legislation, of both mines. To tie this all back to Dr Schuitema's point, the public thinks about how bad things can be and of the consequences, we now have independent evidence for the consequences of mining in Ireland and opinions can be informed by data and not 'inferences'.

It is important now that we look to the future and what societies will require from mining in the years to come.

Figure 3 Infographic of key social, environmental and economic effects of Galmoy Mine.

Figure 4 Infographic of key social, environmental and economic effects of Lisheen Mine.

At the Prospectors and Developers Association of Canada conference in 2020 the Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (https://www.igfmining.org/) set out their vision for global mining in the future. In their vision there is an advanced mining environment, where mines are safer, have smaller environmental footprints and excellent community relations.

Some of the metrics for this mine of the future are:

- Smaller environmental footprints
- Strong relationships with local communities
- Greater social acceptance
- Safer working environments
- Developing the skills of the workforce
- Increased automation, machine learning and digitisation
- Greater energy efficiency and use of renewables
- Climate change adaption in the mine design and management
- Water supply companies
- Energy storage providers
- Land management companies

Reading through the AECOM Report, we can see that both Galmoy and Lisheen reflect this vision. The report finds that robust national and European legislation and enforcement by the relevant authorities require the Irish mines to operate to the highest international environmental, safety and human rights standards. Both mines had sponsorship programmes in the communities and worked to develop better relationships with their neighbours through the life of the mines. Despite the tragic fatalities at the mines, the companies put a strong emphasis on safety and on the training of their employees.

This training and a "Just Transition" effort developed the skill sets within these localities. The report also finds that both mines increased the biodiversity in the locality. In the case of Lisheen it developed a renewable energy resource on site which it used to offset its carbon footprint. This resource continues today, five years after the closure of the mine to provide renewable energy for the national grid. During their operation both companies were, out of necessity, water companies supplying free water to the localities.

After closure both the water supply schemes at Galmoy were handed over to Irish Water and at Lisheen the existing water supply scheme was upgraded and continued under the management of the local community.

We have fully committed to transitioning to a circular economy, which will entail minimising resource use and waste while maintaining the value of materials for longer through better design, durability, repair and reuse. However, with the world's transition to a low carbon society, the continuing supply of raw materials will still be essential.

The European Commission has acknowledged this in the European Green Deal, which sets out a roadmap to carbon neutrality by 2050 but identifies that access to raw materials is key to delivering on this ambition. But this supply cannot be at the expense of local communities or a well-protected environment. It is incumbent on all involved that the supply of these key components of the transition is to the benefit of all.

For those who wish to get more information on the AECOM Report 2020 it is available here on gov.ie

https://www.gov.ie/en/publication/29332-a-social-environmental-and-economic-assessment-of-galmoy-and-lisheen-mines/

Substituted Planning Consent: no longer a feasible option

by Brendan Ringrose, Partner, Whitney Moore

The recent judgment of the Supreme Court handed down on 1st July this year in the case of An Taisce/ Peter Sweetman v An Bord Pleanala and J. McQuaid Quarries Limited will have important knock-on effects for quarrying and peat extraction operations in Ireland. The case concerned the conduct of quarrying operations in two separate locations; one quarry was owned by J McQuaid Quarries in Co. Monaghan and the other by Ms. Sharon Brown in Co. Kildare. The case addressed the use of the "substituted consent" procedure under the Planning and Development Act, 2000 (as amended) (the "Act") in light of EU law including the Environmental Impact Assessment (EIA) Directive 85/337 (as amended).

Before the judgment was handed down, the substitute consent procedure under the Act which was a form of retrospective planning permission, was often adopted by owners of quarrying operations after the quarrying operations had commenced. It allowed the operator to be granted planning permission, in some cases, without filing an Environmental Impact Assessment (EIA) and the usual period of public notice and consultation. There are essentially two stages in a planning permission application in relation to a substitute consent regarding quarrying and similar operations.

The first step, is a "leave to apply" stage in relation to which the Act does not provide for public participation (i.e. notice to or consultation with the public). At this stage the applicant must meet the "exceptionality test" and demonstrate exceptional circumstances that warrant leave to apply being granted. If the applicant is successful at this stage and leave to apply is granted, the second step is the "substantive application" for substitute consent at which notice is provided to the public which is entitled to make legal submissions in relation to the proposed planning permission.

However the exceptionality test, having previously been satisfied, is not part of the substantive application.

In this case An Bord Pleanala ruled that it could not accept submissions from An Taisce at the leave to apply stage, the reason being that the Act did not expressly provide for this. In many cases success at the leave to apply stage is critical and if the applicant such as a quarry operator is granted leave to apply there is some prospect that the ultimate planning permission will be granted at the substantive hearing.

The Supreme Court however found that the use of the substitute consent procedure was a retrospective regularisation and had to comply with EU law (including the EIA Directive). The Supreme Court held that this had to be the case "as otherwise developers may be incentivised to ignore or disregard the requirements of a prior consent/ EIA: in other words, national measures cannot act as an inducement to avoid EIA Compliance.... Therefore, such regularisation must remain the exception, rather than the rule." With this in mind the Supreme Court found that the Act did not sufficiently limit the circumstances to which the "exceptionality test" applied and it had therefore failed to comply with judgments of the European Court of Justice and failed to implement correctly the EIA Directive.

The second issue decided by the Supreme Court was whether members of the public have any right to participate in the application for leave to apply for substitute consent or whether instead such right is limited to the substantive application. The Court noted that the application for leave stage is not a mere box-ticking exercise rather it is a highly significant aspect of the overall process and issues such as exceptional circumstances and the circumvention of EU law are finally determined at the leave to apply application.

Mr. Justice McKechnie decided that the clear intent of the Oireachtas in framing the Act was that the public is not granted a right under the Act to make submissions at the application for leave stage and as a result public participation was limited to the substantive application.

However EU law including the EIA Directive, which takes precedence over Irish law, requires that the public be entitled to participate at the application for leave stage of the substitute consent procedure. In this regard the Act was inconsistent with the EIA Directive.

The result is that the use of the substituted consent or retrospective regularisation in relation to retention planning permission regarding quarrying operations along with certain peat extraction operations has been severely restricted. Quarry operators should in future consult with their advisers at an early stage in order to consider issues in relation to planning permission before commencing quarrying operations.

WHITNEY MOORE
LAW FIRM

Brendan Ringrose (brendan.ringrose@whitneymoore.ie on 01 6110000) is a partner in Whitney Moore Law Firm in Dublin and advises clients in the Minerals and Natural Resources Sectors. He is also a former group leader of the World Association of Mining Lawyers and has spoken at the Irish Seminar at the Prospectors and Developers Association of Canada conference in Toronto, Canada.

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Recent Activites of the IAEG

by Ally Barrow, Secretary – Irish Association for Economic Geology

The IAEG are, as always, pleased to contribute to the 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.

2019

2019 was business as usual for the IAEG, with a busy year of events. We had several brilliant talks in our annual lecture series as well as 2 very popular courses, a seminar workshop and our AGM.

The 2019 conference, entitled Mining: Our Future was held in Kilkenny. 2019 was also the year we saw a modernising of our branding and social media platforms in line with our new website.

Lecture Series

The IAEG hosted five talks in the 2019 Lecture Series. The series was started off by Gerry Stanley in February, with a light-hearted take on his career in Irish geology entitled 'I Got My Degree and Then a Funny Thing Happened'.

In March, Colin Andrew presented his excellent lecture 'Colombian Emeralds, A Product of Over-Pressurised Basinal Fluids, Dissolved Sabkha Evaporites and K-T Boundary Tectonics', discussing gemstone formation linked to regional basin development and his experiences of life in a Colombian emerald mine.

In August, Professor Stephen F Cox of the Australian National University, presented members with the results of his latest research into hydrothermal fluid dynamics in ore forming systems in a talk entitled: 'The Dynamics of Permeability Enhancement, Fluid Flow and Ore Deposition in Overpressured, Fault Controlled Hydrothermal Systems'.

Dr. Sarah Gleeson of the GFZ Helmholtz Centre, Potsdam, presented 'Diagenesis Sulfur and Giant Zn Deposits' to our members as part of her lecture tour with the SEG visiting lecturer programme.

Closing off the year in December, Aiden Lavelle of Erris Resources presented an informative overview of recent developments of The Abbeytown Project, prior to our 2019 AGM.

IAEG Courses and Seminars

The IAEG ran three courses in 2019. The first, held in February was our biennial Applied Geophysics Practical Field Course which took place in Clonbur, Co. Galway. The course introduced the students and early-career geoscientists in attendance to the applications of various geophysical techniques used within mineral exploration. The course also provides valuable hands-on experience with instruments and the processing and interpretation of data collected over the weekend.

Presenters and IAEG Council Members at the 2019 'Mining: Our Future' Conference in Kilkenny.

In October, the very well attended Characterisation for Resource Development one-day seminar was hosted by Grinding Solutions. The seminar comprised nine presentations which aimed to introduce attendees to the concept of geometallurgy and detailed its vital role in the characterisation of mineral resource deposits, emphasising the importance of early stage ore/waste characterisation programmes.

Following shortly after in November, Dave Stewart presented his always highly anticipated QA/QC course at the Radisson Blu Hotel in Athlone. The course provides an introduction to sampling theory and practice, laboratory procedures and analytical quality control with an emphasis on practical QA/QC skills.

2019 Annual Conference

The 2019 IAEG Annual Conference was held over the weekend of 11th-12th May at Hotel Kilkenny. The conference was titled 'Mining: Our Future' and addressed future prospects and opportunities, as well as the challenges Irelands mineral industry will face.

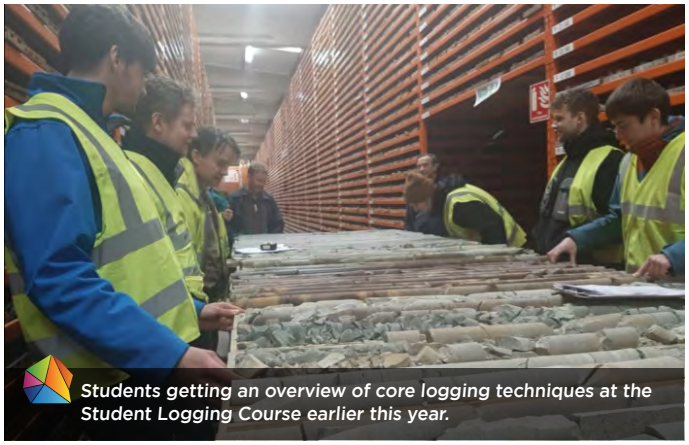
2020

Like many businesses and organisations, the IAEG have had to make changes to the way we do things since the advent of COVID-19 in order to provide our members with talks and events. Early in the year we made the decision to postpone the annual conference and of course, suspend all physical lectures. The IAEG are delighted to now be hosting our 2020 Lecture Series online via Google Meet. We have held 2 talks so far which were incredibly well attended and with more planned for the remainder of the year.

The IAEG were fortunate enough to be able to host one physical event before lockdown began. On 27th February we held our popular, biennial Student Logging Course, this year hosted at the GSI corestore in Sandyford and presented by Dave Stewart and John Colthurst.

The course aims to provide attendees with an introduction to core logging techniques and the hands-on experience of logging, guided by industry professionals. Attendees are also provided with a workshop on industry best practice quality control procedures.

Nick Wilshaw closing up the day at the Characterisation for Resource Development seminar.



Students getting an overview of core logging techniques at the Student Logging Course earlier this year.

Upcoming Talks

On August 18th, Mark Burnett of AMC Consultants will be presenting an extended talk and discussion entitled 'Reporting Standards in Ireland: An Introductory Comparison and General Prerequisites' via Google Meet.

The remainder of 2020 is set to be busy as we are now up and running with our online talk platform and adapting to this new normal. We are in the process of finalising more talks in our lecture series, as well as the possibility of online courses and a symposium.

Work continues to progress on publication of an update to the IAEG 'Blue Book' - Carboniferous stratigraphy of the Irish Midlands, in joint association with Mike Philcox and iCRAG.

Minerals 2021 Conference

Unfortunately, our highly anticipated turn of the decade conference 'Minerals 2020 Europe's Past, Present and Future', due to be held 14th-16th May at the Salthill Hotel in Galway this year, was postponed due to COVID-19. The conference planned to explore Europe's past mining tradition, document current activity and look to the future for the sector. The conference will now be held at the same location in 2021, updates regarding Minerals 2021 will be published on the IAEG website and social media channels in due course.

A summary of all IAEG events and articles form industry, government and academia are provided in the IAEG 2019 Annual Review. For access to our publications and updates on future events, please visit www.iaeg.ie.

Update on The International Thermonuclear Experimental Reactor

by Michael Keane - principal, M. Keane Consulting

The project is known as ITER, the International Thermonuclear Experimental Reactor. I wrote a short article for last year's Review – here's a quick update.

A reminder on the ITER project

This is an international project to prove that power from fusion - the same energy source that powers the Sun - is sustainable and can be produced on a commercial scale on Earth. The ITER facility is being built by a scientific partnership that includes the European Union, China, India, Japan, South Korea, Russia and the United States.

ITER's highly specialised components - many of which are unique - are being manufactured in industrial facilities all over the world. Once they reach the ITER worksite they'll be assembled into the final machine. The cost of the project will be more than €20 billion and is funded by all of the nations involved.

So what is fusion and where does ITER fit in?

The promise of fusion energy once seemed fantastical and unattainable; it is the power behind the Sun and the stars. In a fusion reaction, two light atomic nuclei combine, form a heavier nucleus and release energy. The big challenge: to reproduce a similar reaction in a fusion machine on Earth.

A small amount of deuterium and tritium (hydrogen) gas is injected into a huge, donut-shaped chamber known as a Tokamak. Once in operation, the hydrogen is heated until it becomes ionized plasma.

