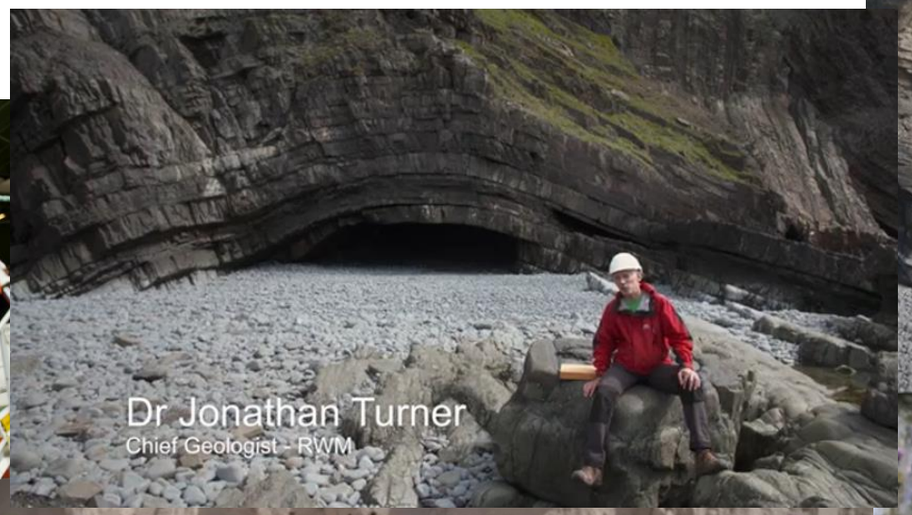
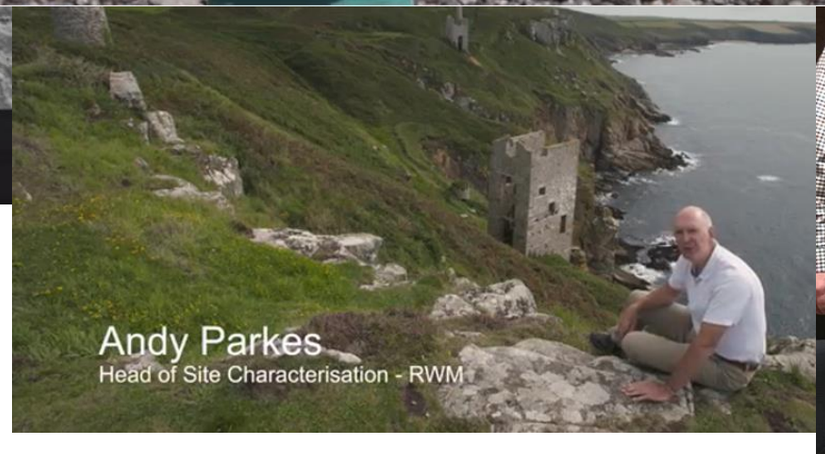
Putting people and the environment first:

a Geological Disposal Facility for the UK

Oskarshamn, Sweden






Carlsbad, NM

Radioactive Waste Management

Introduction

Jonathan Turner

Chief Geologist

- Joined RWM early 2017, I've spent most my career in oil & gas exploration working for major companies (Shell, BG Group), and in the university sector
- This is mostly a general talk discussing the critical importance for radioactive waste disposal of rocks deep underground, and how we'll know whether the deep geology is suitable
- I'll also say a few words on the local geology of the Bath region and southern England

