



Exploring Natural Resources

Geology, The Quarry & The Bog

Student Name		Class Group	
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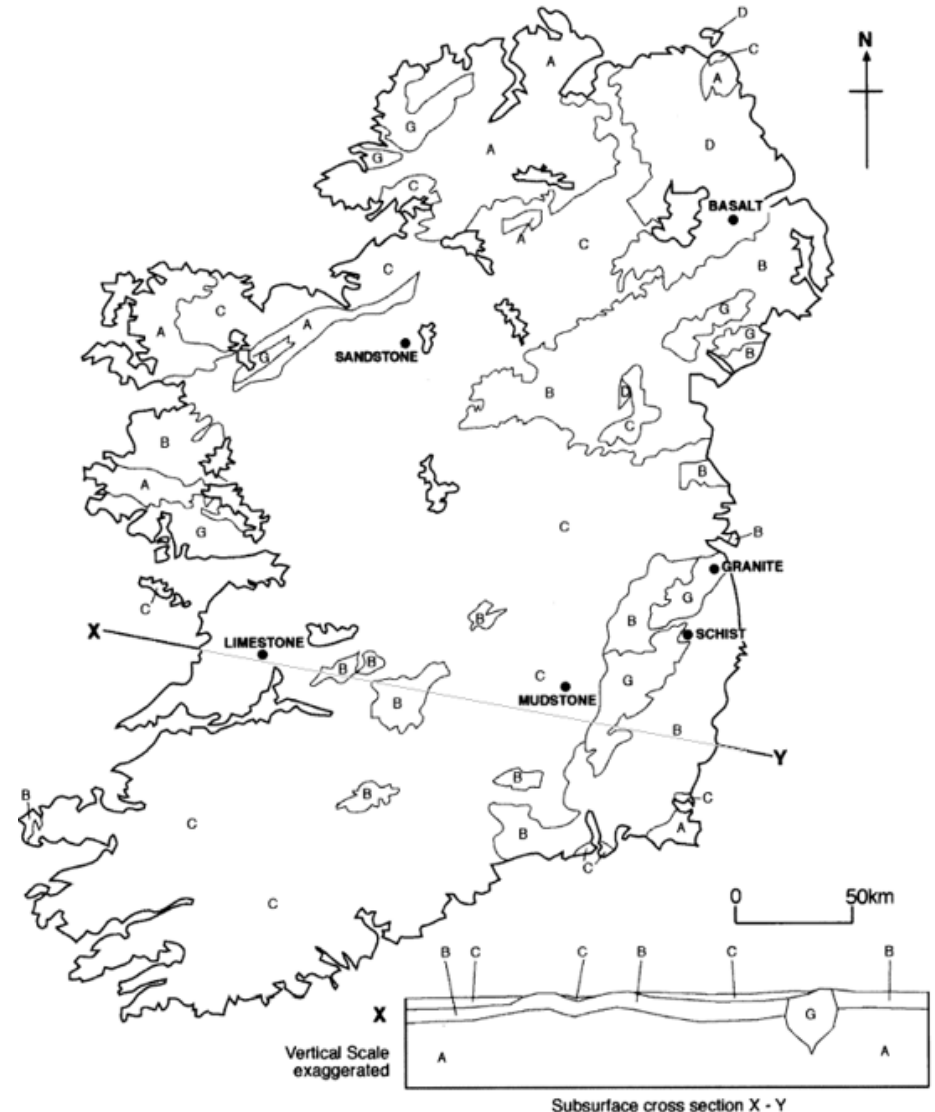
Learning Intentions

- ☐ To revise the rock cycle, examine rock samples and locate them on a geological map.
- ☐ To study geological time, naming the eras and major geological events that impacted on Irish geology.
- ☐ To interpret geological principles from cross sections and date them youngest to oldest.
- ☐ To examine the forces of folding and faulting through modelling activities.
- ☐ To identify and locate peatlands in Ireland.
- ☐ Practice using and interpreting ArcGIS and Scoilnet maps.
- ☐ To investigate quarry output types and processes at work in the quarry system.
- ☐ To evaluate the impact of peatland decommissioning.
- ☐ To synthesis learning about quarries and peatlands and determine their interaction and impacts on the economy, society and the environment.



Lesson Geology: Ireland's Geological Time Scale

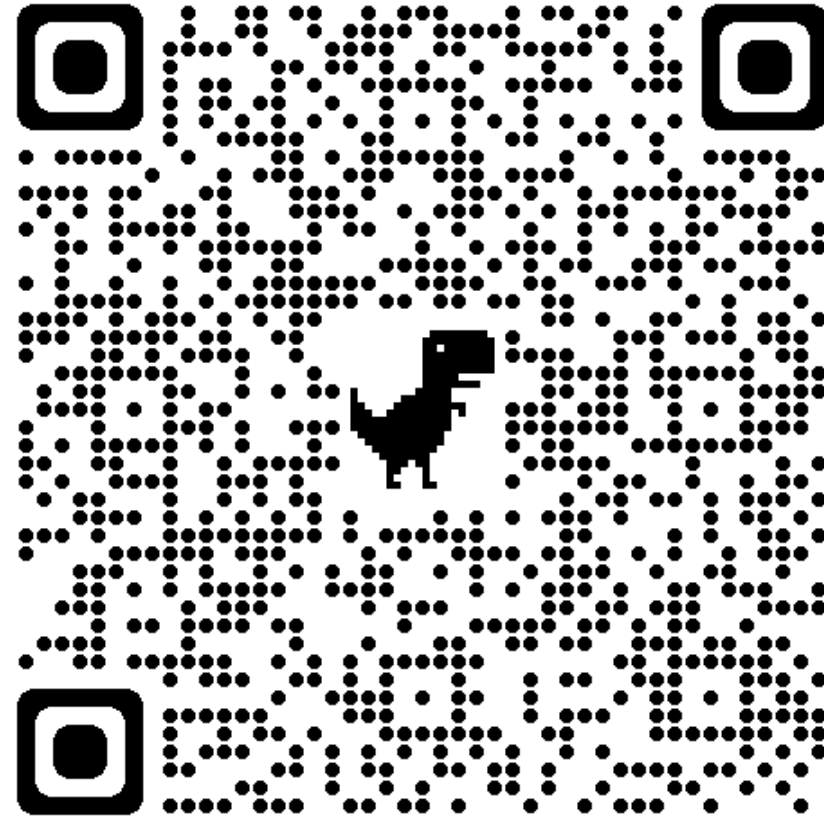
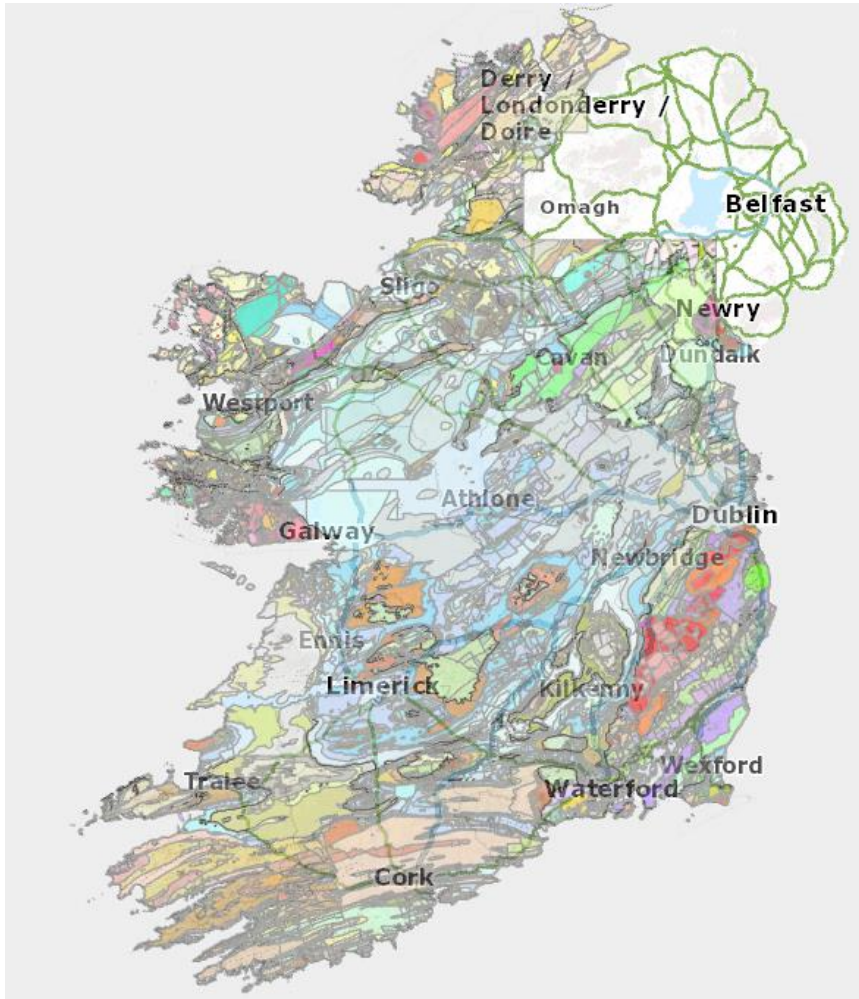
Colour in the
bedrock map of
Ireland with the
colour coded
legend