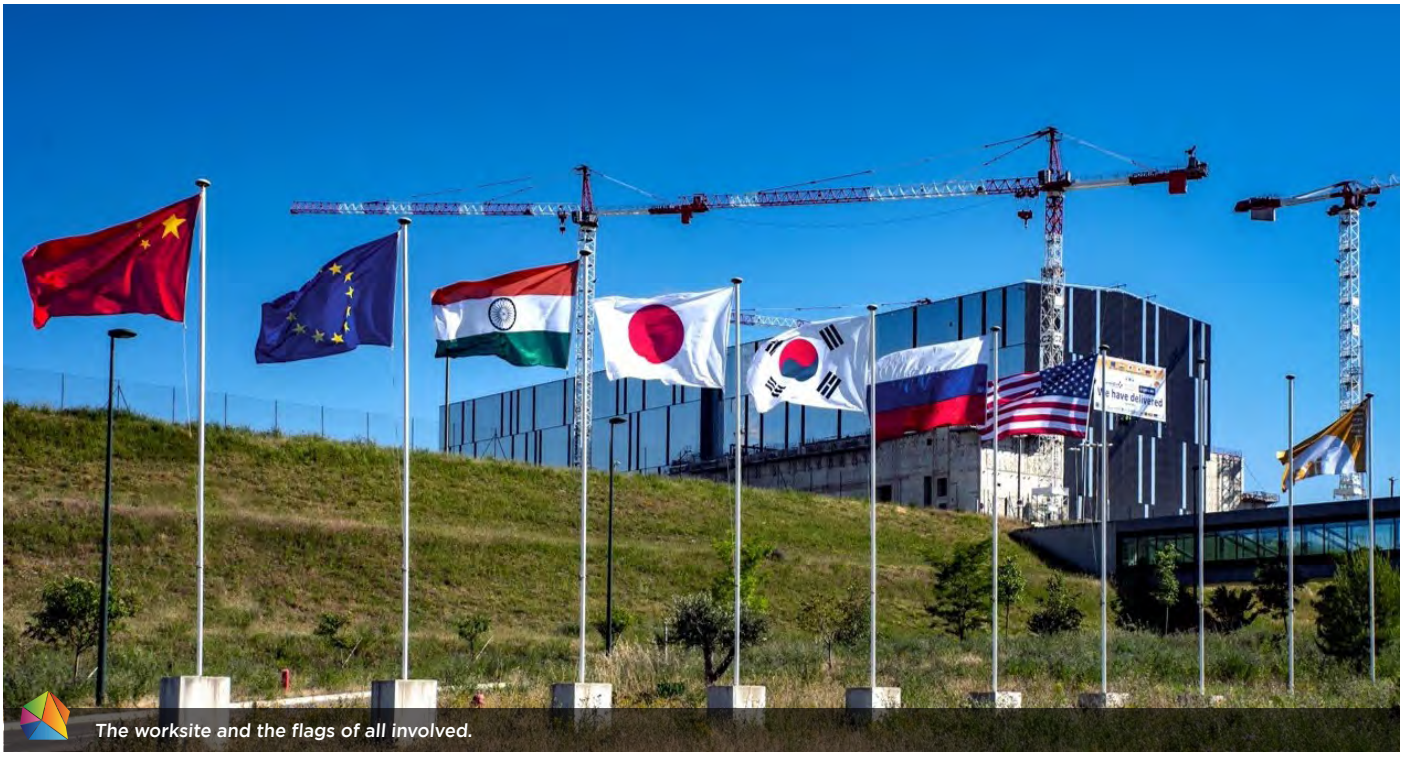
Integrated with the Tokamak are giant superconducting magnets that confine and shape the ionized plasma, keeping it away from the metal walls - the central solenoid is powerful enough that it could lift an aircraft carrier out of the water. These magnets have to be cooled to minus 269 degrees Celsius – the temperature of interstellar space – to be superconducting.

When the hydrogen plasma inside the Tokamak chamber reaches 150 million degrees Celsius (many times hotter than the core of the Sun), fusion occurs.

Water circulating in the Tokamak walls receives the heat and converts to steam. This energy will be harnessed to provide the heat for the operation of power plants of the future. The ITER machine itself will not produce any energy to power an electricity generating plant but will prove the concept for commercial operation.

The environmental bit

Fusion energy is carbon-free, environmentally sustainable and much more powerful than fossil fuels. ITER's fuel



The worksite and the flags of all involved.

The work site – mid-2008.

The work site – summer 2020.

is recycled for re-use. Fusion produces no high-activity, long-lived radioactive waste.

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

So what has happened in the last year

The coronavirus has forced us to rethink our approach, and indeed it hasn't been easy for us all but the team has managed to keep the project going on schedule. Most of the office-based people were working at the same pace off-site for the last few months and so progress on the design and manufacture of the machine has continued around the world.

The arrival of Covid-19 coincided precisely with the timing when many of ITER's First-of-a-Kind components were expected to arrive onsite, in many cases coming from ITER Member countries heavily impacted by the pandemic.

With exceptional effort, we have witnessed the arrival of the first magnets (Toroidal Field Coils from Japan and Italy; Poloidal Field Coil #6 manufactured in China), the first vacuum vessel sector from S. Korea, and extraordinary volumes of smaller components, tooling and support equipment arriving by land and sea.

The on-site construction has also continued, with great efforts and vigilance by all, to ensure it continued safely.

An event to celebrate the beginning of the ITER machine assembly on the site took place in July. The moment was indeed historic, ten years after the start of construction in August 2010 we reached this major milestone for the project. The event was hosted by the French President Emmanuel Macron, with contributions from political and technical leaders all around the globe, again emphasising the scale of this project.

So it continues heading for the start-up for 2025.

The base of the cryostat is lowered into position this summer – the 30m. diameter cryostat acts as a giant thermos, insulating the magnetic system at cryogenic temperatures from the outside environment.

Industry Leader

Dr Marie Cowan PGeo, MIoD, MRIA
Director, Geological Survey Northern Ireland

Marie is a member of the senior management board of the British Geological Survey (BGS) and Director at its Belfast office, the Geological Survey of Northern Ireland (GSNI). GSNI is an office of the Department for the Economy (DfE) staffed by scientists of the BGS.

GSNI provides professional, technical and geoscientific research services and archive management to support the legislative responsibilities and strategic priorities of DfE.

GSNI actively engages and works with all parts of civic society, including central and local government, industry, academia, community and non-governmental organisations, schools and the general public.

GSNI also collaborates on geoscience research with the BGS, the Geological Survey of Ireland (GSI) and over 35 universities in order to support Northern Ireland's economy and protect its environment

Amongst Marie's achievements is the cross-border collaboration on the multi award-winning Tellus geoscience programmes together with the Geological Survey of Ireland to benefit the island's economy and research ecosystem. The communications campaigns of which received five industry awards from the Chartered Institute of Public Relations and the Public Relations Institute of Ireland. Marie also masterminded a multi-lingual communications campaign for OneGeology, a flagship project for UNESCO's International Year of Planet Earth which reached a global audience of 107 million. Marie introduced the MLA-Geoscientist Pairing Scheme to Northern Ireland and the Scientist and Oireachtas Member Pairing Scheme in Ireland to enrich evidence-based policymaking and knowledge exchange.

This year Marie was elected a Member of the Royal Irish Academy (MRIA) for her contribution to geoscience and wider society on the island of Ireland. Recognised internationally, the Royal Irish Academy has been honouring Ireland's leading contributors to the world of learning since its establishment in 1785. Past Members include Seamus Heaney, former Presidents of Ireland Mary McAleese and Mary Robinson, Dame Nuala O'Loan and GSI's Koen Verbruggen.

Pictured in Brussels Feb 2019 with Dr Aoife Braiden, GSI (right), Professor Maeve Boland UCD (left) and Mairead McGuinness MEP, now Ireland's new EU Commissioner.

On receiving this accolade Marie said: "I am absolutely honoured and privileged to be elected a member of the Royal Irish Academy. (Before Covid19) Geoscience accounted for 34,000 jobs and 6,150 businesses in Northern Ireland with aGVA1 of £2.1 billion per year putting it on a par with agriculture in term of jobs and a GVA total close to that produced by construction. I look forward to progressing the Academy's mission to champion academic research and promote awareness of how science and the humanities enrich our lives and benefit society".

Currently Marie is leading the development of a new strategy for GSNI and considering feedback from 590 survey respondents and 120 stakeholders focussed on climate change, the energy transition, security of minerals supply and science in society.

Marie is a certified member of the Institute of Directors and holds both the IoD Certificate and Diploma in Company Direction. She is a professional geologist with the Institute of Geologists of Ireland. She is also a member of the NI Assembly All Party Group for STEM and the RIA's Geosciences and Geographical Sciences Committee, North-South Standing Committee and Higher Education Futures Working Group. Marie is a board member of the Irish Centre for Research in Applied Geosciences at University College Dublin. She is currently chair of a Social Enterprise in her local community.

Marie earned a 1st Class Hons degree in Geology (1998) and PhD (2002) from Queen's University, Belfast.

Marie lives with her husband Sean and their four children in the Mourne Mountains, County Down.

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Delivering an Emergency Response for Abandoned Mines

a multi-agency approach to reducing public risk

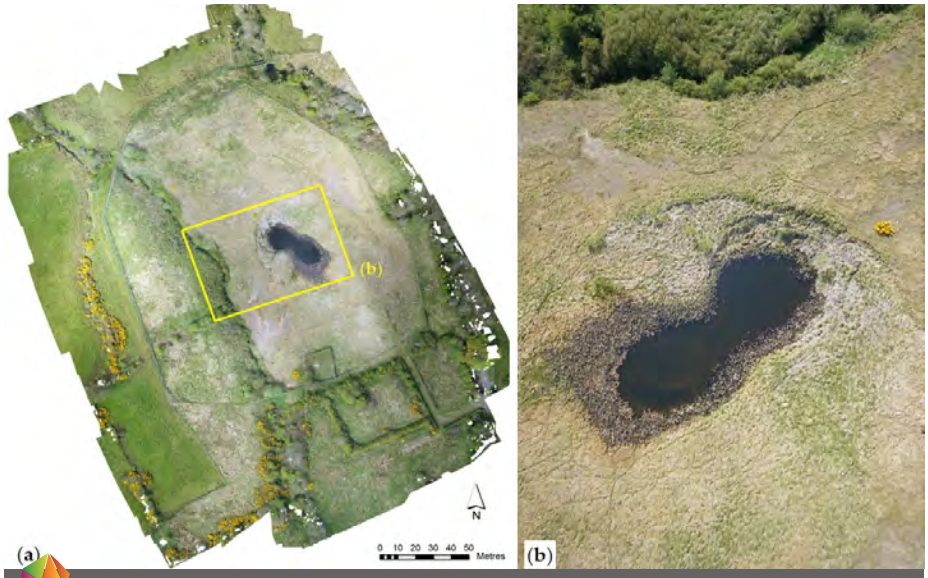
by Kirstin Lemon and Kieran Parker, Information and Infrastructure Team, GSNI

Northern Ireland has a mining legacy that dates back centuries. Providing important resources and employment, mining was a flourishing industry right up until the early part of the 20th century.

A variety of materials were mined from coal to power our towns and cities, clay which gave rise to important pottery industries and bricks to build our homes, metals such as lead, iron, aluminium and copper that supported the industrial revolution, and salt which is still mined today for use as road salt locally, and exported throughout the UK and Ireland.

This legacy of historic underground mining activity is evident in the 2,400 abandoned mine workings found across Northern Ireland. A reminder of the once thriving industries that have taken place over the past 400 years. It has also left a legacy of surface instability above disused mines, and the existence of abandoned mine workings can be a serious problem in relation to planning, development and for public health.

All abandoned mines in Northern Ireland are vested in the Department for the Economy. The Department manages all associated risks with abandoned mines including public safety, risk to infrastructure and assessing any environmental impacts. This is carried out by the Geological Survey of Northern Ireland (GSNI) as part of the Northern Ireland Abandoned Mine Monitoring (ABM) programme. This involves onsite geotechnical and environmental impact assessment of approximately 200 mine workings annually conducted on a priority basis. The programme also includes long term monitoring of land stability above abandoned mines using both terrestrial and sub-surface instrumentation as well as analysing surface motion data acquired from satellites. The ABM programme identifies potential risk and allows for the implementation of measures to manage and mitigate that risk with the assistance of appointed consultant mine engineers who have additional expertise in this field.



Aerial photos of Maidenmount mine: (a) UAV derived ortho-photograph and (b) a close up of the crown hole at Maidenmount, acquired in 2016.

Multi-agency mine rescue exercise carried out at the Marble Arch Caves, Co. Fermanagh.

Whilst the ABM programme minimises the likelihood of risk associated with abandoned mines, collapses can and do happen. Most of these are small events, often in remote rural locations, so the risk to public health and infrastructure is minimal. These are often in areas where the records associated with historic mining is poor, incomplete or absent altogether, although this is diminishing as monitoring work continues. However, larger events, although rare, still have the potential to occur.

One area where the hazards associated with abandoned mines has been most visible is around Carrickfergus in Co. Antrim. The town contains eight abandoned salt mines that operated

from 1852 until 1958 and produced up to 50,000 tonnes of salt annually. Originally developed using pillar and stall methods, several of the mines switched to solution brine methods resulting in the dissolution of the supporting salt pillars creating surface instability. A number of collapses are recorded with subsidence ongoing in several areas. The most dramatic of these has been the collapse at Maidenmount salt mine where a crown hole developed in 2001 creating a depression 30m deep and over 100m in diameter. While there were no injuries to the public, infrastructure and utility networks needed to be relocated thus highlighting the associated hazards.

The risk to the public from further events in and around Carrickfergus is minimal due to mitigation measures put in place by the Department for the Economy. By using knowledge obtained through regular monitoring to inform appropriate mitigation it ensures that the risk to the public is greatly reduced across all of Northern Ireland. The GSNI has also been proactive in ensuring that if a major incident in relation to an abandoned mine anywhere in Northern Ireland did happen, there are procedures in place to for an appropriate emergency response.