Radioactive Waste Management

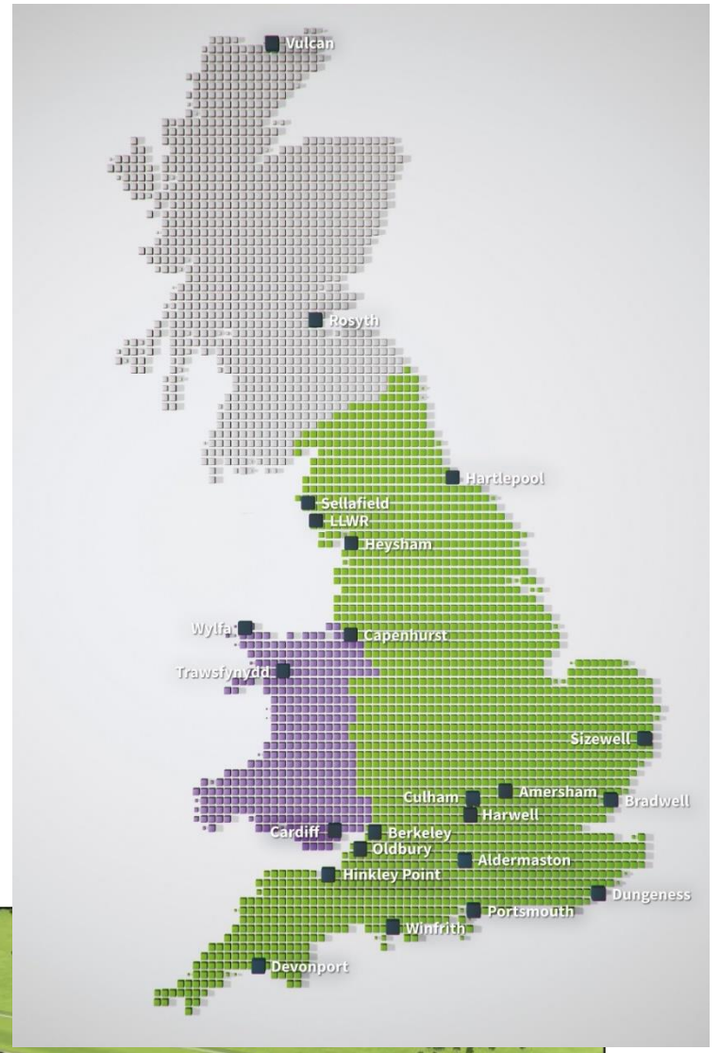
Geological Disposal Facility (GDF)

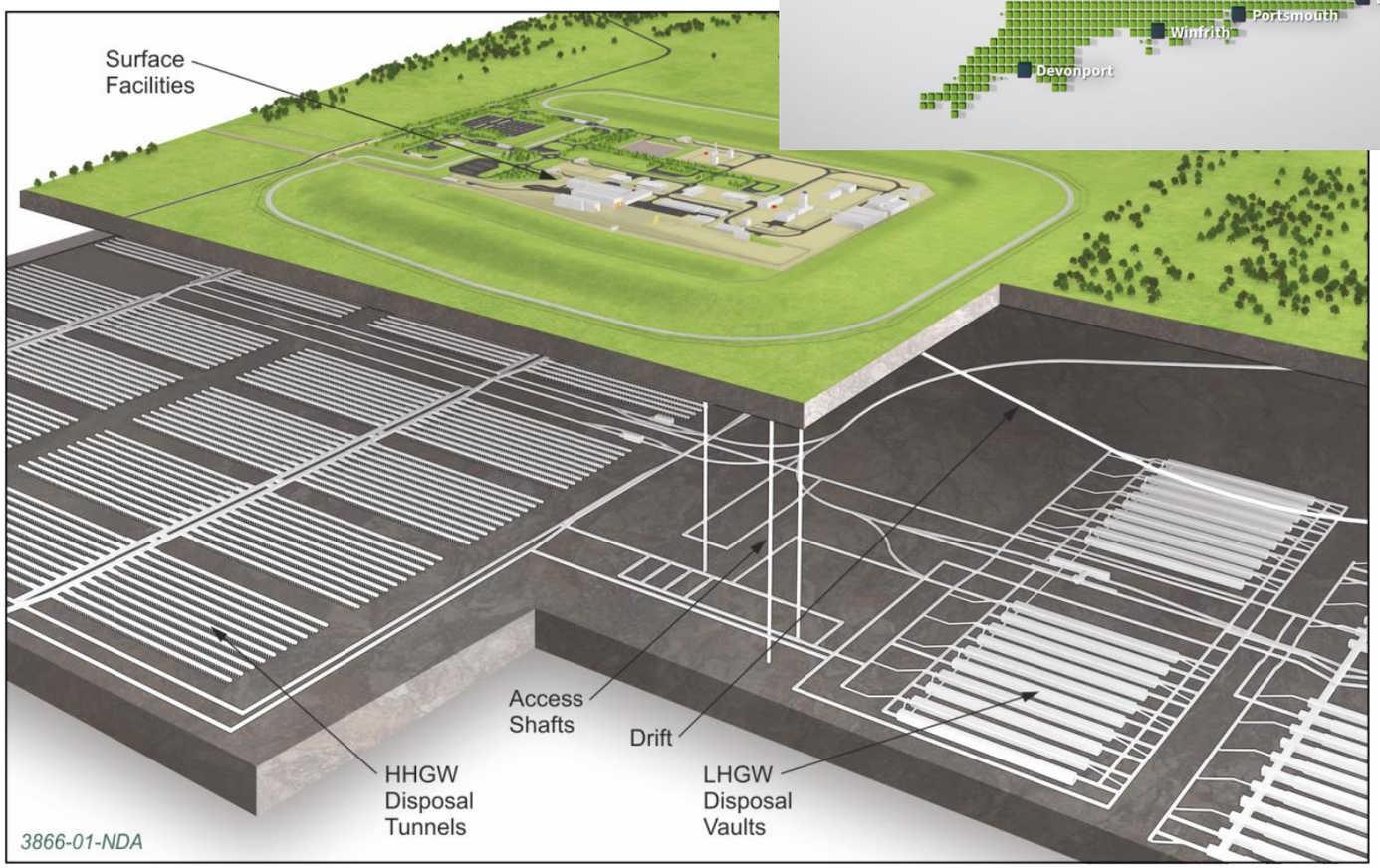
- UK's largest environmental project
- Requires 1) a willing community,