Time Scale	Geological Era	Geological Period	Environment	Rocks	Key (letter & colour)
1.8 - 65 Mya	Cenozoic	Quaternary Neogene Paleogene	Extrusive Volcanic - Mid Atlantic Rifting	Basalt	D
65 - 250 Mya	Mesozoic	Cretaceous Jurassic Triassic	Shallow sea - East Antrim Coast	Chalk	
250 - 410 Mya	Upper / Late Palaeozoic	Permian Carboniferous Devonian	Armorican Orogeny. Desert Dunes Swamps Tropical Sea Mountains & River flooding	Sandstone (new) Coal Limestone Sandstone (old)	C
410 - 545 Mya	Lower / Early Palaeozoic	Silurian Ordovician Cambrian	Caledonian Orogeny Ring of Fire Iapetus Suture	Granite Quartzite Slate Sandstone	B
545 - 1000 Mya	Late Precambrian		Orogeny - metamorphism of ancient continents by igneous intrusions	Schist Gneiss Quartzite	A
	Intrusions	Cenozoic Palaeozoic	Mourne Mts Caledonian	Granite Gabbro	G



Lesson Geology: Explore National Geology

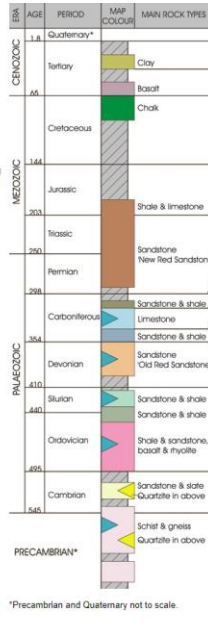


<https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=de7012a99d2748ea9106e7ee1b6ab8d5&scale=0>



Lesson Geology: Explore Co. Meath

Click the map for information on a specific county, or select a county from the alphabetical list above



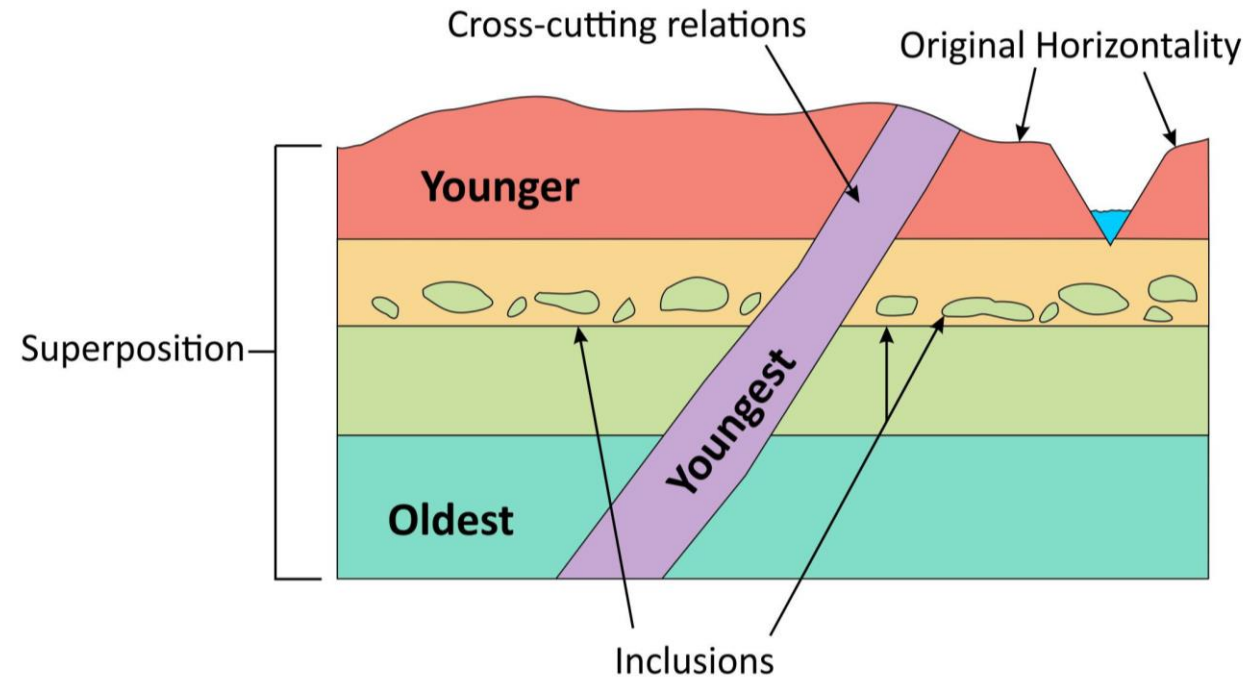
1. Mark an X on the map from the previous activity for Oldcastle, Co. Meath
2. Access <https://www.geoschol.com/ireland.html> and read about Co. Meath
3. Create a summary of notes about the geological history in Meath



Geological Principles

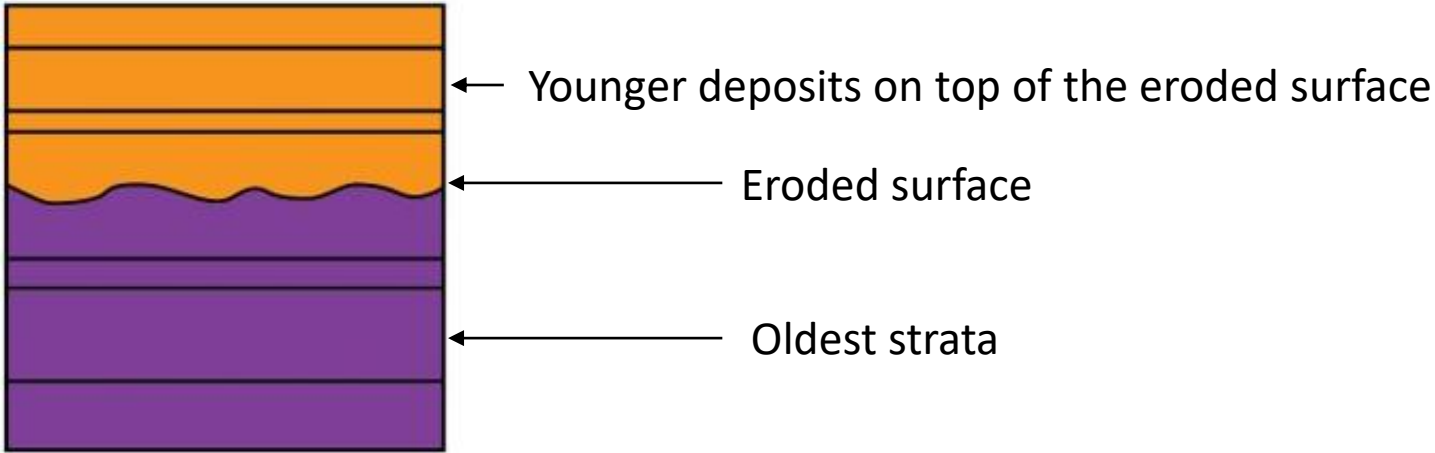
These are used to determine the relative age of rock strata.