The GSNI, together with the Department for the Economy has taken the lead in developing a multi-agency abandoned mine Emergency Response Plan (ERP), involving the Department for Justice, Police Service Northern Ireland, Northern Ireland Fires and Rescue Service, Health and Safety Executive, and District Councils together with local rescue organisations.

This was developed following a review carried out by GSNI and the Department into our preparedness in the event of a major incident at an abandoned mine where there was a potential threat to life. The review found areas for improvement within the emergency response provision in Northern Ireland, and a lack of access to essential geoscience information for first responders including the location of shafts, mine plans, and awareness of potential mine hazards.

The development of the abandoned mines ERP involved in-depth discussions with all relevant stakeholders on the risks associated with abandoned mines and the importance of using geoscience information in risk reduction, the development of spatial datasets and incorporation into emergency response systems, training and awareness raising for emergency services and, the production of task cards for the emergency services control centre. It also involved an abandoned mine ERP live exercise to test our capability to respond and perform a rescue in various situations including a mineshaft collapse, a major subsidence event and a person trapped within an abandoned mine.

It has taken nearly three years to develop the abandoned mines ERP to its current stage, and it has now been officially adopted by the Northern Ireland government, and incorporated into resilience planning and management strategies. The abandoned mines ERP should be seen as an example of best practice in using a multi-agency approach to minimising public risk and preparing for a major incident associated with abandoned mines, highlighting the need to work together to achieve a common goal. Building on the successes to date, the ERP is constantly evolving, and will continue to do so to reflect a rapidly changing world. Ongoing evaluation of the current ERP and regular discussions with relevant stakeholders ensures that the optimal solution for abandoned mines emergency response continues.

Kirstin Lemon and Kieran Parker
Information and Infrastructure Team
Geological Survey of Northern Ireland

iCRAG 2019/2020 update

by Dr Fergus McAuliffe, iCRAG Communications Manager

2019 was an active year for iCRAG, the SFI Research Centre for Applied Geosciences. As a 150-strong team of researchers across 8 Irish research institutions, and hosted by University College Dublin, much of our work has been focussed on creating innovative solutions for a sustainable society that is increasingly embracing the green wave and a low carbon future.

The mainstay of our research continues to be in areas that are critical to society and the economy, including, the sustainable discovery and optimisation of energy resources and raw materials required for decarbonisation, the protection of groundwater and marine resources, and advancing our knowledge on Earth's hazards such as flooding and landslides.

In July 2019, iCRAG hosted the inaugural Researching Social Theories, Resources, and Environment (ReSToRE) International Summer School. Focussing on the nexus of geoscience and social science, ReSToRE brought together 42 postgraduate students and early career practitioners from 28 nations (pictured), including 18 developing countries, with eight distinguished mentors to learn, share, and debate how best to provide the earth resources needed to support society and enable the transition to a low-carbon economy in a sustainable way. Held under the patronage of UNESCO, sponsorship came from BHP, Boliden, Rio Tinto, Teck, with additional support received from the Irish Research Council and UCD College of Business.

The Centre has increased its global network through exhibiting at numerous industry and trade show conferences, including the Prospectors and Developers Association of Canada (PDAC) trade show in Toronto, the Society of Economic Geologists (SEG) annual conference in Chile, Roundup in Toronto and the Society for Geology Applied to Mineral Deposits (SGA) in Glasgow. Internationally, iCRAG is working closely with Embassies and Consulates of Ireland in Canada to promote iCRAG activities in this important trade market. Domestically, iCRAG was active at several key resource and environment conferences including Atlantic Ireland, the Irish Association of Hydrogeologists (IAH), Environment Ireland, International Union of Quaternary Research (INQUA) 2019, IGRM (Irish Geological Research Meeting) and the Institute of Geologists of Ireland (IGI) annual conference.

iCRAG continued to build upon its world-class research in raw materials through utilization of extensive industry data sets. This has expanded to new regionals, such as the Limerick Syncline, and application of structural models with seismic data sets are providing industry with new target fairways for mineral exploration. Our research to better define geochemical vectors to aid in identifying prospective areas has advanced with a number of projects using mineral chemistry to help define and characterise hydrothermal fluids, along with understanding the processes and distribution of hydrothermal alteration related to mineralization. Furthermore, iCRAG research to better characterize and distinguish aggregate quarry sources builds on our in-house analytical equipment and our data analysis techniques, as showcased in a paper in the Journal of Engineering Geology and Hydrogeology. The Centre's pioneering work on Irish building materials, in particular aggregates for roads and cement blocks, will be of increasing importance to the country as part of Ireland's long-term infrastructure roadmap, Project Ireland 2040.

2019 culminated in the iCRAG2019: Resources for a Sustainable Future conference. The conference brought together 250 members of the geoscience community, including academics, industry and government to deliver insights into future directions for Irish geoscience research and how the geoscience research sector can play a leading role in addressing the Climate Action Plan and Ireland's commitments to the UN Sustainable Development Goals.

While 2020 has brought many new challenges to the way our society operates, we look forward to meeting these challenges and strengthening our relationships with IMQS partners in support of solutions for our sustainable future.

Participants at the ReSToRE summer school on the fieldtrip to the Wicklow mountains.

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Technology Developments in "The New Norm"

by Brian Carroll, (Parts, Service & Warranty Lead & Sales Manager Mining Ireland) Sandvik Mining and Rock Technology Ireland

2020 will be a year that we all will remember for this and many years to come. With the enormous impact of the Coronavirus (COVID-19) pandemic on our health, economic and social norms, all companies and industries in Ireland and around the world have had to embrace new norms to ensure that they remain and continue to be as successful as possible. Whether its online meetings, embracing new technologies or changing old ways of working, the pandemic has changed or will change all industries old norms in the near and distant future.

Sandvik TH551.

After 21 years working with Sandvik (and Tamrock), I have seen a dramatic and renewed focus on embracing of the technologies that we have today to sustain our customers business needs globally. My team and I have also seen, (from working with & collaborating with our colleagues around the world) a faster development of upcoming technologies.

For example, on our underground drills, my Drills Specialist (Sean Loughman) and I have kept in close contact with our Tampere factory team to be kept updated on the Byrnecut and OZ Minerals successful implementation of the world's first automation upgrade for Sandvik development drill which was all implemented during the pandemic, despite the challenges of COVID-19.

Byrnecut introduced a Sandvik DD422i development drill, featuring the package, to OZ Minerals' Prominent Hill Mine in March. With COVID-19 travel restrictions preventing Sandvik staff from attending site, Byrnecut, OZ Minerals and Sandvik experts collaborated via phone, Teams meetings, teleconference and email to complete remote commissioning of the rig.

The two-boom rig, which can be monitored and controlled from the surface and features a sophisticated boom-collision-avoidance system, has now been in operation for past few months. The new

Sandvik LH518B underground loader.

Sandvik DD422i.

automation features allow for enhanced drill operation across shift changes – historically a period when development drilling has stopped or been significantly reduced. This upgrade gives a conservative expectation of at least a 10% productivity increase. This figure is expected to improve even more by both Byrnecut and Sandvik as it becomes more and more the norm of everyday operation.

The new boom collision avoidance system means both of the rig's drill booms can be left in operation during shift change – something that was previously not possible. In the first few weeks of operation, the drill has been able to drill 60-70 holes during shift change while being operated autonomously and remotely from surface.

Both Sean and I have also seen the embracing of Sandviks DIGITAL DRILLER simulator from our customers sites in Africa and USA. This now also allows Sandvik to ship the simulator to a customer site (wherever globally) and then, via online training, allow the Sandvik Drill Master to train operators remotely at the mine site from our Tampere base. We are looking at bringing such a simulator to Ireland for high level Drill Master training at Boliden Tara Mines in early 2021.

From an automation perspective on our Load and Haul side of the business, leading underground mining contractor Barminco launched BROC (Barminco Remote Operating Centre) in July and successfully trialled, in collaboration with Sandvik and Independence Group NL (IGO), a new operations centre that allows it to remotely operate underground equipment on a client's mine site anywhere around the world.

My Load & Haul and Automation Specialist (Oliver Boland) and I have closely monitored this project for knowledge building and future developments in the field of Automation, where again things are ever changing and developing.

In what they believe is a world first, Barminco operated a LH517 loader, working underground, from its head office in Perth at a client mine site in the Goldfields, located at IGO's Nova Minesite, almost 1000 kilometres away. The innovation was made more impressive given the remote operation occurred via the internet, instead of through a fibre-optic cable, which is the method that mine owner-operators have historically used.

Barminco's long-term vision is to have a dedicated remote operating centre manned 24/7 where their team and their client's people can work collaboratively side by side to deliver world class operations around the world.

The pandemic also saw Sandvik collaborate with our global teams and customers to present a successful 2-day virtual event in September where we presented our upcoming technologies and features as well as our new equipment & product launches.

This included the world's largest underground, 100% battery powered loader, the Sandvik LH518B loader. Sandvik's next stage of development is to bring automation to this loader, where we will begin to see the true future of underground mining. Battery driven autonomous machines. During the event, Sandvik unveiled a concept loader of the future (battery driven, autonomous and no operator compartment). The future will bring "clean air" mines with clean operator locations (onsite or remotely).

2020 and the pandemic has been and continues to be a difficult time for both supplier and customer but with the technologies available today and the developments over the years from ourselves and all other OEMs, all our us working together can still make the impossible, possible and reduce the impact on the industry.

With the pace of R&D and delivery of new technologies, the world today is in a lot better place to continue in such a "new norm" than it would have been 21 years ago when I started my own career with Sandvik (and Tamrock).

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The history of Rubislaw Quarry: A timeline of events

by Lauren Jack, Evening Express, Aberdeen

For more than 200 years, Rubislaw Quarry was a major contributor to the Aberdeen economy.

An estimated six million tonnes of granite was extracted from the quarry throughout its lifetime to supply materials to landmarks and structures across the world.

Iconic Aberdeen buildings including the Music Hall, Woolmanhill Hospital and Provost Skene's House were all built using Rubislaw granite with Marischal College, the second largest granite building in the world, also built from the same stone.

Cities such as London, Paris, and Austin also all feature Rubislaw granite, with sections of the London Waterloo Bridge and Brisbane Council Chamber built from the material.

The historic quarry was first instated in 1379. King Robert II gifted the land to the Burgh of Aberdeen as a gesture of gratitude after the city's support.

The land was eventually sold off by the city to fund projects such as the construction of Union Street.

This came after a series of disappointing tests that left city bosses disappointed in the returns from the quarry, before deciding to give up their right to work the land.

By 1740, the land was under new ownership and the quarry was cleared to make way for a granite harvesting operation to begin. By 1741, the quarry officially opened for business following in the footsteps of other quarries on the Freedom Land.

Rubislaw was initially 90 metres deep when it opened, and was described as the "deepest hole in Europe". From the 18th century onward, the Aberdeen granite industry boomed.

Quarry owners began to export their goods to cities such as Portsmouth and London to build new pavements and to construct Docks in 1795.

Come 1811, operations had expanded and Aberdeen workers cut and dressed 1,200 pieces of granite by hand to make the balustrade for the Waterloo bridge.

The Austin State Capitol building was constructed using parts of Aberdeen Granite.

Rubislaw Quarry in 1984.

Further afield, international landmarks including the Paris Opera House in France and the State Capitol Building in Austin, Texas were built using Rubislaw granite in the late 1800s.

Rubislaw Quarry.

In the 1900s, more creations came from the quarry. The Bannockburn Robert the Bruce Memorial was built with Rubislaw stone, along with the podium at the Tower of London, parts of the Houses of Parliament, the exteriors of Leeds University, the Halls of Justice in Swindon and Dumbarton's Municipal buildings.

However, come the 1960s the Quarry started to struggle and by 1971 it shut down. It was the last in Aberdeen to close. The enormous scale of the quarry the year it closed.

At the time of its closure, the quarry was around 145 metres deep, 274 metres long and 228 metres wide. Part of the floor was 54 metres below sea level and to maintain dry conditions, it required continuous pumping.

To access the quarry, workers had to be transferred down the hole by a cage or a wooden staircase of around 430 steps. It took them five or six minutes to descend down the steps and 13 minutes to climb back up again.

The incredible depth of the hole and other factors, including poor stone and hefty competition, all led to the quarry's eventual closure.

The Austin State Capitol building was constructed using parts of Aberdeen Granite.

The Aberdeen granite industry had been shifting and declining steadily as newer materials such as glass, steel and concrete became more readily available. Limited exports to countries such as America also contributed to the shrinking of the industry.

Presently, Rubislaw Quarry lives on as a man-made lake.

Over the years, it has been transformed into a beauty spot and current plans for the quarry include a housing development, gym, underground parking facilities and a public bistro.

The enormous scale of the quarry the year it closed.

A Brief History of the Kilkenny Marble Works

by Tony Hand, Architectural Historian

In the IMQS Annual Review 2019, Laura Hally gave an excellent account on Kilkenny Limestone Quarries Ltd. She explains how the company has promoted and modernised their business to continue supplying quality limestone products to its customers at home and abroad. The two types of limestones being worked, the Classic Blue and the Dark Selection contain fossils which are a unique feature of Kilkenny Limestone.

The adoption of new business plans and modern technology are vital in an increasingly competitive global market, however, it is not new to the Marble City and its limestone industry. Almost three hundred years ago the city became the centre of the limestone/marble industry nationally and internationally and renowned for its black fossiliferous marble.

Kilkenny Limestone Quarries Ltd. is continuing the tradition of the entrepreneurial and technological spirit set by one family that dominated the industry for almost two hundred years, the Colles family. The following is just a brief glimpse of the history of the Kilkenny Marble Works with spelling as quoted.

