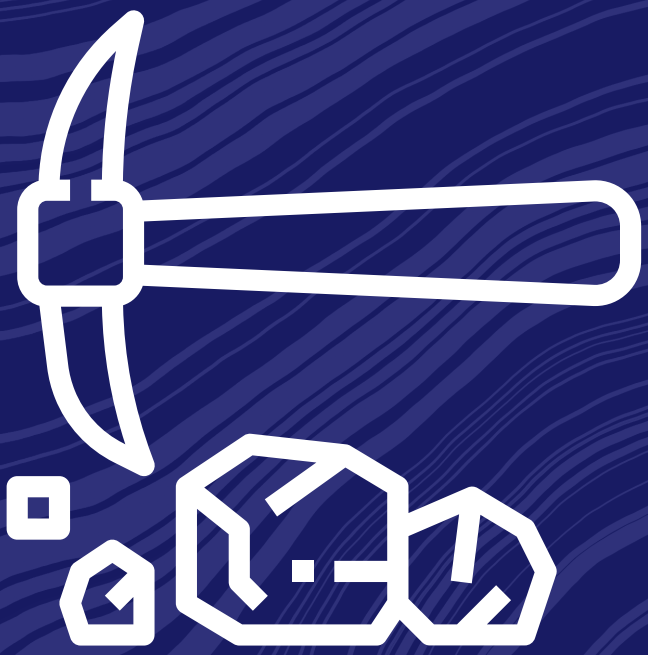
GEOSCIENCE FOR LEAVING CERTIFICATE GEOGRAPHY

Continuing Professional Development Course 2022



MINING IN IRELAND LESSON PLAN

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iCRAG
SFI RESEARCH CENTRE IN APPLIED GEOSCIENCES

Geological Survey
Suirbhéireacht Gheolaíochta
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An Roinn Comhshaoil, Aeráide agus Cumarsáide
Department of the Environment, Climate and Communications

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Geoscience for Leaving Certificate Geography Teachers CPD programme

About the Geoscience for Leaving Certificate Geography Teachers CPD programme

Geoscience is vital for our sustainable future, and geography is the key gateway to geoscience for most students. The Geoscience for Leaving Certificate Geography Teachers CPD programme has been developed by iCRAG (the Science Foundation Ireland Centre for Research in Applied Geosciences) and Geological Survey Ireland to create an opportunity for teachers and geoscience professionals to come together to increase the awareness of geoscience within the Leaving Certificate geography curriculum.

During the CPD course, teachers and geoscience professionals from both research and industry are paired together to co-create curriculum facing resources that are freely available for use. Over the course of six evening sessions, teachers learn more about the cutting-edge geoscience being undertaken by their partnered geoscientists, before working together to develop a curriculum-facing resource using their interests, teaching expertise and the knowledge of the geoscientist. In 2021, the resources produced have included lesson plans, module plans and field guides and the accompanying teacher notes and slides/field booklets for each resource.

The resources link the most recent advances in geoscience to the geography curriculum in a way that is both understandable and relevant. The resources are freely available to be used for classes anywhere in the world. We hope that you and your students enjoy using them.

This resource

This resource has been developed by Eleanor Solon, a geography teacher at Hewitt College, Cork and iCRAG researchers Aileen Dolan and Phil Rieger. The resource is a deep dive into the contentious topic of mining in Ireland. Included in this resource pack is a full lesson plan and associated teacher notes, and a PowerPoint of slides. It is suitable for Leaving Certificate Students.

Sincerely,

Elspeth Sinclair, Fergus McAuliffe, Siobhán Power
Programme Managers – Geoscience for Leaving Certificate Geography Teachers

Geological Survey Ireland, a division of the Department of Environment, Climate and Communications, has been mapping Ireland since 1845. They continue to map the Irish land and marine territories, as well as mineral and groundwater resources. They have responsibility for actions in the current Climate Action Plan including monitoring coastal change, the Just Transition in the midland counties, and providing data for de-risking offshore renewable energy. Irish geoscience research, particularly as it contributes to the development of government policy, is an important part of their work and they fund and co-fund many research projects, including some of the iCRAG research work. Their data and maps are freely available to all at www.gsi.ie.

iCRAG, the Science Foundation Ireland (SFI) Research Centre in Applied Geosciences, are a team of researchers creating solutions for a sustainable society. They develop innovative science and technologies to better understand Earth's past, present, and future and how people are connected to it. iCRAG drives research into areas that are critical to society, including:

- The minerals and metals we need for decarbonisation and sustainable energy.
- Securing and protecting groundwater and marine resources.
- Protecting society from Earth's hazards, such as floods and landslides.