- Superposition
- Original horizontality
- Cross-cutting relationships

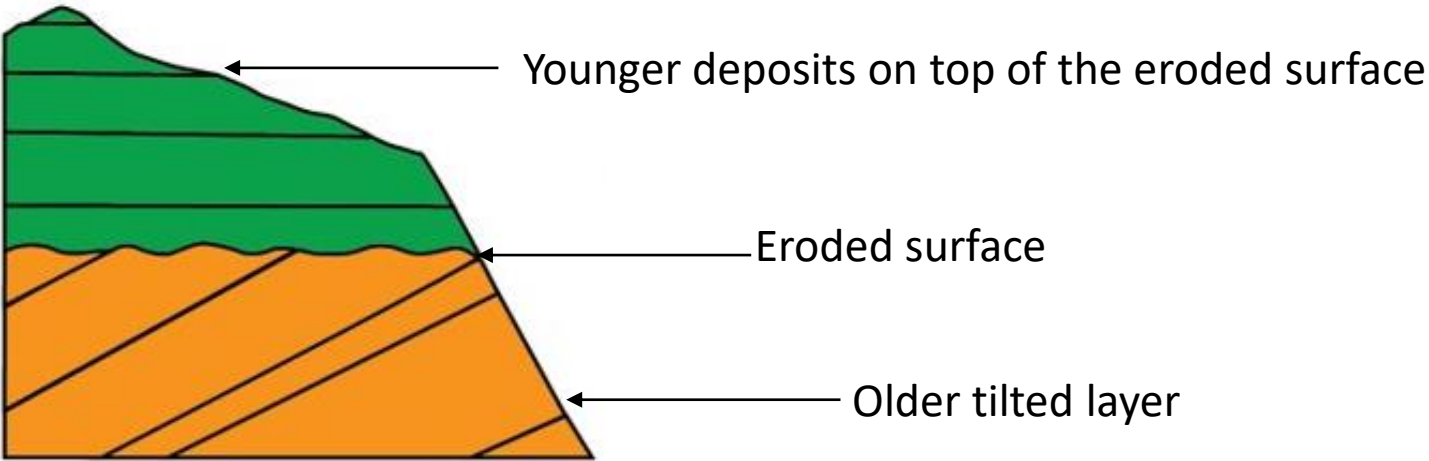


Interpretation of geological cross sections

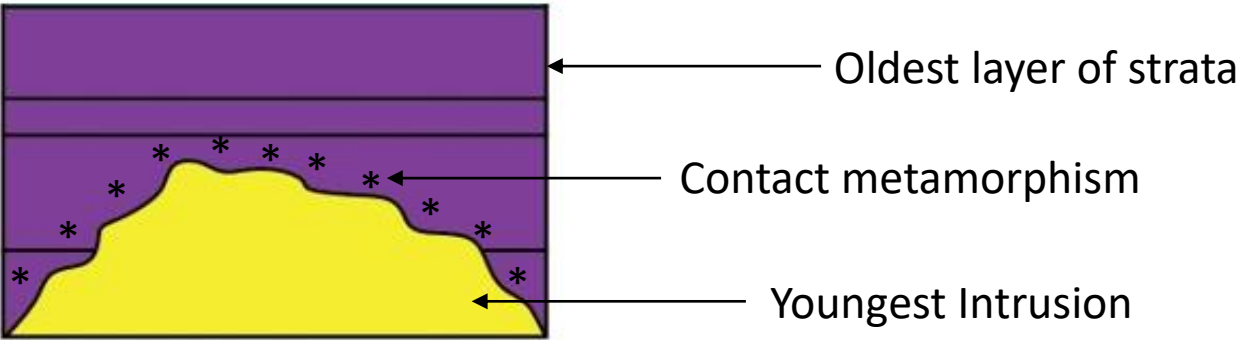
Disconformity



Angular Unconformity



Nonconformity

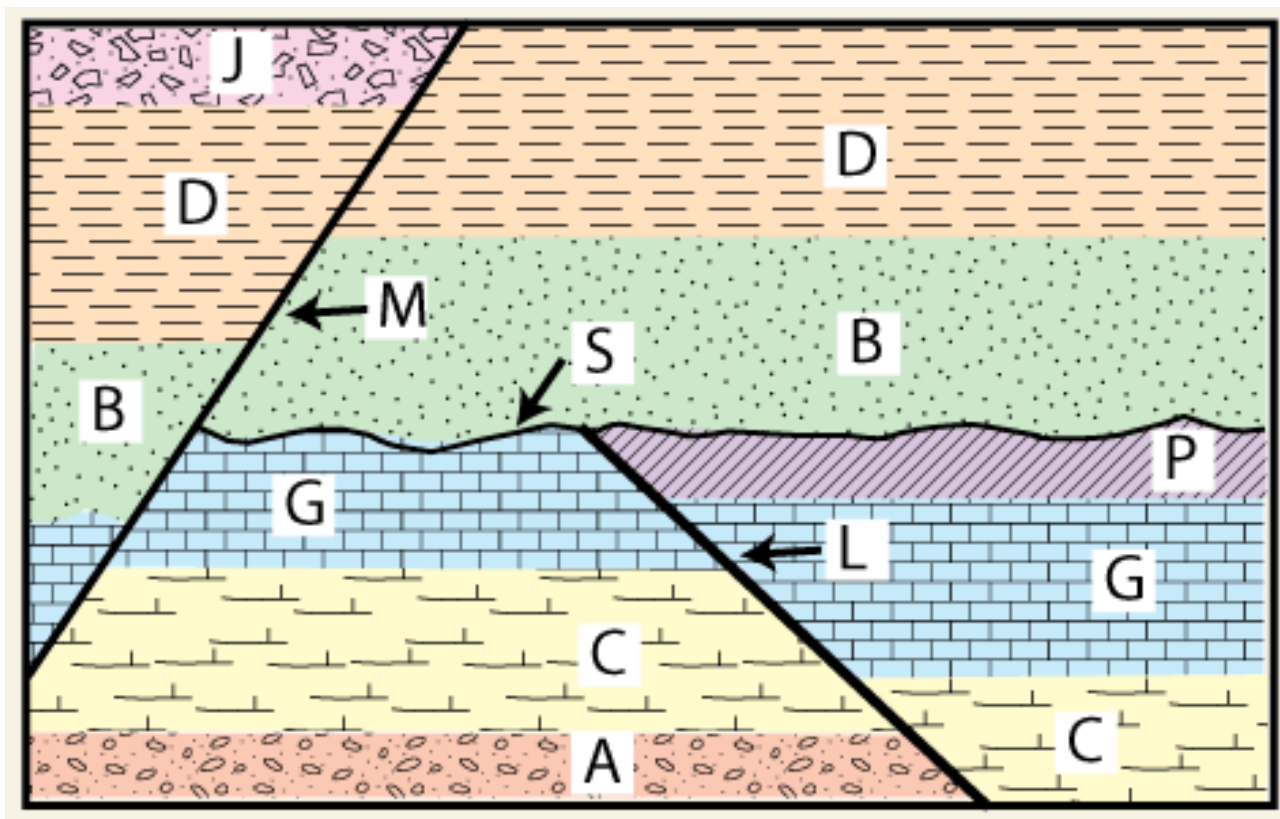




Lesson Geological Principles: Activity

Use the laws of superposition, original horizontality and cross-cutting relationships to determine the relative ages of the cross-section.

Determine the OLDEST bed FIRST.



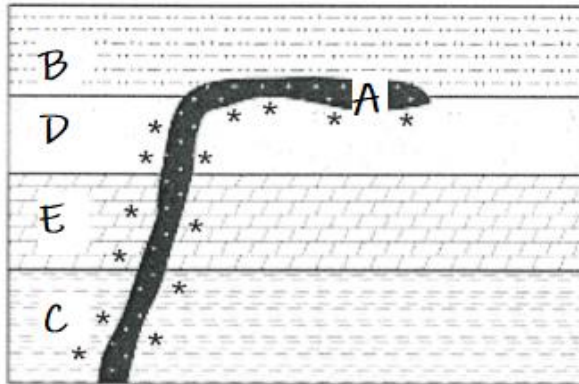
Youngest	
Oldest	

<https://cimss.ssec.wisc.edu/sage/geology/lesson1/activity4.html>

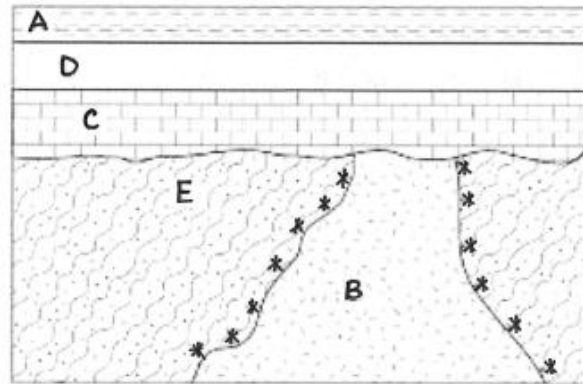


Lesson Geological Principles: Activity

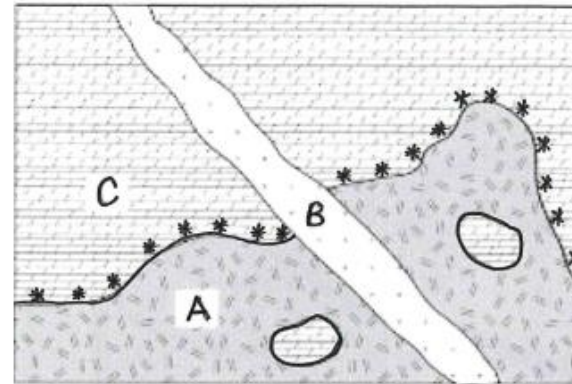
Use the laws of superposition, original horizontality and cross-cutting relationships to determine the relative ages of the following cross-sections. Determine the OLDEST bed FIRST.



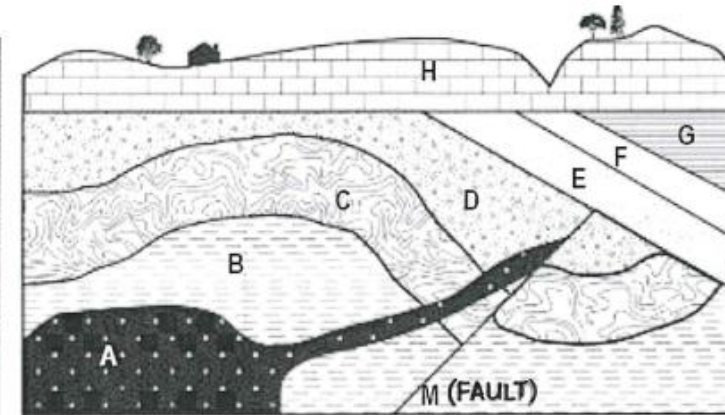
Youngest	
Oldest	
Principle	



Youngest	
Oldest	
Principle	



Youngest	
Oldest	
Principle	



Youngest	
Oldest	
Principle	



Lesson Geological Principles: Create your own

Create your own cross section and share with your partner to see can they interpret it correctly. Use five letters A,B,C,D,E .