  2) a suitable site (design and safety case),

  3) suitably packaged waste
- Highly engineered – ***containment***,

  isolation, ***passive safety***
- Disposal not "storage"





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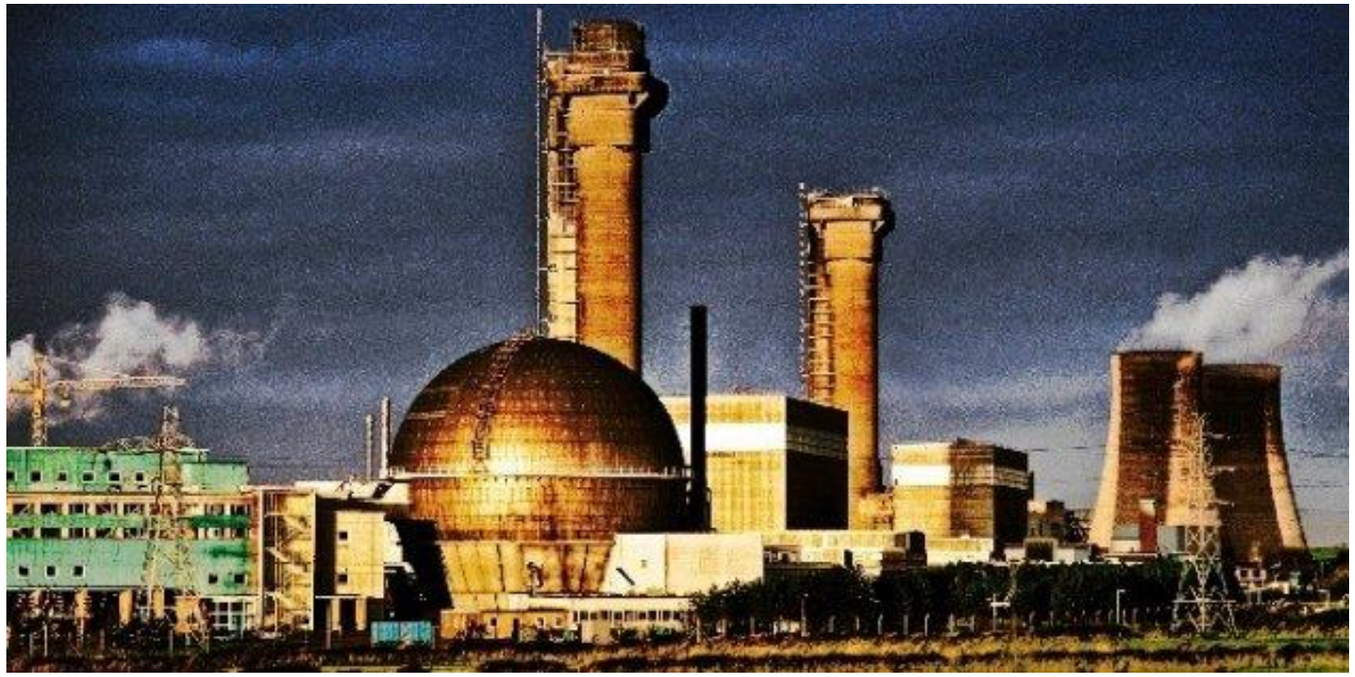