William Colles

In 1732 William Colles (1702-1770) of Abbeyvale, Co. Kilkenny (Fig. 1), wrote a letter to the recently formed Dublin Society (it was granted Royal Patronage in 1820). In this letter he mentions a quarry on the outskirts of Kilkenny city, formed of 'Excellent black Marble, beautifully Veind, with great Variety of White'. He had secured an interest in this quarry on foot of successful experiments carried out on cutting and polishing marble, using machinery driven by waterpower. This feat is regarded as the first of its kind in this country and Britain. Colles recognised that the traditional way of sawing and polishing marble was slow and costly, but 'if wrought by a more expeditious Manner in relation to sawing the same by an Engine' resulted in him having 'ten Saws, wch are mov'd by Water...and saw the Marble more true, and expeditious, than it can otherwise be done'. (Fig. 2)

He constructed another water driven machine to grind the marble with sand so that it could be polished by hand. He employed upwards of thirty men at his mills to polish and finish marble chimneypieces, tables, cisterns and tombstones. Furthermore, he developed a system to bore pipes 'fit for conveying water underground, or from the tops of Houses'. (Fig. 3) Colles's mills utilised the energy of the river Nore to cut and polish the stone sourced on the outskirts of Kilkenny city and combined this with the knowledge of stonecutting inherent in Kilkenny since medieval times. Outside of Dublin, the Kilkenny school of sculptors operating throughout the sixteenth and seventeenth centuries, were the most competent in the country, due primarily to the quality of the local stone.

Fig. 1: William Colles of Abbeyvale (1702-1770).
Courtesy of Rothe House, Kilkenny.

The Black Quarry

Kilkenny marble is in fact limestone. As many will know, in geological terms marble is formed by the metamorphism of sedimentary limestone. Although the stone is limestone, in stonecutting terms any limestone that can take a polish is referred to as marble. The quarry Colles mentioned is the renowned Black Quarry of Kilkenny that lay to the south-east of Kilkenny city on the river Nore (Fig. 4). The quarry had been used by the people of Kilkenny for centuries. Buildings such as Kilkenny Castle, St. Canice's Cathedral and Rothe House span many centuries and are constructed of this limestone.

In 1652, Gerard Boate stated that 'Besides the freestones which is in every part of the land, there is marble found in many places... but most about Kilkenny' which was a grey colour when extracted, but upon polishing it 'getteth a fine brownish colour, drawing somewhat toward the black'.

The 18th century

In the 1730s, William Colles began manufacturing many marble products. Realising that Dublin was expanding rapidly at this time, he quickly set up an outlet in the city to capitalise on the private and public buildings that make up what is known as Georgian Dublin today. In November 1734 the following advertisement appeared in Faulkner's Dublin Journal:

> *Just arriv'd from Kilkenny, and are to be sold at the Kilkenny Marble Ware-house in Batchelor's-Lane...Marble Chimney Pieces, Tables and other Marble Furniture of the best kinds and newest Fashions... At which Place, as also at the Marble Mills near Kilkenny, all Kind of Marble Work is made and sold at reasonable Rates, by Mr. William Collis [sic].*

Visitors to Kilkenny in the late 1740s, were impressed by what they witnessed at the Marble Works. The mills were worked by 'the finest Piece of Mechanism our Eyes ever beheld'. Colles had a production line in operation at the mills, the machinery was 'perpetually at Work... by Night as well as by Day'. Alongside the marble mills were warehouses containing chimneypieces, cisterns, vases, punchbowls, frames for mirrors and pictures, all made from Kilkenny marble.

In 1757, Emanuel Mendes da Costa, writing on the fossilised stones and marbles which were commonly known at the time, stated that black marble can often contain coralloids but when polished can result in a beautiful finish and 'Sometimes this marble has also many white sparry casts of shells, both turbinated and bivalve; but

Fig.2. Marble block being sawn by seven blades at the marble mills during the 1920s. NLI, 3B 1968, Irish Marble Co. Ltd., Kilkenny.

this is not common, and is only observable in the sort dug at Kilkenny'. (Fig. 5)

Colles was not content to use black marble exclusively, he imported Italian marbles from Italy, predominantly Carrera and Siena marbles, especially for chimneypieces. Colles provided a wide choice for the discerning customer. One such customer who purchased a rather plain Kilkenny marble chimneypiece in the 1771 was Colonel Samuel Washington, brother of George Washington for his home in Virginia. (Fig. 6)

19th and 20th centuries

During the early nineteenth century the Kilkenny Marble Works was still in the hands of the Colles family. William passed away in 1770 and the business passed on to his eldest son who ran the business for only nine years. William's grandson Richard continued the improvements from 1779 until his death in 1849.

Richard streamlined the operation and by the early 1800s used one waterwheel to operate the machinery. This wheel was ten feet in diameter and did the work of twenty men. A second crank positioned at the other end moved a frame of five polishers, which did the work of about ten men. The rate of cutting at Kilkenny by water power was ten inches per day, twelve inches when the flow of water was stronger, this being equivalent to two men cutting with a handsaw. The Black Quarry was still the main source of marble. Samuel Lewis's Topographical Dictionary

Fig.3. Piece of Kilkenny marble water pipe.

of Ireland, published in 1837, recognised the importance of the Black Quarry as it noted, 'The most important quarry is that which produces the Kilkenny marble; it is called the black quarry, and is situated about half a mile south of the town'.

Marble exports

During the early 19th century the family continued with improvements and technological advances making the enterprise much more efficient and productive. However, by the late 1830s the business began, literally, to grind to a halt during this terrible period of Irish history. In 1849 William Colles's great grandson Alexander became proprietor and quickly set about reviving the business.

Alexander presented a piece for entry to The Great Exhibition of the Works of Industry of all Nations which took place in London in 1851. In the official catalogue the name of Alexander Colles appears in the section on 'Mining and Mineral Products.' Alexander Colles of the 'Marble Works, Kilkenny' exhibited a 'Bust pedestal of Kilkenny marble, from the Black Quarry'.

A further exhibition was held in 1862, The International Exhibition, and once again Alexander Colles of the 'Marble Mills, Kilkenny' exhibited a 'Black Kilkenny marble chimney-piece, made by machinery.'

Moving such a heavy commodity from one location to another was a challenge to the Kilkenny Marble Works and Alexander was very disgruntled with the transportation costs incurred by the company. Writing to his local newspaper in 1873, he criticised the charges imposed by the railway companies. Highlighting the problem, Alexander stated that he could send marble,

by steamer for exactly the same charge from Liverpool to New York as I pay from Kilkenny to Liverpool. I can send marble from Kilkenny to New York at 15s, per ton cheaper than I can send from Kilkenny to London. I can send marble from Kilkenny to Melbourne 15s, per ton less than I can send from Kilkenny to London.

Nevertheless, during this period many English newspapers carried advertisements for Kilkenny marble chimneypieces, the Birmingham Daily Post being one example. An auction of marble chimneypieces to be held in Birmingham

Fig. 6. Kilkenny marble chimneypiece in the home of Samuel Washington, Virginia, USA.

in March 1871 included a 'massive Black Kilkenny marble Chimneypiece.' Kilkenny marble was still a very popular choice for decorative features, despite the problems being encountered in transporting the marble to overseas markets.

Transportation cost were still to the fore when Alexander's son Richard took over the business in 1876. However, this did not deter Richard from expanding the business, it now supplied red and grey marble from Cork, green marble from Connemara while still importing marble from Italy. In 1892 it was announced that the business carried out by Richard Colles in Kilkenny 'will in future be carried on at same address as a company, under the style and title of The Irish Marble Company, the management being retained in Mr. Cole's [sic] hands'.

An article appeared in the Journal of the Society of Architects in 1897 announcing that Richard Colles

Proprietor of the Celebrated Quarries of Victoria Red, Sunset [Cork marble], Connemara Green, Black Fossil or Kilkenny, Dove, Dark Grey, &c could supply architects, contractors and the trade with a variety of marbles from 'The oldest Marble Works in the United Kingdom, Established A.D. 1730.'

In 1921 it was reported that one hundred tons of marble were loaded at Recess station in Co. Galway for onward shipment to San Francisco. The marble was from the 'Connemara Quarries of the Irish Marble Company (Kilkenny).'

The end of the Colles era.

After being in the family for two centuries Richard Colles sold the business sometime around 1921. There followed a number of profitable years following Richard's departure, but the enterprise seems to have then taken a downward turn a short time later, doubtless due economic and political situations at home and abroad. In the wake of such events there is always a rebuilding process, but such processes now required a swifter response, industries had to quickly adapt or get left behind, the stone and marble industry in Kilkenny was among those that lagged behind. Widespread use of concrete was a major factor in sounding the death knell for the stone industry. It was less labour intensive, less expensive, quicker to work with and its versatility ensured it could replace stone in every aspect of building.

But, as Laura has pointed out, Kilkenny has returned to the top table of suppliers of quality limestone. The Black Quarry is no more, but Threecastles, Paulstown, Butlers Grove and Holdensrath are just some of the sources that still produce limestone that is appreciated at home and abroad. They continue the great tradition that began almost three hundred years ago by William Colles and his Kilkenny Marble Works.

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Fig.1. William Colles of Abbeyvale (1702-1770). Courtesy of Rothe House, Kilkenny.

Fig. 4: 1839 OS map showing Black Quarry in two parts.

Fig. 5: Kilkenny Black Marble containing brachiopods, corals and crinoids.

advertorial

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Geo Drilling Apprenticeship Update

by Stephen D Walsh, Industry Liaison

The Geo Drilling apprenticeship programme welcomed 8 new apprentices in September 2020, joining the 16 apprentices who commenced the course in January.

The 8 apprentices are drawn from the companies and organisations below.

- Boliden Tara Mines
- Geological Survey Ireland
- MK Drilling
- Fogarty Drilling
- Lenihan Well Drilling

Like most other things, COVID-19 has had a significant impact on the drilling sector. The pause in activity resulting from the first national lockdown resulted in the suspension of drilling operations for surface drillers had a significant impact on the drilling industry in the Republic of Ireland.

The objective of the Geo-Drilling apprenticeship is to provide drillers with a dedicated Higher Certificate in Science qualification (National Framework of Qualifications Level Six). The Geo Drilling Apprenticeship is a two-year programme combining work experience with academic study. Apprentices will be paid while in training and the course is open to existing drillers as well as school leavers with the aim of becoming new entrants into the profession.

The apprenticeship covers the drilling professions below.

- mining;
- mineral exploration;
- quarrying;
- groundwater research and abstraction;
- geothermal energy development;
- site investigation for housing and
- infrastructure projects; and
- directional drilling for utilities.

The apprenticeship is delivered by the Institute of Technology Carlow (ITC) and the lead industry partner is Geoscience Ireland. The need for this qualification was identified by the drilling industry in partnership with Geological Survey Ireland (GSI), IT Carlow and the Irish Mining and Quarrying Society (IMQS).

Apprentices will receive practical training in the use of drilling equipment and operating procedures as well as classroom training in:

- drilling equipment & operations;
- sample retrieval and processing;
- environmental management & stakeholder engagement;
- geology;
- geo-informatics;
- health & safety; and
- communications.

Trainees will work 'on the job' with employers for 41 weeks per year and attend classes four days a week for 11 weeks per year 'off the job'. Due to COVID-19 a move to online learning for a portion of the 'off the job' training was implemented.

Geo Drilling apprentices.

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Working Lifetime Contribution

Paddy McConnell

New Boliden Tara Mines 1976 – 2019

Paddy McConnell, Mine Planning Engineer. CEng, IOM3, EurEng

In February 1976 I joined Harry McQuillan (ex Mufulira mine in Zambia) as a planning technician in the ventilation dept. after attaining a Mechanical Engineering Technician Certificate from Dundalk RTC. Working with Harry was always fun and he instilled in me that we provided a service role to the mine department. I gained experience and knowledge of airflows and of gases in ambient air and from engine exhausts.

Paddy McConnell, Industry Leader.

At that time the 1390 level and the 1330 decline had not broken through so my daily recording of airflows and temperature required getting the cage down to the lower levels and then climbing the ladders in the old development shaft up to the upper levels and then walk to surface. Along with sourcing and sitting of auxiliary fans I helped with the works of installing the two main underground fan stations. Harry moved on to head the Safety Dept. and Vincent (Taffy) Exxon (Mufulira) came in as ventilation engineer.

In 1977 I trained as a miner with Canadian Mine Services trainers and spent over three years on the three shift cycle in rock bolting and ground support with hand held air driven "stopper" and gained an instinct for ground conditions and as a development face miner, where hanging services and blasting development rounds and mucking them out was a primary role. I trained in Mine Rescue and participated for ten years with two years as team captain. My time as a miner gave me an understanding that underground crews needed and deserved good technical support to achieve schedules and targets.

In 1980 I felt I was losing ground on my engineering interests and Australia beckoned. However my home GAA club Castletown was going well in the championship and leaving the country would have been very unwise and I applied for, and acquired, a role as technician in the planning dept. with Ron Scott as mentor and Robin Oram as Chief Mine Engineer (CME). Robin was previously in Tynagh mine and now had to mould a young team to design and schedule mine production and development.

He recruited young graduate engineers from Cambourne and Royal School of Mines and mostly technicians from Irish colleges. My role consisted mainly of design and layout of drilling and blasting of production stopes and presenting blasting, storage and mucking tonnages for the monthly Mine/Mill reconciliation report. This was an exciting and demanding time as blasting was closer to private homes and vibration monitoring stations.

Designs were required to stand scrutiny and to avoid breaking the vibration limit and minimise complaints. Occasional visits, accompanying the Mine Manager, to Meath County Council chambers was a reminder to try harder. Up raise (2.0m *2.0m) blasting of up to 20m to open the "Slot" was vulnerable to under break and I designed a consistent pattern and drill template. Most mornings we would meet the blasters and ask "how did the raise go". To check the achieved height I was often seen crossing the site with a black bag full of helium balloons tied with graduated fishing gut, a technique again not for the faint hearted as a balloon often busted when it touched the jagged rock.