Further information is available at: www.icrag-centre.org

Disclaimer: Every effort has been made to ensure that the information in this book is accurate. Data, links, and maps are accurate as of January 2023. The publishers cannot accept responsibility for any consequences arising from the use of this resource. The publishers are in no way liable or responsible for any injury or loss to any person using this resource.

Lesson plan: Mining in Ireland

Contents

Lesson plan:

Links to curriculum

Core Unit 1 Patterns and Processes in the Physical Environment

The human interaction with the rock cycle, paying particular attention to **one** of the following: mining, extraction of building materials, oil gas exploitation, geothermal energy production.	Appropriate national examples.	Appropriate international examples.

Elective unit 4: Patterns and Processes in Economic Activities

• conflicts that may develop between local and global economic interests and environmental interests. Students should be familiar with the issues relating to at least two examples.	Appropriate national examples e.g. Irish fish stocks, tourism, and heritage.	Appropriate global examples.

Elective unit 4: Patterns and Processes in Economic Activities

• sustainable economic development so as to control its environmental impact. Students should examine past experiences, future prospects and the necessity for environmental impact studies	National issues, the role of the EPA. Depletion of fish stocks, mining sites.

Specific Teaching objectives

- To give Students an understanding of the inputs from the mining industry required to develop renewable energy resources.
- To give students an understanding regarding the potential advantages and disadvantages of mining as a primary economic activity.
- To give students an understanding of Sustainable development and to develop the concept of sustainable mining.
- To give student an understanding of the stakeholders involved in sustainable mining practices.
- To give students an understanding of Mining in Ireland (it attractiveness for investors and benefits to economy) and the role of regulation in promoting sustainable mining practices.
- To give student an example of sustainable mining in Ireland using the Lisheen Mines case study.

Learning Outcomes

Students should be able to:

- Identify the role of mining inputs in the development of wind and solar energy.
- Discuss the advantages and disadvantage of mining as an economic activity.

- Explain the concept of sustainable development
- Explain the concept of sustainable mining.
- Understand the stakeholders in sustainable mining
- Identify the role of regulation in promoting sustainable practices.
- Understanding the history of mining in Ireland.
- Understand the attractiveness of Ireland for the Mining industry.
- Understand the economic importance of Mining to Ireland
- How case studies are a valuable learning tool.
- How to apply knowledge learnt to Leaving Certificate Geography Examination questions.

Keywords and definitions

Mining	extraction of valuable material from the earth
Rock	A solid collection of minerals
Mineral	a naturally occurring substance with distinctive chemical and physical properties, composition and atomic structure
Metal	E.g. Iron, copper, zinc, lithium, aluminium
Ore	Rock which contains valuable minerals
Raw Materials	Input for manufacturing
Sustainable Development	Development which meets the needs of current generations without compromising the ability of future generations to meet their own needs
Sustainable Mining	Resource extraction undertaken in a manner which seeks to improve social, economic and environmental outcomes

Linkage and Integration

Linkages

- English: Oral discussion, debating, memory maps, note taking.
- Team building: Group tasks, discussion, problem identification, solutions.
  Geography/Science: Placing discussions with the wider context of environmental issues

Differentiation

- Think-pair-share on impact of mining, sustainable mining, application to Ireland etc.
- Use of higher and lower order questions in class.
- Power point will aid visual learners.
- Group work, note taker, presenter: Students assign roles.

Approaches to teaching and learning

Resources

- Typed notes.
- Power point visuals.
- Video Clips.
- Leaving Cert Examination papers.

Literacy

- Use of keywords.
- Use of typed notes and power point slides.