Youngest	
Oldest	
Principle	



Lesson Folding & Faulting: Playdough Folds & Faults

What do I need? • Three or more colors of playdough • Ruler • Plastic knife • Coloring pencils

Lesson Objective Make **four** models of different crustal deformations arising from stress on the Earth's crust paired with erosion over time.

Method

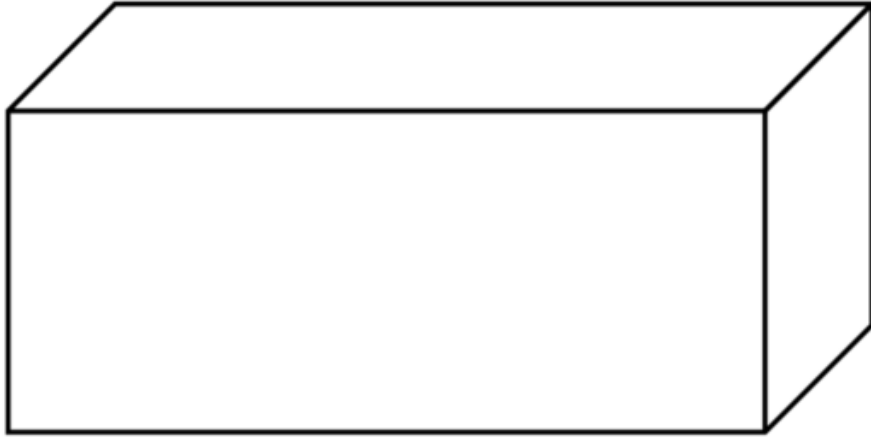
For each model, take at least three colors of playdough and form them into thin rectangles, roughly 0.5-1 cm thick and 5-6 cm wide. Stack each of the colored layers on top of each other and trim or square off the edges to form a uniform block.

1. **Syncline and Anticline:** Take your block and apply pressure evenly from the sides to create a uniform wave. Trim a thin, 1 centimeter layer off the top of your block horizontally to represent erosion, which exposes hidden layers in the rock. Draw your block in the space on the next slide.
2. **Plunging Synclines and Anticlines:** Cut another centimeter off your block, this time vertically from the top to the bottom at an angle, shaving off the forward-facing side of your model. Notice that the newly exposed layers are no longer on the same plane. Because you cut at an angle, there's a plunge in the block where the rock is exposed at different angles. Draw this perspective of your block.
3. **Asymmetrical Folds:** With a fresh block with your playdough. Compress your layers from the sides as before, but this time, make the folds lean more to one side. As before, "erode" away the top centimeter horizontally with your knife. How does this block differ from steps 1 and 2 above? How could you tell from looking at the top of your block that there was an asymmetrical fold hidden beneath?
4. **Faults:** Lastly, cut your block in half from top to bottom at an angle of your choosing. Reattach the two sides with one side sliding lower than the other. You've just simulated a type of earthquake! As before, use your knife to "erode" the top centimeter of the block. Draw your block. From your observations, what does erosion tell us about the presence of faults?

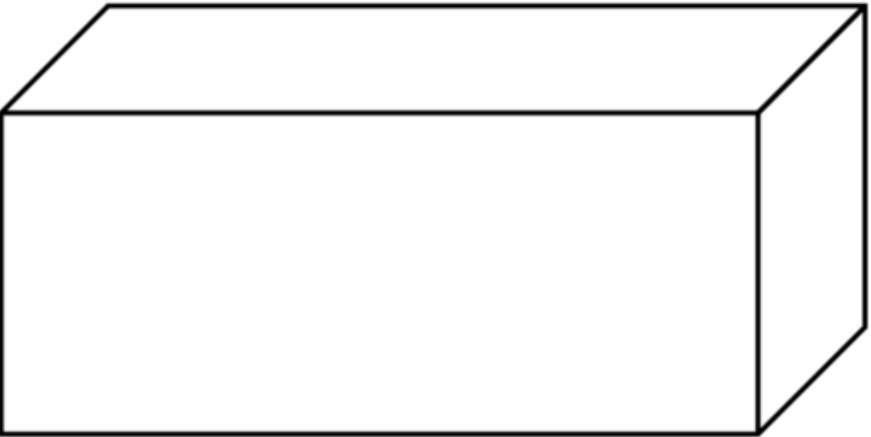


Lesson Folding & Faulting: Playdough Folds & Faults

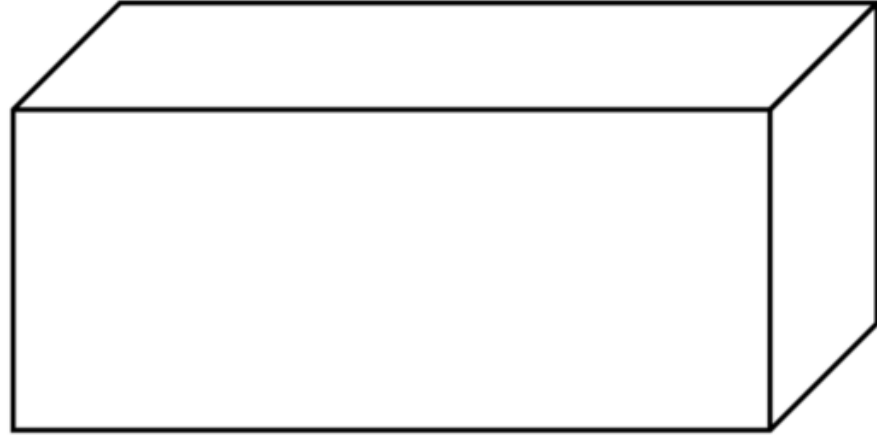
Sketch of simple folds



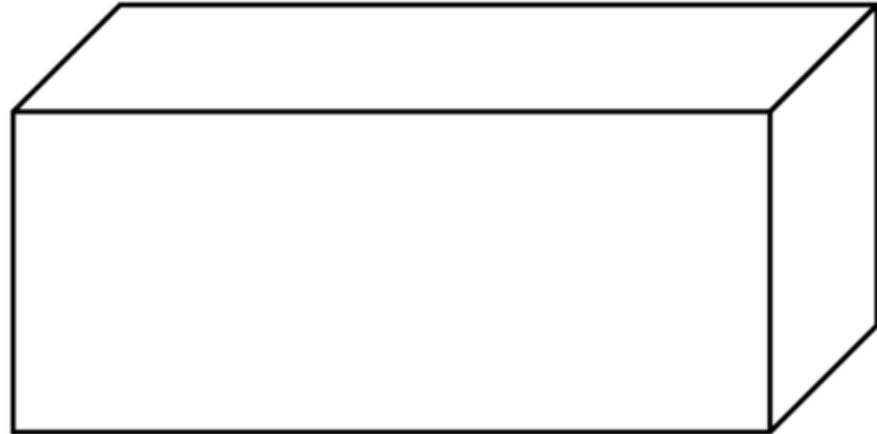
Sketch of normal faults



Sketch of asymmetric folds



Sketch of reverse faults





Lesson Peat: Formation Video

Answer the questions on the resource booklet.



of fresh, fertile, sediment.



Lesson Peat: Formation Video

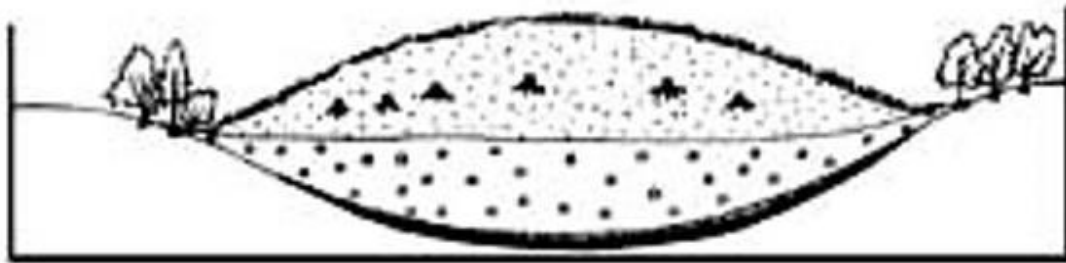
Watch the video and answer the questions below. <https://www.youtube.com/watch?v=kYqygTcO-YQ>

1	When / how long ago did peat begin to form?	
2	What geological / geomorphological conditions led to the formation of peat bogs?	
3	How did the retreat / melting of glaciers contribute to the creation of peat bogs?	
4	How did plant seeds from southern Britain and Europe arrive?	
5	Which types of plants were among the first to arrive and what conditions allowed them to thrive?	
6	How did the climate change? What vegetation replaced the trees?	
7	Name three environmental conditions in which peat develops	
8	Why are bog plants like cotton grass and sphagnum moss well-suited to live in waterlogged and nutrient-poor conditions?	
9	Approximately how much peat forms each year?	
10	From your knowledge of the geological timeline, which geological period is modern day peat derived?	