Most production blasts were small due to the limited range of electric detonators and charged with cartridge dynamite. Larger blasts were possible if initiated with electric dets via a sequential blasting machine with maybe five or six slave units but was not for the faint hearted as being a surface initiation system was prone to cut-offs. Bigger blasts were routinely made possible with the introduction of Anfo explosives which replaced cartridge dynamite and nonel dets to replace electric dets.

We worked closely with the production teams and the drillers and blasters in particular. We developed the nonel system with two and three dets in a piggy-back style and so delays were relatively safe from cut-off inside the collars of the blast holes. This facilitated a number of pillar blasts of over 100,000 tonnes and in 1985 we fired the then western Europe's largest underground blast of 315,000 tonnes with 66 tonnes of explosives and over 3,000 detonators, of which I did the drilling and blasting designs.

Although the roof span (heavily cable bolted) was too great for the local ground conditions significant dilution covered the broken muck we still recovered over 80% of the good grade ore. Timmy Garrigan (Silvermines and Zambia mines) and I presented a talk on the blast to the IMQS and later a paper and talk to the American Society of Explosives Engineers in New Orleans. I was promoted to Blast hole Engineer in 1985 with a team of two technicians and continued my interest in explosives and initiation systems.

In 1990 I joined colleagues in mine planning to study a mine engineer degree course through the Engineering Council exams for the Institution of Mining, Minerals and Metallurgy via night study in Bolton Street, Athlone RTC and Doncaster University. This I found exciting to be learning the theory behind familiar mining functions and later achieved CEng. and Eur Eng. In 1994 I, with John Kelly, did an in-depth study on drilling and blasting design.

The results showed that Tara Mines could efficiently use 70 mm dia. blast holes (up from 64mm) and emulsion explosives rather than Anfo. With emulsion pumping efficiencies we would require 6 operatives in blast hole charging - down from the then 13. Unfortunately it took until 2005 before emulsion became available and the first trials were conducted successfully. In late 1994, with Brian Keady as CME, I began work as a mine planning engineer which broadened my experience and my work included block, stope, development and services design.

I also trained as a Shift Boss and spent 6 months on construction works. In 1998 I was placed as Area Engineer by CME Mick Flynn, with Kevin Lawlor as Engineer for the upper half of the mine, with Tommy Moore, and his team, for the lower half and SWEX area, and Paddy Connolly (Tynagh mines), and later Timmy Garrigan as scheduler.

I was pleased to get my teeth into the block design and scheduling of the Nevinstown ore (8 million tonnes) and later the complex Shaft Pillar and later again the Crown Pillar. With over 100 stopes or pillars in production every year, and many different elements of local ground conditions, geology, rock mechanics and backfill status demanded intense focus and consideration. I believe we contributed well as a tight team with CME's Jeremy Cooke and later Gerry Clear– including Survey dept., Backfill Engineer, Rock Mechanics, Ventilation dept. and Geologists, most with thirty years plus experience, in scheduling and attaining production targets over the following 15 years.

Although designs were as per good practice not all went according to plan and some, in hindsight perhaps could have been done differently. I also carried responsibility for face blasthole pattern design for the computer aided navigational face drills for development of 14.5km annually.

I participated in design of underground explosives magazines, design of production primer holder, implementing of Track and Trace of explosives, preparing requisitions for quarterly importing of detonators and also technical input on mobile equipment for explosives use. I chaired an international conference on explosives systems and applications in Stockholm in 2014, and I became a member of the European Federation of Explosives Engineers.

In 2014 the Area Engineering roles were changed by CME Nils Steen with Tommy taking over all short term planning, and I was given the long term planning role. My brief was to hunt down every potential ore source, and design stopes and place them in the life of mine schedule. This was important work to guide future board investment in Tara Mines. Close cooperation with the Geology Dept. and in particular Jim Geraghty, facilitated the design of a further 4 million tonnes from Inferred to mineable ore designs. A new auto cad design package – Deswik was introduced to replace our Eagle graphics system that had served us well from the early 1980's mostly driven by John Ashton (Geology) and Gerry Harte (IT).

However it had had its day and the integration of Deswik proved a challenge for us to learn but particularly for the Deswik implementer – Borja Arias to get us to learn. A major advantage over Eagle was that Deswik facilitated Geologists, with Finn Oman to the fore, to create ore models for the different ore reserves and resources throughout the mine, and these could be updated as fresh exploration drilling added new information.

The mine ore was grouped into 14 distinct 3d ore models and ore delineated relative to the number of ore portions of the exploration drill holes and the ore models handed over to Mine Planning. After the already mined out areas were deducted the current and additional new stope designs were included in the life of mine schedule.

This added another 4 million tonnes approx. and extended the life of mine out to 2028 albeit with lower annual grades. This could provide time for the new Tara Deep ore to come on stream and provide continuity for mining into the 2030's. This new system of using ore models and "stope optimiser" facilitated block and stope design that did not necessitate an in-depth local knowledge. Borja and new graduate engineers - Caitlin and Marta, with modern computer skills now teamed up with our experienced planning engineers of Kevin, Blaine, Coli, Nicola and Declan under Charles Walker (Australian mines) as CME to provide all necessary designs and schedules.

In my career I tended to invest more towards my technical mining competence and felt that I could deliver more value by immersing myself in in-depth examination and design of production areas. I believe that design requires a certain discipline and level of responsibility and commitment, and that the door needs to be shut for as long as it takes until a solid mining plan emerges. Further iterations are often necessary before the drills are ready to move in.

I have always been happy to share what I have learned and welcome new people into the group. I enjoyed giving support to students and interns, many from international mining colleges, and I have helped out in a number of Master's Thesis. I was content to work a 3 day week for my final 6 months up until Christmas 2019 to mentor and give support for the mineral reserve annual calculations I am pleased to have being a member of the IMQS since the early 1980's and I contributed in a number of talks, and papers for the Annual Review, and through the IMQS have made many friends in the Irish extractive industry.

I like to think I was part of the continuity of mining operations in Ireland initiated by the successful exploration by the original Tara Exploration company of Hughes, McCarthy, McParland and Gilroy. I feel privileged to have enjoyed a varied, interesting and stimulating mining career, with interaction with all departments over nearly 44 years.

I have worked with dedicated colleagues and friends, union officials, supervisors, managers and parent companies, contractors and suppliers and Government Officials that have cooperated as a team to efficiently exploit this wonderful national resource and that have contributed to making New Boliden Tara Mines a great place to work. I am happy that, with my wife Mary, we have been fortunate to rear our family (3 boys and one girl) close to my work and only a 17 km round trip bicycle commute, and that I barely travelled 20 km in my work career from my birthplace suggests that I am a home bird at heart.

Going forward I intend to become more active in environmental matters, and am involved in our local Bective GAA club and Headfort Golf Club.

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.

FINNING CAT

"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."

DALRADIAN
community commitment continues

"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."

SANDVIK

"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
Part of the Breedon Group

"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."

CDM Smith

"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 LIMITED

"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."

CDE

"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."

KILKENNY LIMESTONE

"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

"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."

LTMS

"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."

EQUITY | EXPLORATION CONSULTANTS LTD.

"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."

Close Brothers
Commercial Finance

"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."

"We are very pleased to have joined the IMQS in 2018 and have found it a great resource for prevailing industry news, networking opportunities, and its relevant and frequent events and field trips"

"Since joining the IMQS in 2018, we have welcomed and appreciate the networking opportunities and field trips the IMQS offer. MDS International offers its full support to the IMQS for pushing for the development and sustainability of the sector."

"In celebrating 50 years in business, Pat O'Donnell & Co continues to supply its products and machinery across Ireland and the UK. Membership of the IMQS affords us the opportunity to engage with several businesses, and we support the IMQS's efforts in promoting the all-island sector and its growth in membership."

"Boliden Tara Mines have been long term members of the IMQS and we value the work that the Society does on behalf of the Mining and Quarrying industry in Ireland. The IMQS, among other things, provides an excellent network for people in the industry and is important in promoting the industry at a national and international level."

"iCRAG recognises the importance of industry engagement when working toward enhancing the innovativeness of Ireland's extraction sector. The IMQS continues to provide a strong voice and platform for iCRAG to demonstrate its expertise and research capabilities to Ireland's mining and quarrying supply chain."

"Membership of the IMQS provides us with key insights and challenges on Ireland's natural resources sectors. Gavin & Doherty Geosolutions is committed to the sustainable and responsible harnessing of Ireland's natural resources and we value the IMQS's approach to promoting and safeguarding this."

Twitter: @IMQS_IE LinkedIn: Irish Mining and Quarrying Society (IMQS)

William T Mulvany

Irish Board of Works Engineer, and coal mining entrepreneur in Germany

by Paddy McConnell

William Thomas Mulvany (1806 – 1885) was the eldest of the seven children of Thomas James Mulvany and Mary Field and lived in Sandymount Dublin. Thomas was a painter and one of the founders of the Royal Hibernian Academy. Their home was a rendezvous for writers, artists and musicians and members of the ruling establishment. William was sent to Dr Wall's school in Hume Street and converted, with his family, to the Protestant faith at the age of 16. William enrolled in the medical faculty in Trinity College in 1823 but had to leave months later possibly due to family financial difficulties. He then worked as an architectural pupil under Francis Johnson on public buildings and under John Semple on churches.

In 1826 he was appointed as an assistant surveyor on the first Ordnance Survey and later transferred to the Boundary Commission under Richard Griffith, and achieved his Diploma as Civil Engineer. In 1835, now married to Alicia Winslow (Fermanagh) he accepted a role as assistant engineer to the Shannon Navigation under Henry Buck and moved to Limerick. He acquired additional engineering and valuation responsibilities and later was appointed a district engineer in 1839. Many of the maps and task descriptions for the Shannon project were drafted by Mulvany as he worked towards making it useful for steam traffic.

He also drafted proposals for legislation governing the navigation of the Shannon and frequently travelled to London for consultations with Charles Trevelyan- the then secretary of the treasury. Mulvany assisted John Fox Burgoyne Commissioner for Shannon Navigation (and later first Chairman of Irish Board of Works, and the first President of the Institution of Civil Engineers Ireland) in the drafting of the first comprehensive legislation on arterial drainage which became law in 1842.

Mulvany was considered of the highest rank on technical and economic questions and was appointed Commissioner for

William T Mulvany.

Drainage and Inspector of Fisheries and in 1845 was appointed Commissioner for Fisheries and was appointed full Commissioner of the Board of Works in 1846. He drafted the Act for a closed season for fishing and when made Law showed its benefits up to the present day. He directed drainage works in many counties through-out Ireland. The Arterial Drainage Act was a notable landmark in the development of public works and their effect on private property.

In 1846 special legislation was passed to speed up procedures (previously requiring two thirds majority assent from the Landlords) under the impact of the Famine and applications for works increased from 10 to 300 per year. The remit of the Board of Works was extended to incorporate the development of infrastructural projects such as coastal and inland harbours, fishery facilities, weirs, railway works, etc. The aim was to improve the economic viability of the country within limited budgets (little investment capital from private sources) and also to relieve widespread destitution by providing work schemes for the unemployed.

The historical backdrop of this era was dominated by the Cromwellian Settlements of 1652. The aim of which was to replace the Irish population with a mainly Protestant English one. Catholics, including many of the Old English landholders (loyal to King Charles), were driven off the best lands and forced to try and eke a living in the poorer lands of Connaught. Catholics accounted for 80% of the population but only owned 5% of the land, and little changed for two hundred years.

Ireland in the 1840's had a population of 8.5 million with 27% considered paupers, and 70% considered illiterate as they could only speak Gaelic. The bulk of the people were farmers or farm labourers who languished under an inequitable legal and social system. Half were living in window-less mud cabins of a single room, with little understanding of the value of money and work or rent paid for by barter of crops. Most of the best lands were held by landlords, mostly descended from settler families from England, Scotland and Wales. These landlords were loyal to the crown, and if non-resident, their estates were administered by agents. Landless people rented ground to grow crops.

In 1841, 45% of all holdings were less than 5 acres, but an acre and a half of potatoes (staple food) would feed the family for a year. However when the crop failed due to bad weather or blight the family would be destitute and unable to pay the rent (via corn or other foods) and many were evicted to clear the way for grazing animals. Workhouses for the poor were set up but were considered worse than jails with terrible conditions and miniscule rations. During the famine years from 1845 to 1849 well over one million people died from hunger and disease and a further one million emigrated. Relief schemes for the unemployed and destitute were undertaken and some food supplied via "soup kitchens". During the Famine twice the quantity of food that could sustain the population was been exported to England in the form of grain, cattle, sheep and pigs.

Mulvany and his colleagues recruited labourers to carry out works on roads, rivers and canals, and in County Clare alone there were 25,000 working on

projects directed by him. Mulvany also designed a canal link between the Shannon and Lough Erne and again thousands of workers were employed in its construction over its 63 km during the famine years. The canal was to carry goods and also to drain the surrounding country side but was never a commercial success as it was overtook by the railways. However, after 150 years, it is now in use for the leisure sport industry. Mulvany stayed two weeks in London in 1847 to plead with treasury for more generous finances for carrying out relief projects

As a member of the Institution of Civil Engineers of Ireland William gave lectures in Dublin on the potential of expansion of fisheries and presented five papers on regulating weirs, drainage, and costs of blasting operations. His brother Thomas, who worked as an engineer on the Shannon scheme, also presented three papers on drainage of turloughs, flood gauges and screw pumps. Thomas also presented a paper in 1851 on the Method for Estimating Flood Peaks which provided a basis for modern scientific methods.

It is since recognized that the work carried out in Ireland by these engineers engaged in arterial drainage was fifty years ahead of its time and made a remarkable and pioneering contribution to hydraulic engineering.

Although the drainage schemes were largely beneficial and opened up many acres for farming use some landlords took issue with Mulvany and the Board of Works with the overruns from the estimates that they would have to make up. The third Earl of Rosse of Birr Castle William Parsons led the charge that the Board had forced the Government to spend three million pounds on drainage works that the Landlords had not approved first. The Parsons family had opposed the Act of Union, and William Parsons supported Daniel O'Connell's campaign for Catholic Emancipation. He also was a gifted engineer and designed and built the then largest telescope in the world at Birr castle. The Earl had gained from the drainage works but contested the authority of the Board of Works and prompted a parliamentary enquiry into the costs. A select committee of enquiry was made up of well connected landlords with the Earl of Rosse in the chair and the outcome was inevitable.