Numeracy

- Data relating to the inputs in construction of Wind Turbine and Solar panels.
- Data relating importance of mining to Ireland.

Assess student learning

Teacher questioning and teacher observation of student engagement and understanding of individual lessons/classes.
Homework tasks completed, oral questioning and/or correction of written material.
Examination of Memory maps created by individual students.

Teacher Notes

Carbon Capture and Storage

Learning Activities and Detailed Instructions

History of Mining in Ireland
Ireland has a rich history with respect to mining and mineral exploration, dating back to the Bronze Age (2000 BC). However, mining did not begin to flourish until the late Industrial Revolution of the 18th and 19th centuries, with the South East of the country associated with Copper, Iron in the East, lead and silver in the Midlands and Gold in Wicklow. Since then Mining has evolved through the decades and remains a small but important part of the Irish economy. Despite this long history, awareness remains low regarding the importance of raw materials to society, the potential for Ireland to expand mining activities and the social and economic benefits of sustainable and ethical mining.

Current Mining Activities in Ireland
Ireland has a diverse geology and a range of rich mineral deposits (high concentration) including zinc, lead, copper and gold bearing quartz veins.
Today Ireland is a major producer of zinc and lead ores e.g. Tara mines and also produces gold in Co Tyrone, gypsum in Co Monaghan and rock salt in Co Antrim.

Advantages of Ireland for the Mining Industry
Ireland has a well-established international reputation in terms of mining operations and is supported by international companies including Bolden, Glencore and Teck.

- The country is ranked first in world for discovery of Zinc per km2 and in the last 50 years have discovered over 25 sites containing over 20mt of zinc metal of high-quality concentrates.
- Ireland has a well-developed transport system which facilitates the transportation and export of material to European smelters through our portal sites.

In addition, the country has

- a stable electricity network,
- a pool of skilled works and
- an attractive fiscal policy which includes a 25% corporate tax rate on mining operations.

Ireland came fourth in the Fraser Institute's 2017 Survey of Mining Companies. The survey rates the attractiveness of countries where mining is undertaken. It looks at a number of factors including but not limited to:

- Administrative and environmental regulations certainty
- Regulatory framework and legal system
- Environmental and ecological designations
- Infrastructure
- Socioeconomic factors and access to social infrastructure
- Political stability
- Quality of geological database Etc.

Economic benefits of Mining

- valuable raw materials for industry,
- generates employment (direct and indirect)
- Government revenue in the form of taxes and royalties
- payments to local authorities and

- local community contributions.

Direct expenditure on mineral exploration in Ireland for the period 2009-2019

- was 234m Euro,
- while metal mining annually contributes 550m directly to the economy
- as well as a further 230m in gross added value.
- over 1,400 regional jobs, many of which are highly skilled.
- Mining has a broad regional distribution and has a positive economic and social impact on local communities (wages, provision of infrastructure and services and a positive multiplier effect.)
- The industry is also locational specific, or resource orientated and 80% of workers are domiciled with the community.
- Long-term spin off industries associated with mining include
- geochemical laboratories,
- drilling companies, design, consultancy, and contracting services companies in the fields of engineering, geology and the environment.

Example of Sustainable Development – Case Study Lisheen Mines – by Institute of Geologists of Ireland 2021.

Regulation of Mining activities in Republic of Ireland.