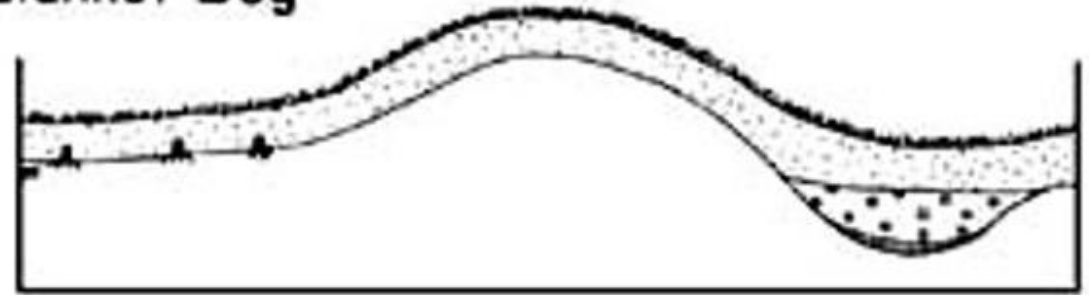


Lesson Peat: Sketching Activity for the types of bog

A Raised Bog



B Blanket Bog



■ Lake marl ■ Lake peat ■ Fen peat ■ Bog peat + Fossil tree stumps



Lesson Peat: Sketching Activity for the types of bog

Type One = _____	Type Two = _____
Relief Environment = _____	Relief Environment = _____
Irish location = _____	Irish location = _____
Key for diagrams	



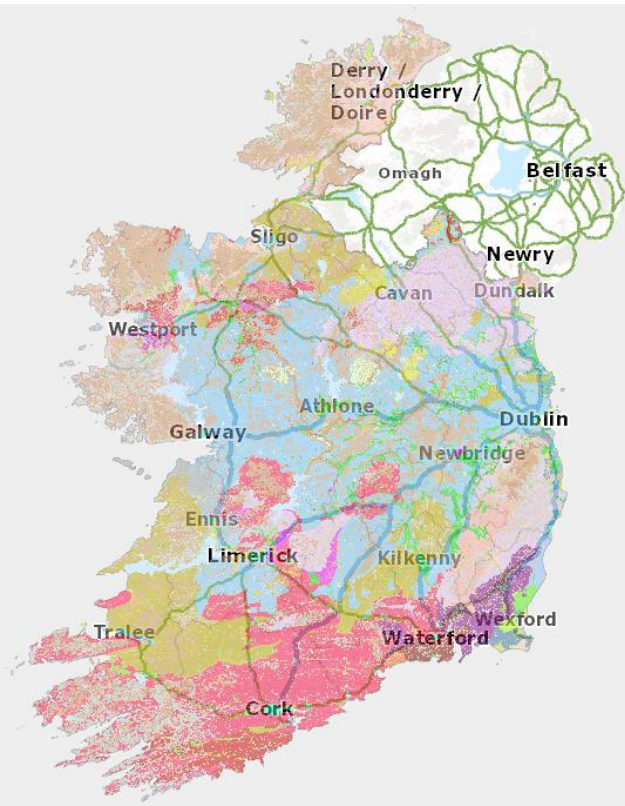
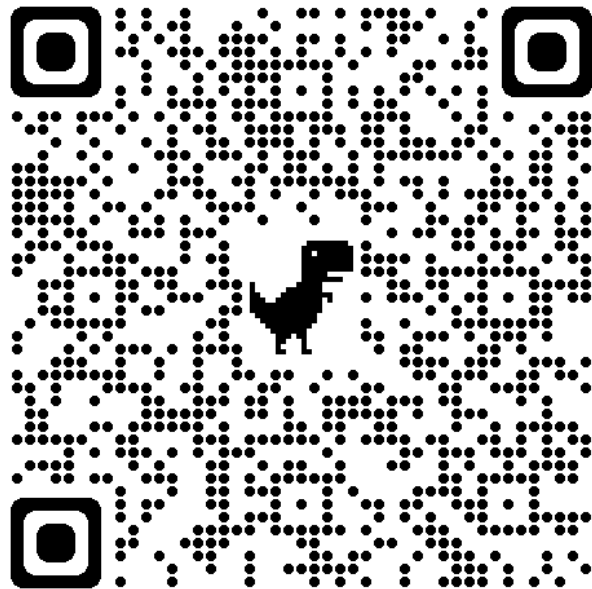
Lesson Peat: Exploring Quaternary Sediments

1. Deactivate all layers on the ArcGIS maps.
2. Then select Quaternary Sediments.
3. Zoom into the map for your local area

Discover local quaternary sediments.

Name and explain three different quaternary sediments you find. Can you find any peat?

Colour Key	Lithology	Description / Explanation





Mudstone



Basalt

Schist

Conglomerate



Gneiss

Granite



Slate

Limestone

Limestone is a carbonate rock that is often composed of the skeletal fragments of marine organisms.

[illegible]



Lesson Peat: Identifying bogland using Google Maps

Research and locate a local peatland.

It is easier to identify from the satellite layer

<https://www.google.com/maps/@53.7253164,-7.3440571,7587m/data=!3m1!1e3?entry=ttu>



Name a local bog discovered on Google Maps _____

Give the coordinates for this Bog _____

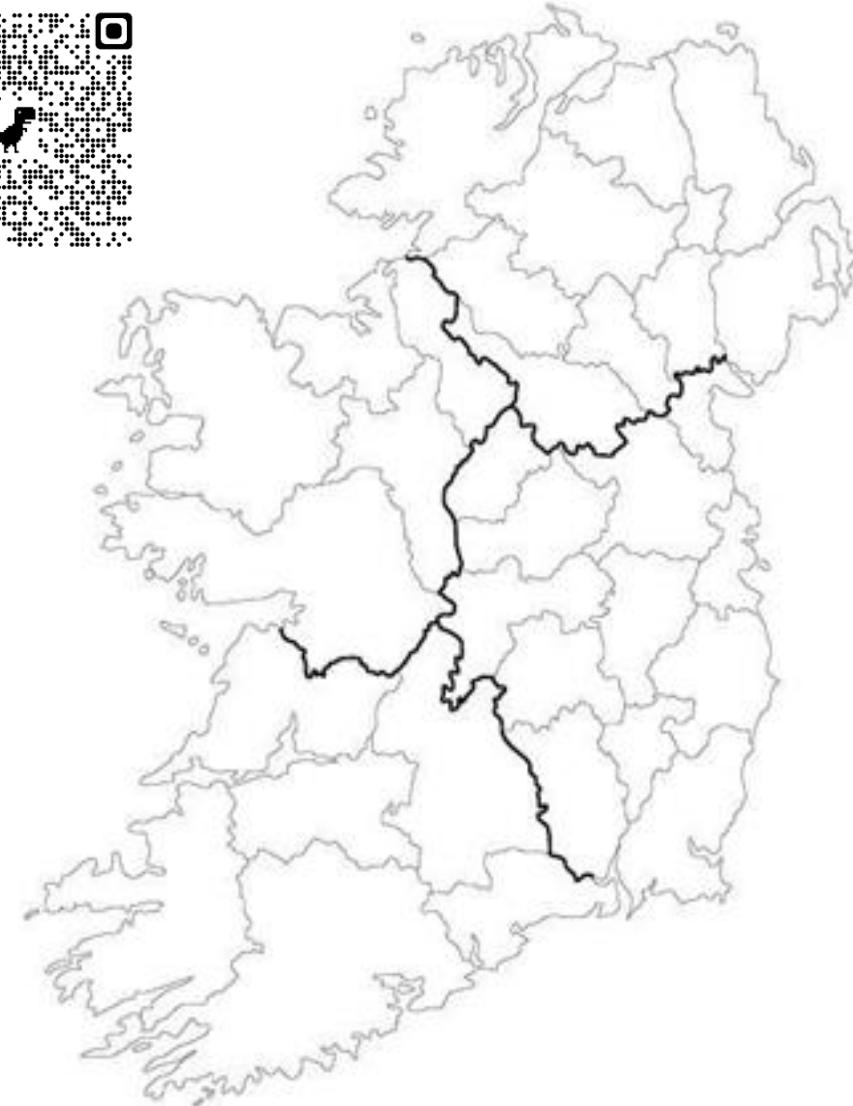
How can you identify a bog from a satellite image? (What do you see?)





Lesson Quarrying: Active Quarries in Ireland

1. Examine the ArcGIS map, only turning on the Active Quarries layer
<https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228>
2. Explore the map and research an example of each quarry type.
3. Select one example of each output and label on the map
4. In the final row, reference a local quarry
5. Complete the table, gleaning information by clicking the quarries on the map.



Active Quarry	Outputs / Products	Location	Rock Type	Product Use	Other Information
	Crushed Stone				
	Dimension Stone				
	Sand & Gravel				



Lesson Quarrying: Label the Quarry Photograph

Person and
vehicle for
scale

Greywacke

- a variety of sandstone
- a hard rock,
- dark grey color
- poorly sorted angular grains of quartz, feldspar, small rock fragments
- cemented in a compact, clay-fine matrix.