Mulvany provided details of the 121 projects, planning and execution, and how they complied fully with the current provisions of the relevant legislation. He was supported by Trevelyan, Griffith, and Larcom who were called to give information, and they spoke of the vigour and integrity of his efforts and extent of the most extraordinary work of its kind and at minimal costs to the Landlords in a time when money was scare. The committee ignored the secondary aim of the works to alleviate the stress during

Zollern Head Frame and Museum.

the Famine with many thousands of workers employed and they believed that the Landlords (accustomed to absolute authority) should have approved the expenditure first. The Treasury was censored for failing to protect the rights of the Landlords. Mulvany (now living in Dublin) felt he was made a scapegoat of and considered retiring but was persuaded to stay on as Commissioner for a further two years to complete many projects and he retired in 1854 after 19 years with the Board of Works with appropriate sizeable pension at the age of 48.

The stress of the enquiry and carrying such a responsibility through the famine years took a toll on William's health and a more sedentary lifestyle for his remaining years would have suited most people. However he was a man of so many interests and his thinking sought after and valued on many projects and policies and a meeting was arranged in 1853 with Michael Corr in Dublin. Michael Corr (van der Maeren), born in Slane, was a prominent Belgian business man and

owned some property and a claim near Gelsenkirchen in Westphalia and he was interested in the possibility of modernizing of the mining industry in the Ruhr region. In attendance also were James Perry (Quaker) (father's acquaintance and a pioneer of railway development in Ireland) and Joseph Malcomson (Quaker) corn, cotton, iron and ship building. Mulvany joined Corr in an exploratory site visit to Germany in 1854. Mulvany, meticulous as usual, included a short visit to the Head Mining Office and upon examination of the geological map and could see what "wonderful riches were hidden under the earth and how inadequate your railways and insufficiently your canals and railways were used".

William had no experience of coal mining but he was determined to be involved with the exploitation of the claim and quickly persuaded Perry and Malcolmson and their families to invest. They set up a company which was a purely Irish undertaking and Mulvany held a minor shareholding and was to manage the operation. To get to know mining he recruited an experienced mining engineer, Louis C Konig, and they visited the deeper coal fields in Durham and Northumberland, and he witnessed the steam engine systems for hoisting, mechanical handling, ventilation and pumping.

In Durham he saw the advanced Tubing system of steel shuttering for shaft sinking and roof support in the tunnels. This is where sections of prefabricated concave sheeting are attached by bolts to forged circular

T-bars and offered enormous savings in assembly time with enhanced safety and control of water ingress.

More daunting for William was he knew little about the legal and social systems in Prussia and did not understand or speak the language. Having a background only in civil service he now had to carve out a new path and was to become the only Irish entrepreneur of the nineteenth century in this part of Europe. He recognized that communication was compulsory to attain access to mining rights, land purchase and met face to face even though he always struggled with the German language. Two more claims were purchased and Mulvany recruited skilled miners from Durham including William Coulson who had developed the Tubing system. On St. Patrick's day 1856 the Hibernia Mine was opened in Gelsenkirchen with great pomp and ceremony and work started on shaft sinking of a 112m shaft. A further shaft of 211m was later added to provide for return air and improve safety.

The Shamrock and Erin mines were to follow and all were highly successful. Over the following years three hundred miners from England and Ireland were brought to Dusseldorf and were housed in purpose built modern houses that became the standard in that region. The Hibernia mine was in production from 1856 to 1926 and yielded a total of 18 million tonnes of high quality coal. In 1872 it delivered 148,000 tonnes with 852 employed and set standards which were followed by the industry as a whole. William had brought his family over to live in Dusseldorf and his brother Thomas, who had recognized experience with screw pumps, took over technical responsibility for the company and the Shamrock Mine was started in 1857 near Herne.

The Shamrock mine,1857 to 1967, became an economic pillar of Herne over the following century with 62 million tonnes of coal exploited. In 1932 there were 3,500 miners producing coal at an annual rate of 715,000 tonnes. They extended the Shamrock activity to include the production of coke, via coke ovens, for the steel furnaces and was an early attempt at achieving a vertical integration in the exploitation of a natural resource.

Mulvany also purchased the Zollern and Hansa mines and the Erin mines near Castrop in 1866 under the Prussian Mining and Ironworks Company and was later sold to a Berlin commercial company, and the Erin mine closed in 1983 with the loss of 3,000 jobs.

Equally important with the production of coal was the finding of suitable markets for its sale. Mulvany believed that to progress Westphalian industry was to expel English coal from Germany and Holland. To do this the greatest barrier was the poor disorganized state of transport. He advocated strongly the necessity to plan an adequate transport system in order to enable producers to reach their markets. He wrote on the benefits of a one penny tariff to encourage railways to carry more cargo and increase profits.

He proposed a new central station for Dusseldorf, integrated water way canal systems, inland harbours, a new harbour for Dusseldorf, and on Hambourg Port. Gradually Mulvany became known in business circles and was invited to comment on new developments. He preached strongly on co-operation among those concerned with the same industry and actively involved in the formation of business groups – Ass. Of Mining Interests in Essen, Rhineland Westphalia Economics Association, the Association of German Iron and Steel Industries in Berlin, the Coal Export Committee, and was one of the most active persons in the foundation of the Dusseldorf stock exchange. He was awarded a gold medal in 1875 by the King of Prussia for his services to the country.

William T Mulvany played a huge role in the industrialization of the Ruhr region of eastern Germany by opening coal mines

Zollern Head Frame and surrounds.

with Irish investment in the 1850's and introducing the then modern technology of steam driven pumping and ventilation. Mulvany had belief in the fairness to working men for a fair day's work for a fair day's pay and gradually lift themselves out of a subsidence life style to rear their families and give opportunity to advance. He believed that the workers and owners were interdependent and advanced best when they cooperated in making the works continually more efficient. He took the wider view that this cooperation was necessary countrywide and continent wide. He proposed a global view of the local infrastructure of railways, shipping, sea and inland ports, river freight and drainage goods and also could envision the wider impact of free movement of people. He presented many papers and expansive plans for towns to grow into cities, and provided linked-up thinking. In seventy years he was instrumental in bringing the Ruhr region from small towns and agriculture to major industrial strategic cities. With his interest in breeding and racing horses he introduced steeple chasing to the Ruhr region on his grounds in Goldschmieding, and his English miners introduced soccer which became Germany's national sport.

William T Mulvany died in Dusseldorf on 30th October 1885 but is remembered with street names in Dusseldorf, Gelsenkirchen, Herne, and his son Thomas in Castrop-Rauxel. In 2016 the Irish Business Network in Germany held a commemorative event which included a bus tour of his physical contribution to society, his coal mines, canal systems, housing, the stock market, EON headquarters and to the shipping museum in Dusseldorf. The evening was concluded with a formal reception and presentations with Ambassadors and ministers from Germany and Ireland in attendance.

There is no street name or memorial to commemorate him in Ireland.

I became aware of this great man when chatting recently with Shane McQuillan who worked in the music business in Germany. Shane's father Harry was my first boss in Tara Mines. I also have learned more of how highly Mulvany is regarded in Germany from one of our international mining students.

Thank You,

Paddy McConnell

Sources: Breaking Ground – John J O'Sullivan, History Ireland__Hibernia im Ruhrgebiet – Jim Dooge, MHTI_2004 Olaf Schmidt-Rutch, WT Mulvany- John Ryan 1923, Irish Business Networks Germany.

Mining Ireland Conference 'Ireland - Open for Business'

by Andrew Gaynor, Executive Secretary, IMQS

In November 2019, the IMQS was delighted to have partnered with Geoscience Ireland to deliver the 'Mining Ireland' conference in Dublin.

The one-day conference welcomed over 100 delegates from across the mining value chain and opened by **Sean Canney TD**, then-Minister for Natural Resources.

Mining Ireland had grown from the **'Ireland – Open for Business' forum at the Prospectors & Developers Association of Canada** (PDAC), Toronto. The annual PDAC show is led by the Department of Environment, Climate and Communications and is well-attended by Irish delegates including several IMQS corporate members.

The Dublin conference focused on mineral exploration and development activity on the island of Ireland and provided project updates from exploration companies.

The day included a market outlook session delivered by **DAVY** and an 'Open Data' session which reflected the projects and research undertaken by **Geological Survey Ireland (GSI), the Exploration and Mining Division (EMD)** of the Department of Environment and Climate, and **the Irish Centre for Research in Applied Geosciences (iCRAG)**.

A panel session focussed on the Irish expertise across the mining value chain – exploration, planning, operation and closure – was delivered; experts included

Ireland's post-mine closure expertise.

Tim Paul of SLR Consulting, Brendan Morris of Lisheen Technical and Mining Services, and **Stephen Wheston** who is an environmental consultant with expertise in mine closure. **Kenmare Resources** closed the conference with a presentation on its operations in Mozambique.

We welcomed the success of Mining Ireland given it demonstrated the technical and commercial expertise of Irish companies and how this expertise is internationalised. **Geoscience Ireland** – the business cluster supported by our corporate member GSI - continues to assist Irish companies in winning business overseas and operates at key industry events and tradeshows including PDAC, AME RoundUp in Vancouver, Mining INDABA in Cape Town and the Mining Show in Dubai. IMQS corporate members **QME, Boliden Tara Mines, CDE Global, LTMS, Priority Drilling, Dalradian Gold, iCRAG, Irish Drilling, SLR, Equity Exploration, Golder, Mincon** and **Group Eleven** regularly participate at these global forums.

The IMQS looks forward to future collaboration with our industry partners and continue to support and safeguard Ireland's mining and quarrying sectors.

Expert panel discussion at Miming Ireland.

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Obituary
Peter McAleer (1943 – 2020)

by John Clifford, Athlone, Co. Roscommon, May 5th 2020

Peter McAleer was born in Omagh, Co. Tyrone on February 2nd 1943. He died in Dublin on April 15th 2020. He packed more into those 77 years than most people, and left behind a legacy of achievement that few will equal.

After early education in Garron Tower, Co. Down, he went to UCD to study veterinary science. Fortunately, the queue for registration to that course was a long one. However, the queue for Commerce was much shorter. Always nimble in his thinking, and ready to change direction at a moment's notice, the plan was modified and he graduated in 1964 with a B.Comm (Hons). He was then head-hunted by Pat Hughes (RIP), Chairman of the Northgate Group of Companies, as his executive assistant.

Northgate at that time had made the first of its many mineral discoveries at Tynagh in Co. Galway. Peter's first assignment in his new role was to buy a slab of beer to fuel a boardroom discussion, a task that required explanation by Nick O'Neill (RIP). He went on to be intimately involved with the financing, management, direction, concentrate sales, and administration of three of Ireland's modern major base metal deposits (Tynagh – 1965; Gortdrum – 1967; Tara – 1970). In his spare time, he qualified as a Barrister in Kings Inn, Dublin, and was called to the Bar in 1968, but never practiced.

In 1969, Pat Hughes delegated Peter, and his life-long friend and colleague, Andy Meldrum (RIP), to lead Northgate's expansion into Australia and the successful flotation of Whim Creek Consolidated NL on the Australian Stock Exchange. Together they identified, and developed, the Haveluck gold deposit as the first commercial heap leach operation in Australia, and subsequently as the first combined heap leach and CIP operation. Through a process of successful exploration and acquisition the company grew from a single mine operation in 1980, with gold production of 2,000 ounces, to four operating mines in 1988 with annual production of 200,000 ounces of gold. Throughout this period, he successfully led, and organised equity capital raising of approximately A$80 million to fund the expansion, and develop both Whim Creek, and its publicly quoted affiliate, Austwhim Resources N.L.

In 1984, while continuing with his Whim Creek responsibilities, he was appointed Chief Executive of Ennex International plc, to lead the restructuring of Northgate's European exploration interests and the company's floatation on the London and Dublin exchanges. While CEO, the Ennex exploration team went on to discover the Curraghinalt gold deposit in Northern Ireland – about 20 km from his birthplace, and the Cononish gold deposit in Scotland.

In 1987 an invitation from David Whitehead (RIP), an ex-Northgate colleague, but then CEO of Shell Chile, brought Peter to Chile, in his capacity as CEO of Westfield Minerals Ltd, another Northgate subsidiary. There he participated in the development and operation of the Choquelimpie gold-silver deposit, and established a presence in Chile that he maintained for the rest of his life. Financing for Choquelimpie was arranged by Lucho Baertl of Citibank, another life-long friend. The project became the world's first high-altitude heap leach operation producing up to 100,000 ounces gold equivalent per annum.

Given the growing importance of Whim Creek to the Northgate Group, Peter and family moved from Ireland to Perth in September 1988. However, a 1989 Board Room coup in Whim Creek led to his departure from the Northgate Group and to him taking on the role of CEO of Equatorial Mining Limited, an Australian-registered junior explorer. This allowed him to maintain a residence in Perth, where, for the next 25 years, he continued to spend several months every year, dividing his time between Ireland, Australia and Chile. Given his Chilean experience and connections, he quickly re-focused Equatorial's exploration efforts, and personally identified and acquired the Leonor copper prospect in northern Chile. Equatorial went on to raise A$60 million to explore it, define a major copper resource, and complete a bankable feasibility study. In 1996/7 he, together with Jorge Bande, his good friend and fellow Equatorial Director, successfully negotiated with the Luksic Group of Chile (Antofagasta plc) to develop the resource jointly with their contiguous deposit as the El Tesoro Project. He then led the Equatorial negotiating team to raise the US $300 million of financing required to bring the Project into production in 2001 at a rate of 75,000 tpa of cathode copper. Twenty years later this project has produced in excess of 1 million tonnes of copper, making it the second largest copper exotic producer in the world.