- Application for a **prospecting licence** – A Prospecting licence permit is given for a period of 6 years which allows exploration in a specific geographic area, this may be renewed. Prospecting uses different techniques, including the examination of historical and geological records, mapping different rock types and mineral occurrences, collecting samples of rock, soil or sediments for geochemical analysis or measuring the geophysical properties of rocks in an area. Exploration generally involves the drilling of small holes which allow the extraction of core samples for analysis. Licence holders are required to actively engage with landowners regarding access and to ensure that all activities are undertaken are environmentally sound. A prospecting licence does not give permission to mine.
- The next stage in the process is application for **Planning Permission permit** which is based on the submission of an Environmental Impact Assessment (EIA) to the Local Planning Authority or An Bord Pleanala. In applying for planning permission, the applicant must provide detailed information regarding mining operations, processing, waste storage facilities and infrastructural requirements, public consultation is also part of this process.
- The next stage is the granting of an **Integrated Pollution Control (IPC) or and Industrial Emissions (IE) licence** from the EPA.
- The final stage is the granting of a mining lease or licence from the Department of the Environment, Climate and Communications. A mining licence allows the EPA to regulate environmental performance, including emissions to water and air, noise and vibration impacts and the generation and disposal of waste from mining activities. Site inspections by EPA staff are undertaken on a regular basis and are unannounced and emissions are monitored on a regular basis. Health and safety inspections by the HSA are also undertaken to ensure safe working practices. The mining company is responsible for self-monitoring of activities and is required to report any incidence on site or areas of non-compliance. Failure to fulfil monitoring and reporting can result in legal action by the EPA. Furthermore, mining companies are required to publish Annual Environmental Reports on their environmental performance. Mining companies are also required to plan and provide adequate finance for the closure and after care of mines. Closure and aftercare plans are very detailed and are underpinned by international guidelines to protect the natural environment.

A number of institutions play a key role in the development of mining in Ireland. These include:

- The Minister (the Department) of Communications, Climate Action and Environment, who grants and renews prospecting and state mining licenses.
- The Environmental Protection Agency (EPA) which oversees applications for Integrated Pollution Prevention Control licenses and is completely independent from all other parties.
- The local Planning Authorities are the principal institutions responsible for the assessment of planning applications for the development of mines. They undertake the assessment of environmental impacts and of effects on Natura 2000 sites.
- An Bord Pleanála, the national independent appeals board.
- In addition, Geological Survey Ireland may provide scientific and/or technical advice.

Lisheen Case Study: Sustainable Mining

Mining Life Cycle

Exploration and Feasibility Study

Lead and Zinc deposits discovered in 1990

Early 1990's Feasibility Study undertaken which involved

- Technical, Economic, Environmental and Planning studies and
- Community consultation.

Mine Design and Planning

1995 Submission of an Environmental Impact Statement (EIS) and Planning application to North Tipperary County Council.

Approved in August 1996.

June 1997 An Integrated Pollution Control Licence was issued by the Environmental Protection Agency (EPA).

June 1997 final planning permission granted by An Bord Pleanala.

October 1995 a State Mining Licence was issued by Minister for the Marine and Natural Resources.

Construction and Installation

Construction work started in 1997, went on for 2 years employing up to 700 workers.

Total development cost of 256 million Euro

Extraction and Economic Benefits

Production began in October 1999 and continued for 16 years until 2015.

- 300,000 tonnes of zinc concentrate produced annually.
- 2.8 billion in mine revenue.
- 350 direct jobs.
- 352 million Euro in wages
- 500 indirect jobs

Over its 15 years of operation the mine generated

- 1.3 billion Gross Value Added to the Irish Economy
- 5.8 billion in direct, indirect and induced spending
- 257 million to the State in royalties, taxes and rates.

Mine Closure and Aftercare

As part of its Mining Licence, the company was required to a submit Closure, Rehabilitation and Aftercare Management Plan (CRAMP) and to allocated funding for same (27million).

Prior to Closure, Rehabilitation work was undertaking

- in the tailing ponds (storage of ore residue) and was 60% completed by 2015

After the mine closed in 2015 work continued including

- Backfilling of the underground mine
- Clearing and removal of buildings and equipment
- Removal of ground contaminated with Lead and Zine
- Rehabilitation of tailing ponds to agricultural land

All work undertaken was closely monitored by relevant authorities.

Post-Mining Land Use

- Mine infrastructure removed
- Wetlands to trap water runoff
- Buildings used to support other economic activities
- Campus for National – Bio economy established supporting agri-food industry
- Development of 44 wind Turbines which supply electricity to power 70,000 homes (size of Galway City)
- Improvement of road network, telecommunications, new fresh water supply, investment for local sport facilities and community hall
- Reskilling and upskilling of mines workforce.
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Overall sustainable mining is possible if efforts are made to enhance the benefits of mining activity and to the reduce or mitigate negative impacts. Involvement of the local community in the process allows companies a *"social licence to operate"*.