14m height

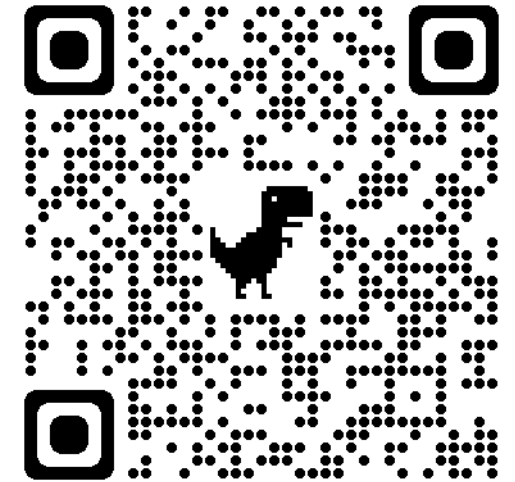
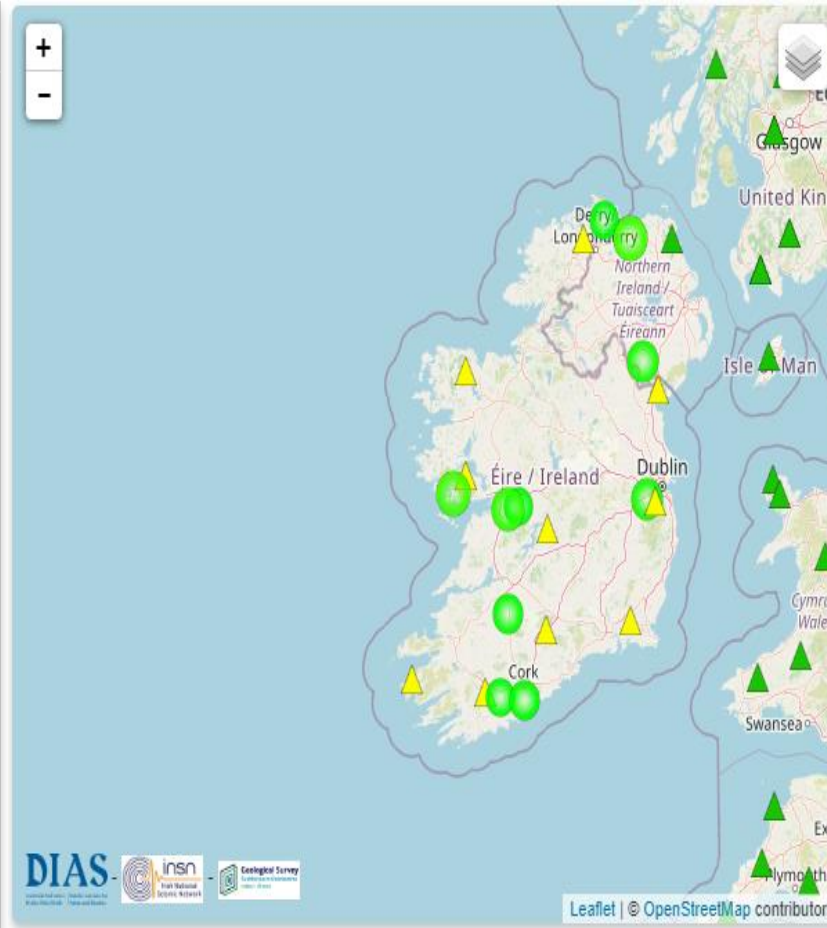
Product Use ...



Lesson Quarrying: INSN Seismic Network

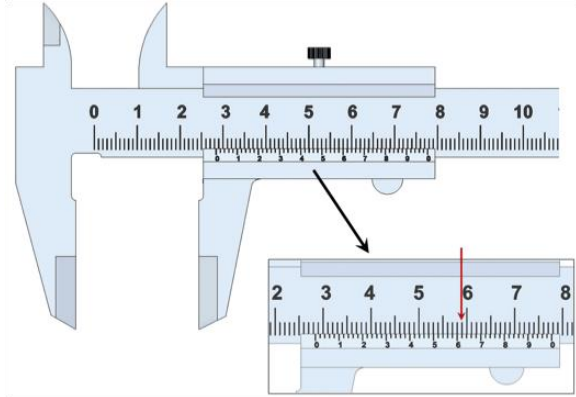
<https://www.insn.ie/events/> Map of seismic activity from around the world picked up on local seismographs.

DATE TIME (GMT)	MAGNITUDE	TYPE	LATITUDE	LONGITUDE	DEPTH (KM)	REGION	ID
2023-11-28 14:15:59.0	0.7	quarry blast	51.80	-8.43	0	Co. Cork, Ireland	dias2023xhvt
2023-11-28 13:36:25.1	1.0	quarry blast	53.29	-9.57	0	Co. Galway, Ireland	dias2023xhul
2023-11-28 13:29:22.5	1.0	quarry blast	55.08	-6.77	0	Co. Derry, Northern Ireland	dias2023xhuf
2023-11-28 13:09:32.6	0.7	quarry blast	52.43	-8.70	0	Co. Limerick, Ireland	dias2023xhto
2023-11-28 12:50:00.0	0.6	quarry blast	53.20	-8.54	0	Co. Galway, Ireland	dias2023xhsy
2023-11-28 12:49:06.4	0.8	quarry blast	53.25	-6.51	0	Co. Dublin, Ireland	dias2023xhsx
2023-11-27 14:31:32.2	0.8	quarry blast	54.23	-6.57	0	Co. Armagh, Northern Ireland	dias2023xgat
2023-11-27 14:27:34.1	0.6	quarry blast	55.20	-7.18	0	Co. Donegal, Ireland	dias2023xgaq
2023-11-27 12:49:57.1	0.6	quarry blast	51.81	-8.84	0	Co. Cork, Ireland	dias2023xfxk
2023-11-27 12:36:14.8	0.9	quarry blast	53.19	-8.71	0	Co. Galway, Ireland	dias2023xfwy





Lesson Quarrying: Examine rock graded material



Describe how difference grades of material can be separated?

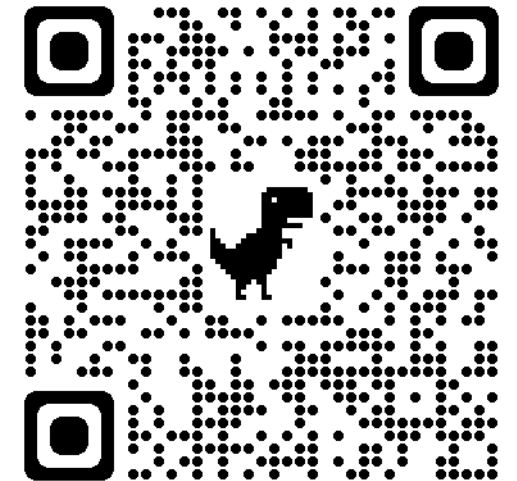
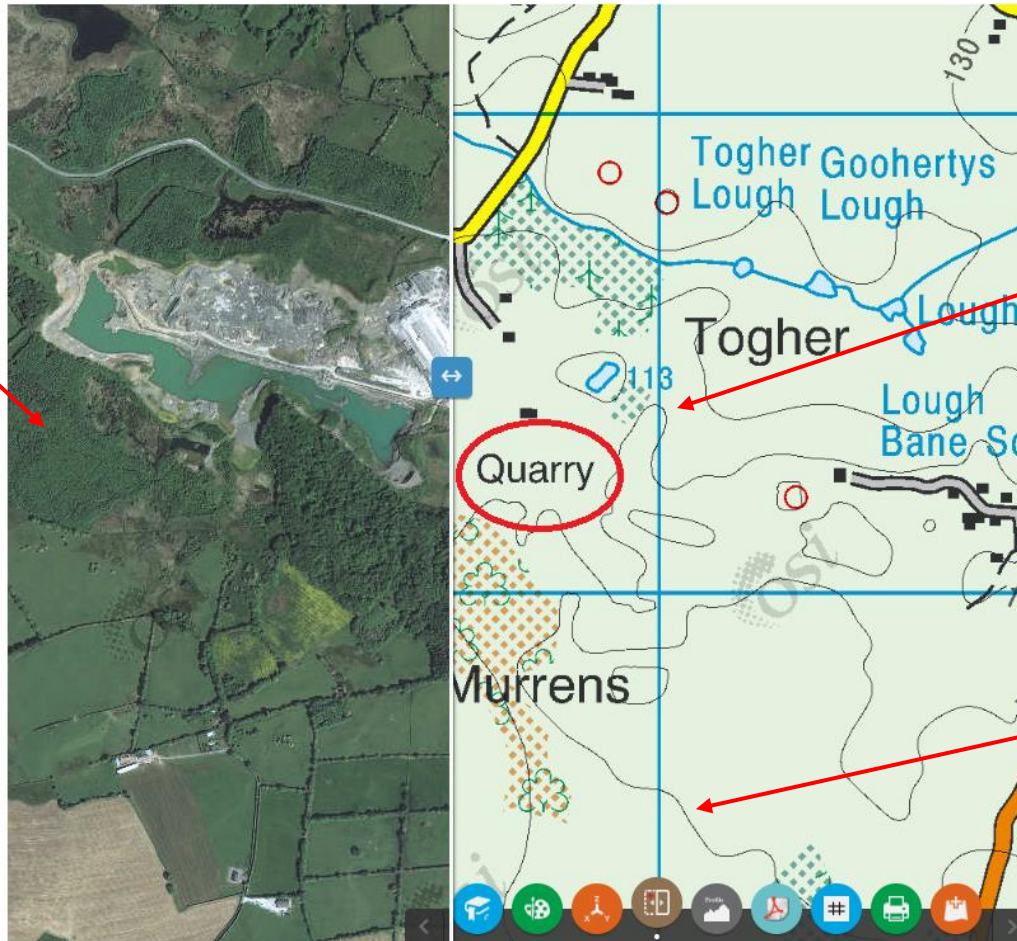
Measure the largest sediments in your sample using the vernier calipers: Size = _____