Peter's advice on mine financing and development was valued throughout the mining world and contributed to the creation of shareholder value at numerous projects, as for example as a Board member for Kingsgate (Chatree Gold Mine, Thailand) and Kenmare (Moma Ilmenite Mine, Mozambique). He dominated the Board Room with his business acumen, but could equally enthral the clientele of The Market Grill in Salt Lake City with his rendition of "Pretty Girl from Omagh".

However, those of us privileged to travel with Peter know other sides of his character. He never started a journey without making the "sign of the cross", Sunday morning Mass was never missed, no matter how late the party on the Saturday night and, wherever he was in the world, the Sunday call to his family and mother was never forgotten.

Peter was large in body and mind, a friend to trust, a wise man to learn from, generous to a fault, and with an indomitable spirit. When others collapsed due to oxygen starvation at Choquelimpie, all he had a problem with was keeping his cigar alight.

He was equally well known, and respected, in the horse-racing world, particularly in Australia, where he owned bits of horses with his great friends Don Maloney (RIP), Ted Codd, Mick and Siobhan Campbell. While he never made a fortune from this, he loved the ambiance, and was ever ready to regale listeners with the background story to the naming of one of his more successful horses - Craft Memory, a winner of 19 races, including the 1993 Bunbury Stakes.

His love of food and wine was legendary. Yet, he equally enjoyed breakfast at the "Bar of the Immaculate Conception" on his way to the Michiquillay Project in the Peruvian Andes. He revelled in company, and was always most happy when surrounded by family and friends, whether in a restaurant - often merging lunch into dinner, in a bar, or just sitting on the veranda in the late-evening, chatting, and enjoying a brandy and cigar. He was an inveterate collector of gadgets, but never knew how to use them, and always bought in bulk so that he could distribute to his family and friends.

In his final years, Peter's love of travel and company was inhibited, but not diminished, by a stroke in December 2015. It is amazing what you can communicate with a lift of the eyebrow, a twist of the mouth, a smile, and three words! It was a source of great pleasure to him that the one trip he did make was to revisit Australia in 2017.

It was entirely appropriate that Peter went to his final resting place to the sounds of Flower Duet from Delibes' opera Lakmé – British Airway's theme song, and a rendition of a Parting Glass.

Peter is survived by his loving wife, Annette, his children Cathal, Orla, Cliodna, Una and Brian. He is sadly missed by his grandson, Charlie; Orla's partner James; his surviving sibling, Bernadette; and fondly remembered by his host of friends world-wide.

Ar dheis Dé go raibh a anam

Obituary
Michael A Healy (1931 – 2020)

by Deirdre Byrne (née Healy), Dermot Healy, Mike Lowther IMRC, Aoife Tallon IMRC and Pat Griffin HSA

Michael Augustine Healy was born on 9th January 1931 and grew up in Wexford town. Growing up Michael was heavily involved in the boy scouts. He was also a keen footballer and played in right half back position with the Young Ireland Minor team, achieving All Ireland medals in the 1948, 1949 and 1950 seasons.

Michael moved to Arklow Co Wicklow in 1954, to set up his own business in the trading of clothing and menswear. His ambition to succeed was spurred on as he had watched four of his older siblings take the "boat to England" and he was determined to make his life in Ireland. In the early 60's in Arklow the St. Patrick's Mine Avoca was a major employer and the arrival of Nitrogen Éireann Teoranta presented many opportunities to a young energetic entrepreneur like Michael. He built on this experience, and grew the business to be a major supplier to the thriving mining industry in Ireland.

Michael went on to found M.A. Healy & Sons Ltd in 1971, which grew to be one of Ireland's leading suppliers of PPE safety workwear and equipment.

Michael presents the trophy to Joe Rice, captain of the winning Tara Mines team in 1979.

The business is based in Arklow, with a second outlet in Passage West Cork. The focus of the business in the Cork region was the upcoming pharmaceutical and mining industry.

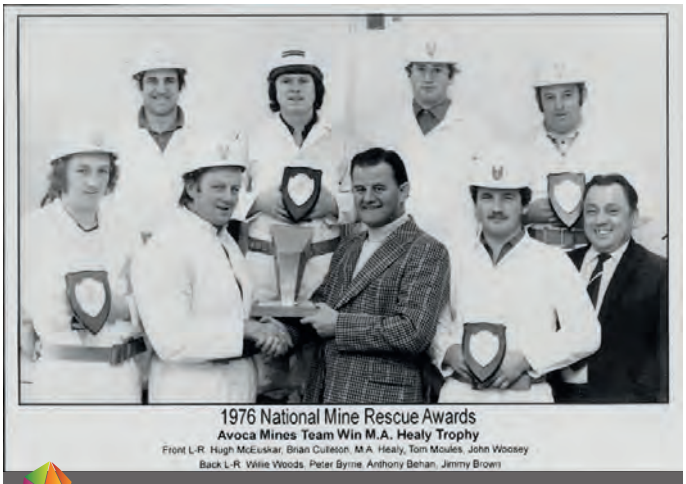
The modern phase of base metal mining in Ireland began with Tynagh in County Galway in 1965. As the industry developed, the need to encourage all mining personnel to achieve the highest standards in work practice, rescue protocols and the use of the best equipment was the start of a competitive mine rescue competition, which pitted each mine against each other. In 1976 Michael presented a trophy to be awarded to the winning team in the annual mine rescue competition. The trophy was commissioned in Avoca from an up-and-coming silversmith Brian Clarke, and the first winner was the Avoca Mines Team.

Forty four years later winning this competition and the MA Healy trophy is still the most valued prize in mine rescue in Ireland, north and south.

Much training goes into preparation for the competitions, and this in turn keeps the teams in readiness to tackle any emergency situations. By his foresight in presenting the MA Healy Trophy, Michael contributed in a valuable and lasting way to the safety of mines in Ireland.

The business went on to pass to a second generation with Michael's son Dermot and daughter Deirdre now running the business as a privately owned company.

Michael passed on August 13th last, peacefully surrounded by his family at his home. He was very proud of his achievements and had many fond memories of the mining fraternity, especially the annual mine rescue competitions. May he rest in peace.



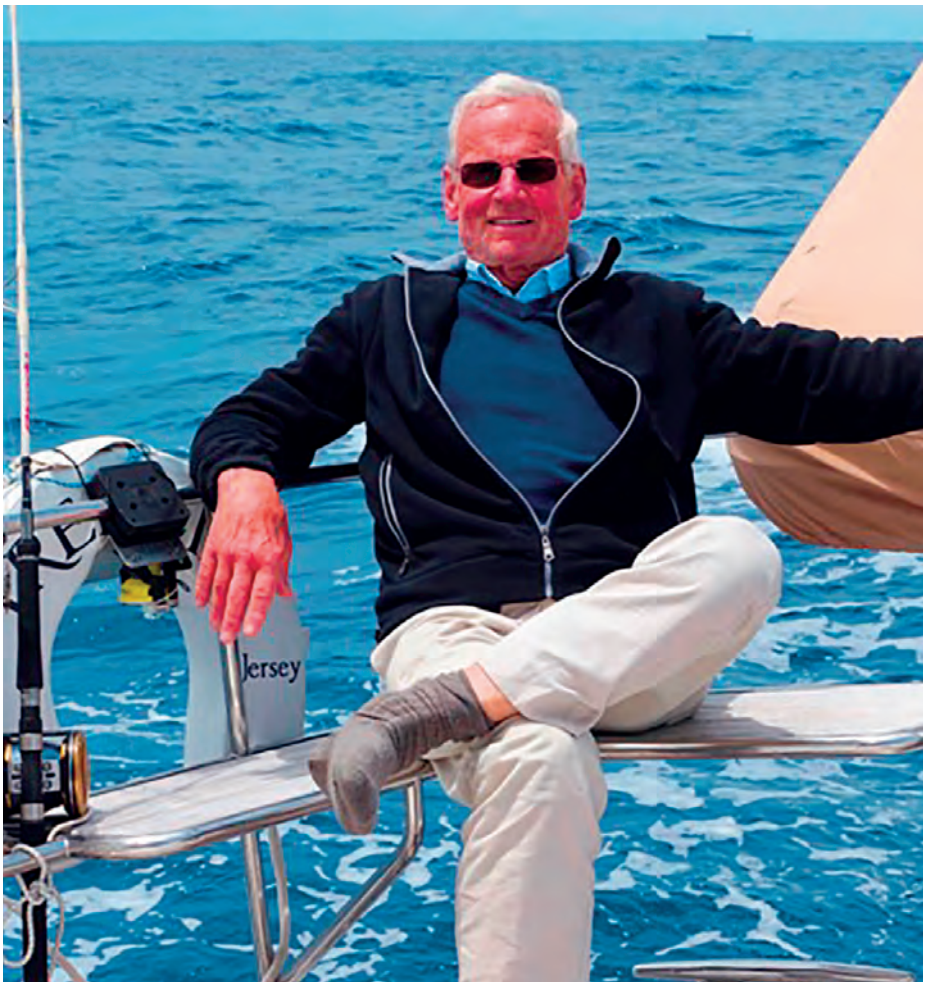
Michael presents the trophy to Brian Culleton, captain of the winning Avoca Mines team in 1976.

Deirdre presents the trophy to David Harrington, captain of the winning Tara Mines team in the All Ireland and UK Mine Rescue Competition in 2013.

Obituary
John Louis Goor
(17 February 1939 - 10 August 2018)

by Les Sanderson FIMQS

I have been asked to put down on paper my memories of the enthusiastic, exciting life of John L Goor. Born in February 1939, the son of L. Goor, who was Chief Engineer at Cement Ltd., Boyne Road,where I believe he lived for a time in staff accommodation. Married to Magsie, they lived a while in the Burnaby, Greystones, later moving to the most beautiful Annacrivey House, Enniskerry with his family Sabine, Monique and Louis.



In the late 60's, John was employed by Blackwood Hodge Ireland (the first overseas company of Blackwood Hodge (UK) which was later to become the largest distributer of earth moving equipment in the world). The Irish company was founded here by Erskine Childers to which over the next few years John became General Manager and Managing Director, growing it substantially in the 1970's. In those years, there was an explosion of innovative equipment with BH cornering the market with JCB, some of the largest earth movers Euclid Terex (eg The Turlough Hill Project) and the scoop trams LHD's (e.g. Tara mines). This was a company to which he recruited and trained a very young team, many of whom went on to run and even own large companies in their own right in the equipment and transport distribution sector. During this period he was also instrumental in acquiring businesses for the group and became a director of Camac Transport Warehousing and Logistics, Barkley JCB in UK and North Sea Marine Rig Services in Aberdeen.

The early 80's saw a recession in construction and with the potential withdrawal of BH(I) from the market here, John moved on and became a partner at Anderson and Martin, who were best known as Agents for Alice Chalmers Crushers and also Power Station Boilers.

Being a motivator, John was involved in leading many business organisations and in 1985 he was nominated as President of the Irish Mining and Quarrying Society (IMQS) having been on the IMQS Council for over 12 years.

John's enthusiasm for life and business drove him on to develop his own company to distribute polymer materials, process and conveying equipment and, for over 30 years, this company was nurtured and built up by him into one of the largest suppliers of its type.

Well, you might say, what did this man do for life and fun while building his business empires? In early life, he had a passion for motoring, owning Jaguar XJ's and Porsche. He had a real grá for Sailing and in the mid 70's with friends sailed across the Atlantic. This love grew so much that as his most recent adventure, on the 24th of May 2018, he sailed again across the Atlantic on Irene III less than 3 months before his passing.

After moving to Annacrivey, his passion for horses and riding grew and he built his own stables to further this hobby. But, being now the country gentleman at heart it was well known that he loved to relax fishing. And it was on such an occasion in Dingle Bay while fishing alone that he had a heart attack and passed from us on the 10th of August 2018. What a fitting way to end a life full of adventure.

His funeral, a beautiful tribute to a very great man who changed so many lives, was celebrated at St Mary's Church, Enniskerry and, the church filled to overflowing, was a very fitting tribute from so many who knew him.

May John L. Goor Rest in peace.

Obituary
William George (Bill) Dallas
(1929 - 2020)

by Maria Flood and Sean Finlay, 9 November 2020

Born in Garvagh, County Derry on the 20th August 1929, Bill Dallas died on 6th November 2020 at the age of 91.

Bill graduated in Forestry from Trinity College Dublin in 1954. He started his career as a Forester with the Northern Ireland Forest Service, and was posted to Ely Lodge Forest outside Enniskillen. He later transferred to the North Antrim district Office in Ballymena and then to West Tyrone District .

In 1960 Bill was awarded a Masters Degree in Forestry at Oregon State University, within which was one of the foremost Schools of Forestry in the USA. He returned to Northern Ireland Forestry as Research and Development Officer.

Two years later Bill was appointed Regional Forest Officer and was in charge of the substantially enlarged West Tyrone District.

Bill moved to Navan Co Meath in 1971 to take up the position of Conservation Manager with Tara Mines Ltd, a company then part of the Northgate Group , which was commencing the development of the recently discovered zinc lead orebody near Navan. The development was sensitive politically, environmentally and socially, being the largest base metal orebody discovered to date in Ireland and lying a short distance from a major provincial town. Somewhat unusually at the time, Bill's position ranked equally with those of other disciplines, recognising the importance of environmental issues in the project. He skilfully managed the internal and external relationships for Tara, freely sharing information with the community and working with the widest possible range of stakeholders, ensuring that environmental controls and management were an integral part of the project. The integration of environmental measures into operations was tested by a

nuisance action in the High Court by local residents against Tara in 1973. The case was settled quickly and resulted in the development of one of the world's first automated noise and vibration monitoring system developed By Tara which ensured that environmental limits were adhered to. The construction phase of this major development- then the largest project in Ireland- was completed in 1977. As the underground and related operations settled into production, the early incorporation of environmental standards into the project design were clearly evident with almost perfect compliance to planning conditions. Extensive landscaping played a major part in this work. This continued performance, along with community engagement means that the mine has achieved social licence to operate; this was the situation long before the term was coined.