Lesson Quarrying: Describe Quarry Processes

1. Name
Describe
2. Name
Describe
3. Name
Describe
4. Name
Describe

Local Quarries – Explore on Scoilnet Maps

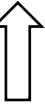


<https://maps.scoilnet.ie/OSiMaps/EsriVer17/index.html>



Lesson Quarrying: Sketch-map Skills

Title:



Key:

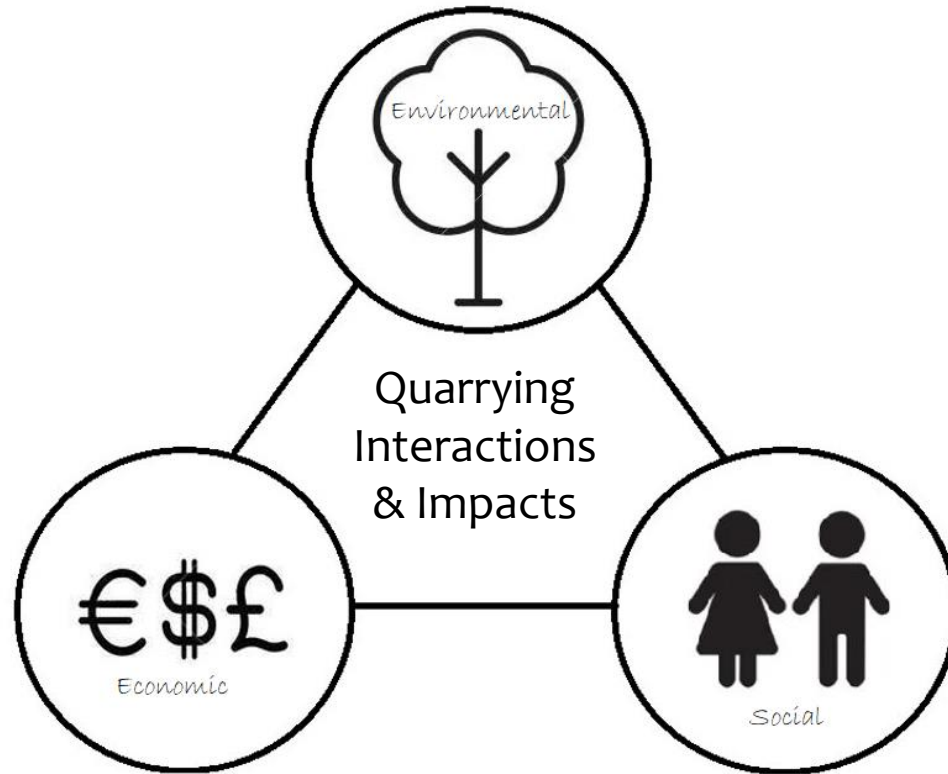


1. Access Scoilnetmaps <https://maps.scoilnet.ie/OSiMaps/EsriVer17/index.html>
2. Practice using swipe and spotlight for the Discovery Map and Aerial Photograph.
3. Locate a local Quarry
4. Take a screenshot of the Scoilnet Aerial Photograph and Discovery map of a local quarry.
5. Draw a sketchmap from your screenshots, using sketching skills (location, title, direction, key/labels etc.)



Lesson Quarrying: Interactions & Impacts

In pairs complete
the mind map
template
considering the
positive and
negative impacts
of quarrying,
reference case
studies (local and
national), statistics
etc.





Lesson Bogs: Identify the stages of peat exploitation by Bord na Móna

Peat Processes	Letter
Draining	
Scraping	
Ridging	
Collecting	
Transport	



A



C



E



B



D



Lesson Bogs: Notes from presentation on decommissioned bogs

[illegible]



Lesson Bogs: Derrinlough windfarm

<https://youtu.be/BLF8cVlv3Wo?si=kTb5saNgRpcsbRGV>



1	How much onshore energy is BnM aiming to create?	
2	What evidence of quarrying can you identify?	
3	Identify two of the main aims of the project at Derrinlough	
4	How many turbines will be installed on the site?	
5	Mention how was the local area considered?	
6	Mention how was the local area considered?	
7	Can you identify and irony to the decarbonising aim? And describe what that is.	

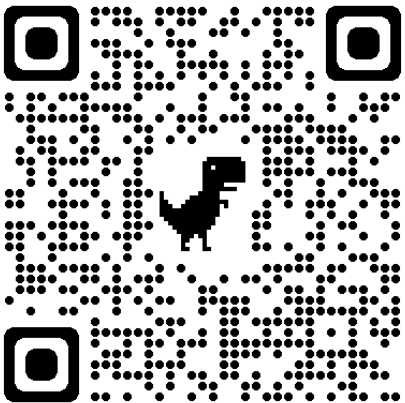


Lesson Bogs: Carbon Farming

RTE Player "Heated"

Watch the video from 16:06 (minutes) and answer the questions.

<https://www.rte.ie/player/series/heated/10002421-00-0000?epguid=IP10002422-01-0001>



1	How much of Ireland is covered with peat deposits?	
2	Why are farmers encouraged to restore bogs?	
3	Who funds the Peatland Restoration Pilot Scheme?	
4	By increasing the amount of drainage in wetland peat areas, what can be a consequence for farmland?	
5	To what height does the scheme recommend raising the water table on grazing farmland?	
6	For every 10cm the water table is raised, how much CO_2 per hectare can be stored?	
7	What is paludiculture?	
8	Name two crops that thrive in wet acidic conditions	
9	True or False. Irish bogland is a more efficient carbon sink than Redwood Forests of North America	
10	How many years of formation represent 1m of peat?	
11	Describe how sphagnum moss creates a carbon sink	

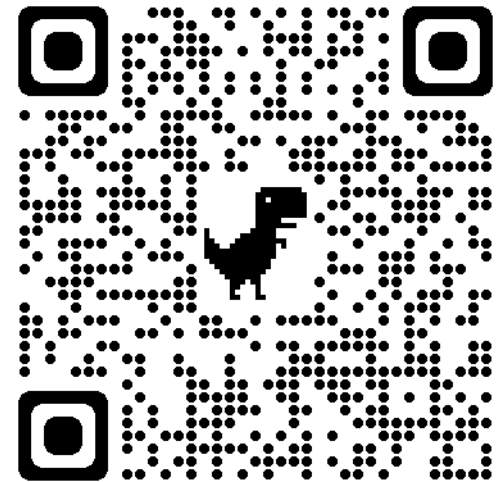
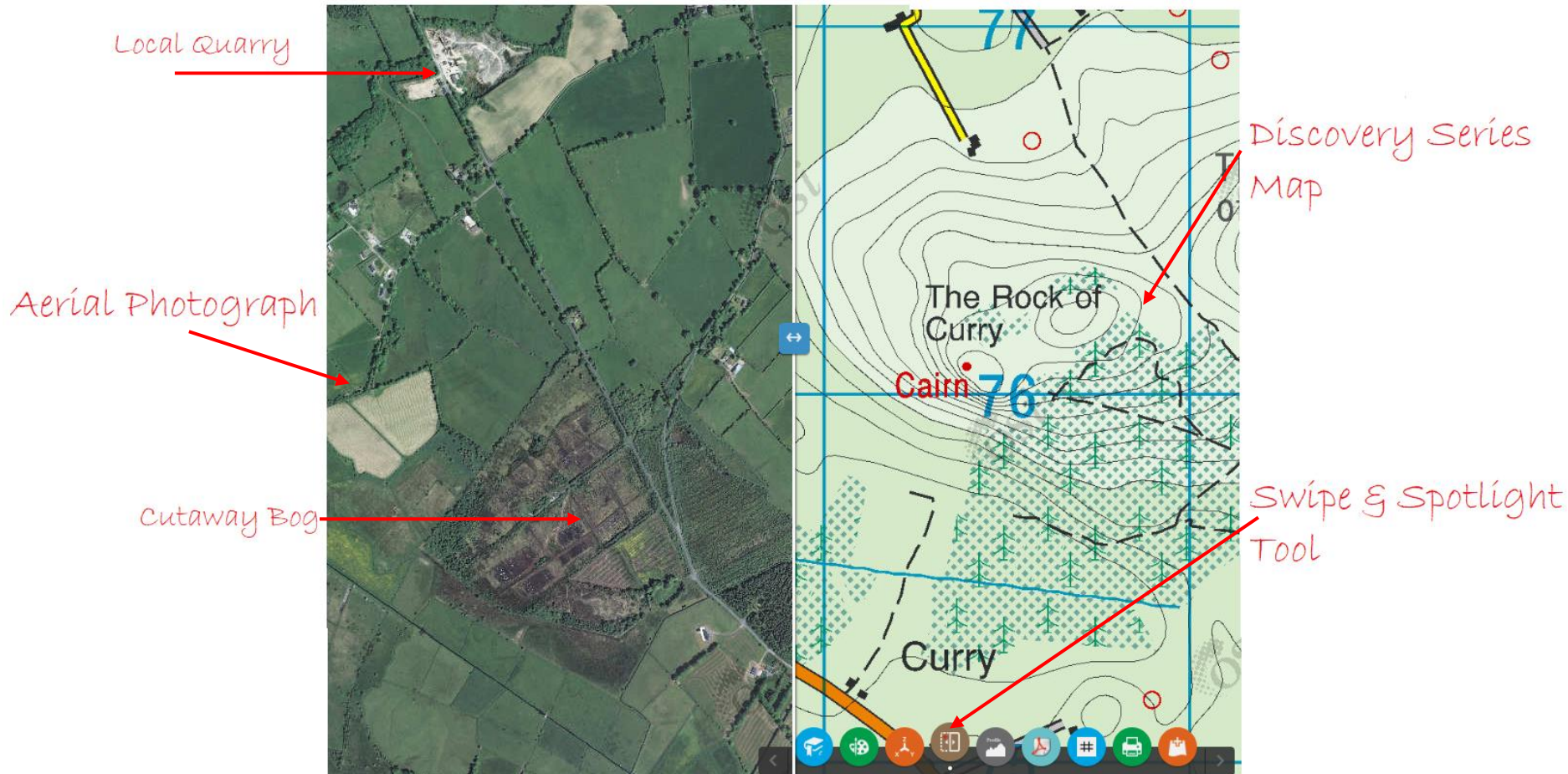


Lesson Bogs: Timelapse from Google Earth

1. Open <https://earthengine.google.com/timelapse/>
2. Type in the search engine Kilmurrays, Derryarkin
3. Watch the timelapse from 1984-2022
4. Click on the map to identify place names (top right-hand corner)
5. Describe with evidence how the site of the bog has changed over time (pause if you need to)

[illegible]

Local Bogs – Explore on Scoilnet Maps



<https://maps.scoilnet.ie/OSiMaps/EsriVer17/index.html>

Lesson Bogs: Walking Debate "Should bogs be decommissioned?"

I agree!



I disagree!



I'm not sure...



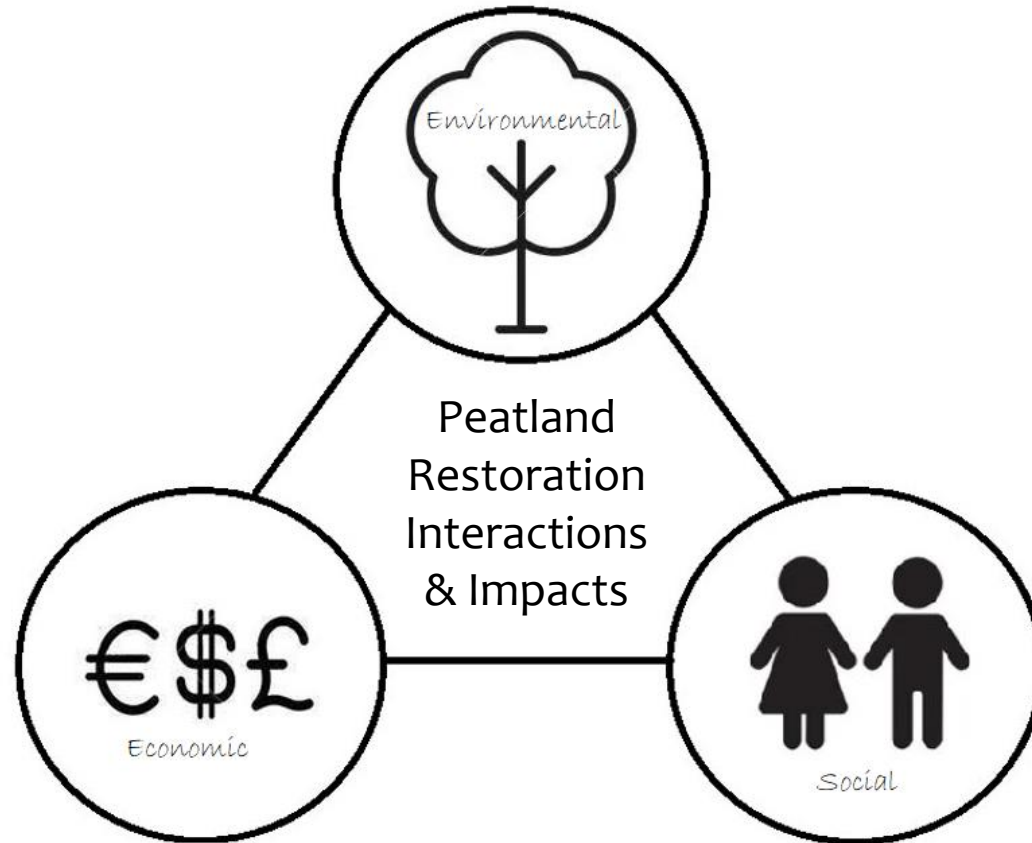
Where do I stand? Prepare a convincing well-developed argument for your viewpoint.

Examine how other people's perspectives has influenced you from the walking debate?



Lesson Bogs: Peatland Restoration Interactions & Impacts

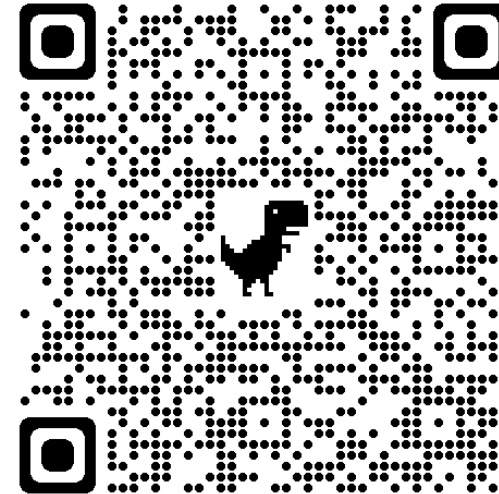
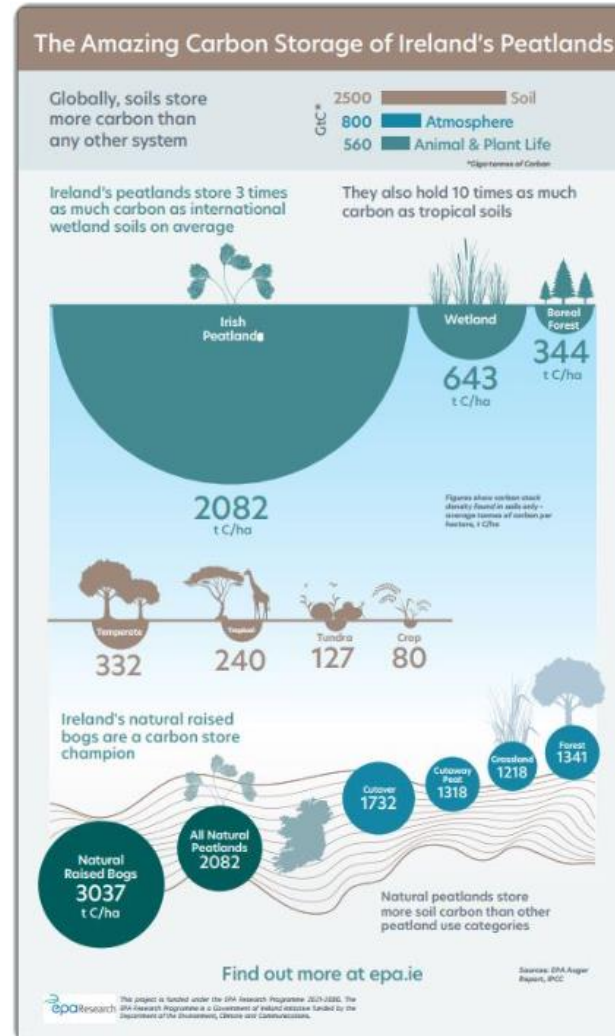
Complete the mind map template considering the positive and negative impacts of peatland restoration, reference case studies (local and national), statistics etc.





Lesson Bogs: Further Research

<https://www.epa.ie/publications/research/communicating-research/the-amazing-carbon-storage-of-irelands-peatlands.php>





Essay: Human Interaction with the Rock Cycle - Quarrying

Definition	
Case Study	
Types of Quarry	
Quarry Processes	
Impacts: • Economic, • Environmental, • Social	
Diagram (flowchart of quarry processes)	



Essay: Environmental Impacts of Economic Activities - Peatlands

Definition	
Case Study	
Types of Peatland	
Historical Extraction for Economic Purposes	
Environmental Impacts of historical extraction and contemporary rehabilitation	
Diagram (type of bog)	



Additional Space for notes and diagrams

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