A further complication was the proposed development by Bula Mines of part of the Navan orebody which involved a major open pit along with a river diversion. The environmental and economic effects of these proposals were vigorously contested by Tara with Bill to the fore until the ill-advised proposal was abandoned in the mid 1980's.

As mines developed in earlier years in Ireland moved to closure, Bill's expertise was called on by other companies in the Northgate Group. These earlier generation mines had very limited environmental design features and presented significant challenges for their rehabilitation. Bill's work on revegetation of tailings facilities contributed greatly to solving many of these issues at Tynagh, Gortdrum and Silvermines. In this regard, he worked closely with researchers in IT Sligo, TCD and Liverpool University.

Bill continued to guide the Environmental Department at Tara; his tasks included the management and rehabilitation of the tailings areas and the development of new tailings facilities for the mine. He retired formally in 1986 but continued advising Tara for many years thereafter. He remained involved with the industry as recently as last year as a trusted adviser and consultant. His outgoing and gregarious personality, combined with his genuine love of nature and commitment to environmental protection, enabled Bill to be the forefront of sustainable development of the mining industry.

Bill is survived by his wife Helena (nee Hogan), his daughter Sarah, sons Gerard and John , daughters in law Bela and Lucy and grandchildren Evie, Imogen, Willian and Naiyara.

Obituary
Matthew Parkes
(1962 - 2020)

by Sarah Gatley, October 29th 2020

We were all deeply shocked to hear the news of Matthew last Friday (October 23rd 2020), and the task of paying tribute to him is as monumental as his stature and the impact that he had on the geological community throughout his career.

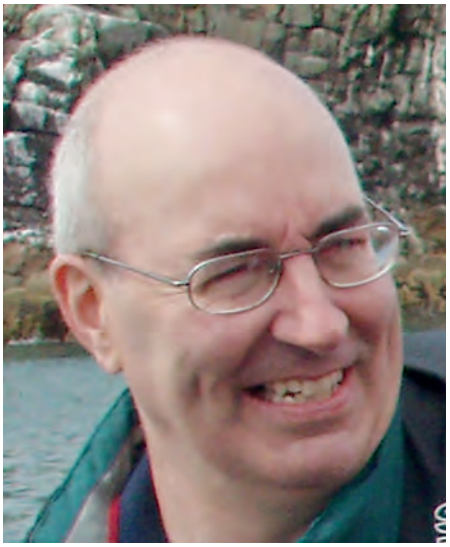
His last role was as Assistant Keeper for Earth Science at the National Museum of Ireland, where Matthew demonstrated his wide-ranging expertise in Irish palaeontology and geology, collections and displays. He also pursued his other passions, including the promotion of Ireland's geological and mining heritage, through his publications and outreach activities.

Matthew's reputation as the Go-To-Man for Irish geological heritage was established during his time in the Geological Heritage Programme in Geological Survey Ireland from 1998 to 2005.

Probably one of his greatest legacies is the national programme of County Geological Audits, which Matthew initiated in 2004 with the publication of counties Sligo and Carlow. He continued to have a central role in each County Audit to the present day, and is the author of several follow-up books and exhibitions.

He was also instrumental in securing Ireland's only Geological Monument, the Valentia Tetrapod Trackway in Kerry, through the purchase of the site by the Irish Government.

With a love of quarries, Matthew was always closely associated with the



industry. Amongst his many publications, the "Geological Heritage Guidelines for the Extractive Industry", was a collaboration between the Irish Concrete Federation and GSI.

A prolific author of academic and other papers, Matthew's ridiculously long list of offices held, would include:

- Chairman of the Mining Heritage Trust of Ireland;
- Editor of Earth Science Ireland;
- Editorial Board of the RIA's Irish Journal of Earth Sciences; Chairman of the Geological Curators' Group;
- Librarian and Expedition Fund Committee member of the Speleological Union of Ireland;
- Irish representative of ProGEO, the European organization for geological conservation;
- Founding member of the Institute of Geologists of Ireland, involved in several working groups, including the Ethics Committee.

Matthew was a long-serving member on the Geological Society's Geoconservation Committee and helped organise the 2018 Annual Gathering in Dublin, bringing speakers from across the island of Ireland. He was also involved with international conferences, most notably 'Natural and Cultural Landscapes - The Geological Foundation", held in Dublin in 2002.

Perhaps Matthew's lasting legacy was going to be the new major GSI-National Museum exhibition in Collins Barracks; he will live on through its realization.

Matthew had fingers in so many pies (and such a huge network of friends and colleagues), it is impossible to cover them all, but those of you who worked with him, or just talked with him, know that he was passionate, prolific, indefatigable, always good humoured and unfailingly generous with his time and assistance. A kind and gentle, gentleman. And I feel honoured to have been one of those people. And he loved cats.

I am sure that you will all join with me in extending our sincerest condolences to Matthew's wife Michelle, and to their families and friends.

IMQS Golf & Dinner Dance 2019

The K Club Hotel, Straffan, Co. Kildare. 9th November, 2019.

Andrew Gaynor (Exe.Secretary), IMQS Council members Brendan Morris, Ronan Griffin, Ciaran Greenan, John Francis (President) Alan Dolan, Les Sanderson, Sean Finlay and Nicola Nixon (Vice President).

Sinead and John Francis (IMQS President).

Janice and Roy Wallace.

Roy Wallace, Chairman of the Institute of Quarrying Northern Ireland and John Francis, IMQS President.

Nicola Nixon, IMQS Vice President and John Francis, IMQS President.

Dr.Derek Nixon and Nicola Nixon, Vice President.

Roy Wallace Chairman of the Institute of Quarrying Northern Ireland.

John Francis, IMQS President.

Stefan and Susan Romedahl, Tadg & Róisín Farrell - New Boliden Tara Mines.

Rachel Paul & Joe McNamee, Danny Quinlan, Shelagh Mahoney, Mary Quinlan, Tim Paul, Leo McNamee and Kate McNamee - Irish Salt Mines.

Gary Megarrell, Chris Stevenson, Steve Breen and Colin McCord - Finnings.

Ann and Pat O'Connor.

Barbara & Jason Hopps and Molly McNamee - Irish Salt Mines.

Brendan Reilly, Lorraine Gibney, Maria Flood, Eric Tremblay (Dalradian), Rosemary Reilly, Loy McParland and Peter McParland - QME.

Michael Moore, Michelle Howley, Sean Murphy and Maeve O'Callaghan.

Dr. Susan Atkinson and Malcom Morgan.

Past Presidents, Les Sanderson and PJ O'Donnell.

Suzie Delahunty, Brendan Morris, Alan Buckley, Eamon McAuliffe, John Guven, Kat Guven, Jonathan Talbot, Blaine O'Brien, John Elmes and Tom Bailey. Front Trio: Orla Marnell, Ann McCormack and Martin Farrelly.

Brendan Morris, Lynne Francis (Runner Up), Les Sanderson and John Francis (Winner) - Clay pigeon Shooting Competition.

Brendan Morris, Brian Keenan (Winner) and Gordon Best - Golf Competition.

Breda & Alan Geraghty, Ciaran & Marcella Greenan, Cormac & Noreen McCarthy, Bridget & Jim Ray, Cyril & Martina Maher, Kelly and Peter Mahon, Patricia & Garry O Brien, Liz & Ronan Griffin, Deirdre & Damien Smith - Roadstone.

Sean Francis (Raffle Winner), Brendan Morris and Ciaran Greenan.

David & Jenny Glenn, Alan Carry, Stephanie & Padraig Flynn, Dave & Deirdre Egan, Chris & Shirley-Ann Stevenson, Gary & Ruth Megarrell, John & Sinead Francis, Des & Annmarie Sheridan, Eoin Ryan, Steve & Jane Breen, Victoria & Colin McCord and Brian & Siobhan Roche. - Finning CAT.

Andrew MacGregor, David Johnston, Lynne Francis, John Francis, Alan Dolan, Stephan Walsh, Les Sanderson and Eddie Devereaux - Clay Pigeon Shooting Competition.

Gordon Best, Ciaran McCreanor, Pat O'Connor, Phil Eaglestone, Garfield Harrison, Alwyn, Brendan Morris, Brian Keenan, Roy Wallace, Jason, Malcom, Alan Geraghty and John Francis.

Annual Dinner Dance

In the K Club,
Straffan, Co Kildare

We hope to confirm details of the 2021 IMQS Annual Dinner Dance by August 2021.

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COVID-19

Coronavirus
COVID-19
Public Health
Advice

Stay safe.
Protect each other.

Continue to:

Wash
your hands well and often to avoid contamination.

Cover
your mouth and nose with a tissue or sleeve when coughing or sneezing and discard used tissue safely

Distance
yourself at least 2 metres (6 feet) away from other people, especially those who might be unwell

Avoid
crowds and crowded places

Know
the symptoms. If you have them self isolate and contact your GP immediately

COVID-19 symptoms include

- high temperature
- cough
- breathing difficulty
- sudden loss of sense of smell or taste
- flu-like symptoms

If you have any symptoms, self-isolate to protect others and call your GP for a COVID-19 test.

#holdfirm

For more information
www.gov.ie/health-covid-19
www.hse.ie

Ireland's public health advice is guided by **WHO** and **ECDC** advice

Rialtas na hÉireann
Government of Ireland

Membership Application Form

Irish Mining & Quarrying Society, 27 Upper Pembroke Street, Dublin 2, Ireland, D02 X361
Web: **www.imqs.ie** Email: **info@imqs.ie** Tel: **089 49 27942**

PERSONAL Details (PLEASE USE BLOCK CAPITALS THROUGHOUT)

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

EMPLOYER Details (PLEASE USE BLOCK CAPITALS THROUGHOUT)

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

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

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

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

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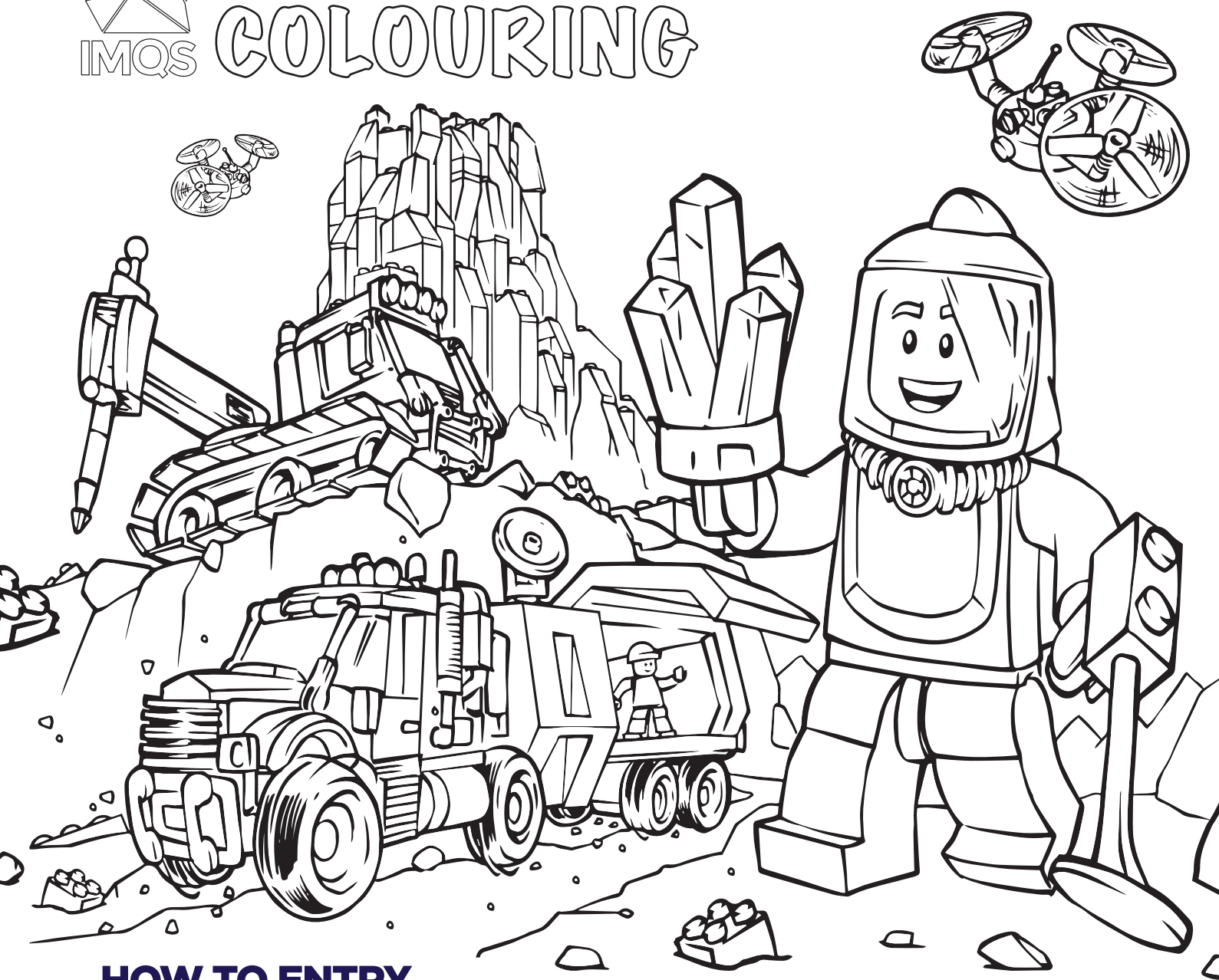

HOW TO ENTRY

Name: .....

Address: .....

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Please send your entry to **IRISH MINING & QUARRYING SOCIETY, 27 UPPER PEMBROKE STREET | DUBLIN 2 | IRELAND | D02 X361**

*Terms and conditions apply.

Competition Closing Date: January 29th, 2021

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