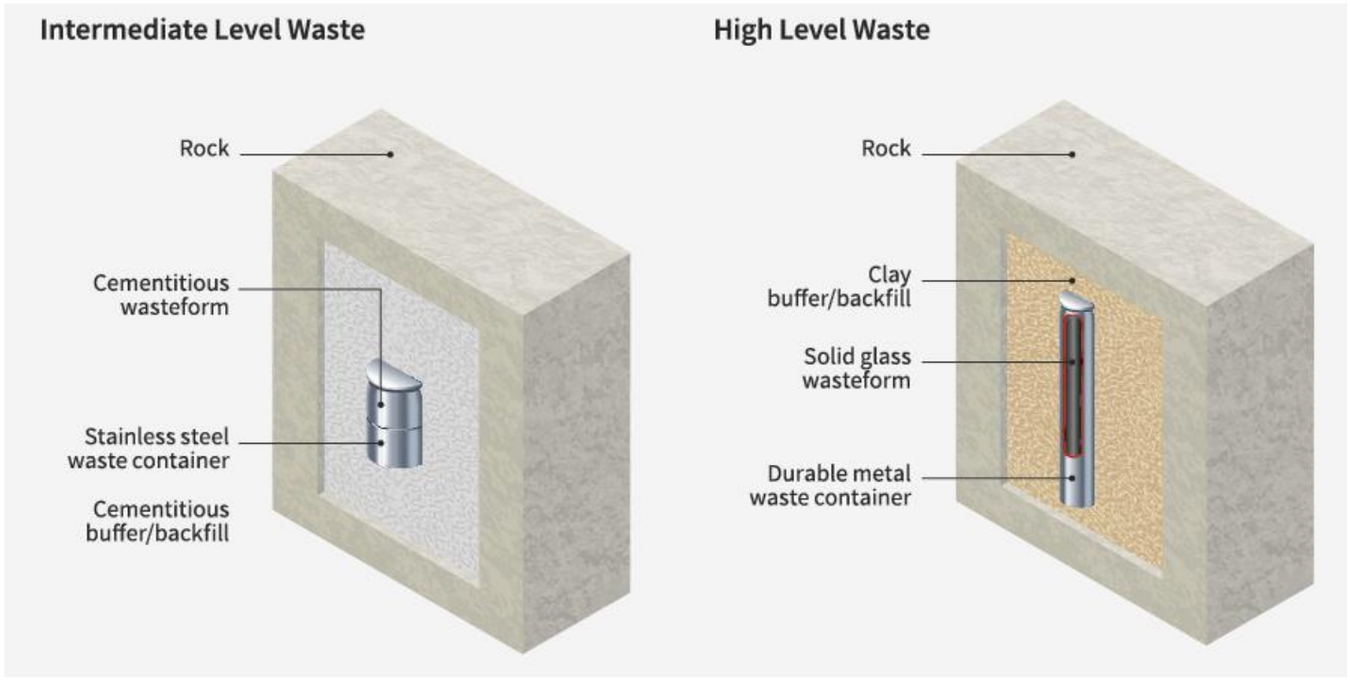

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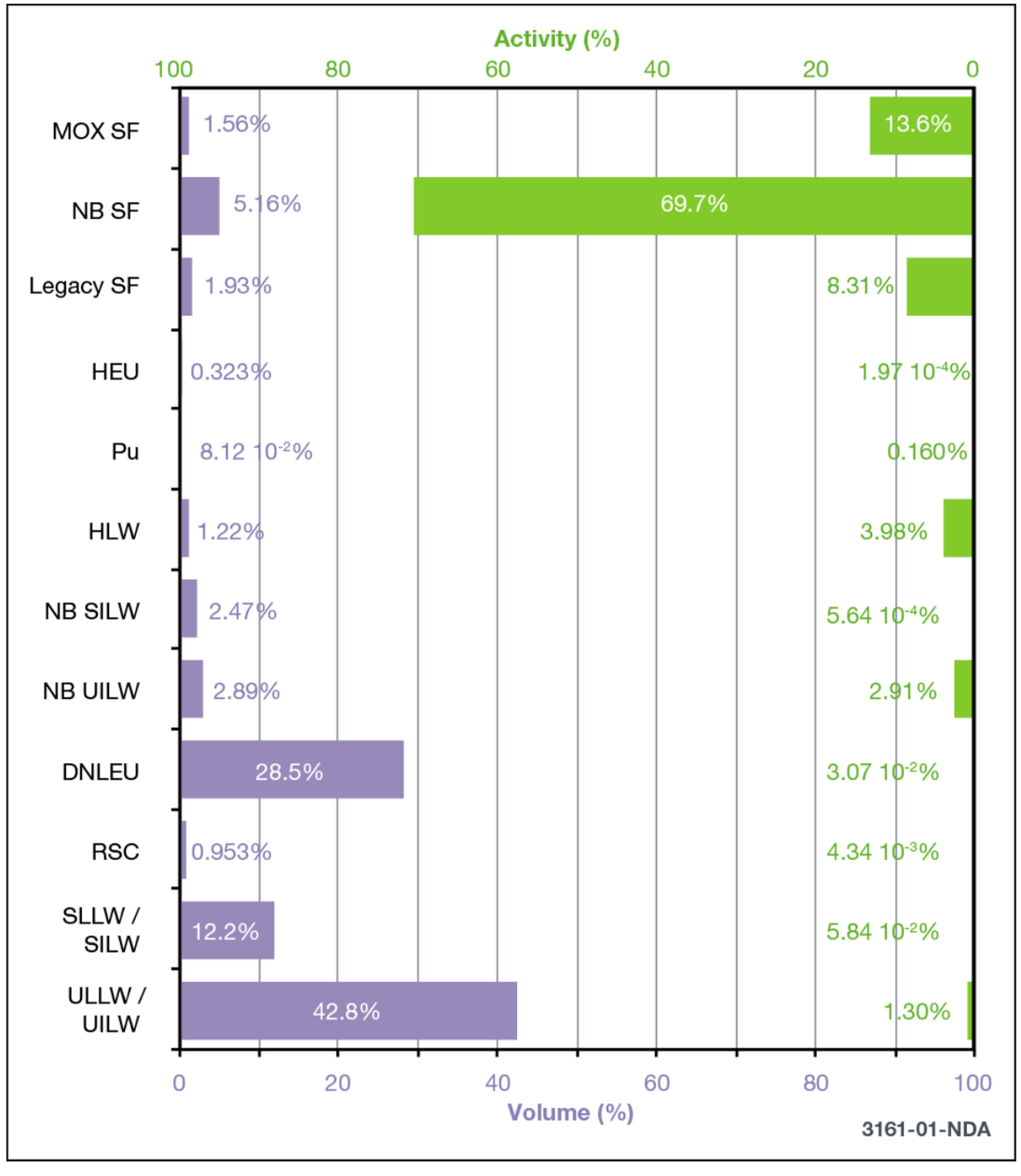
Inverse relationship between activity levels and waste volumes



What might a GDF look like at the surface?

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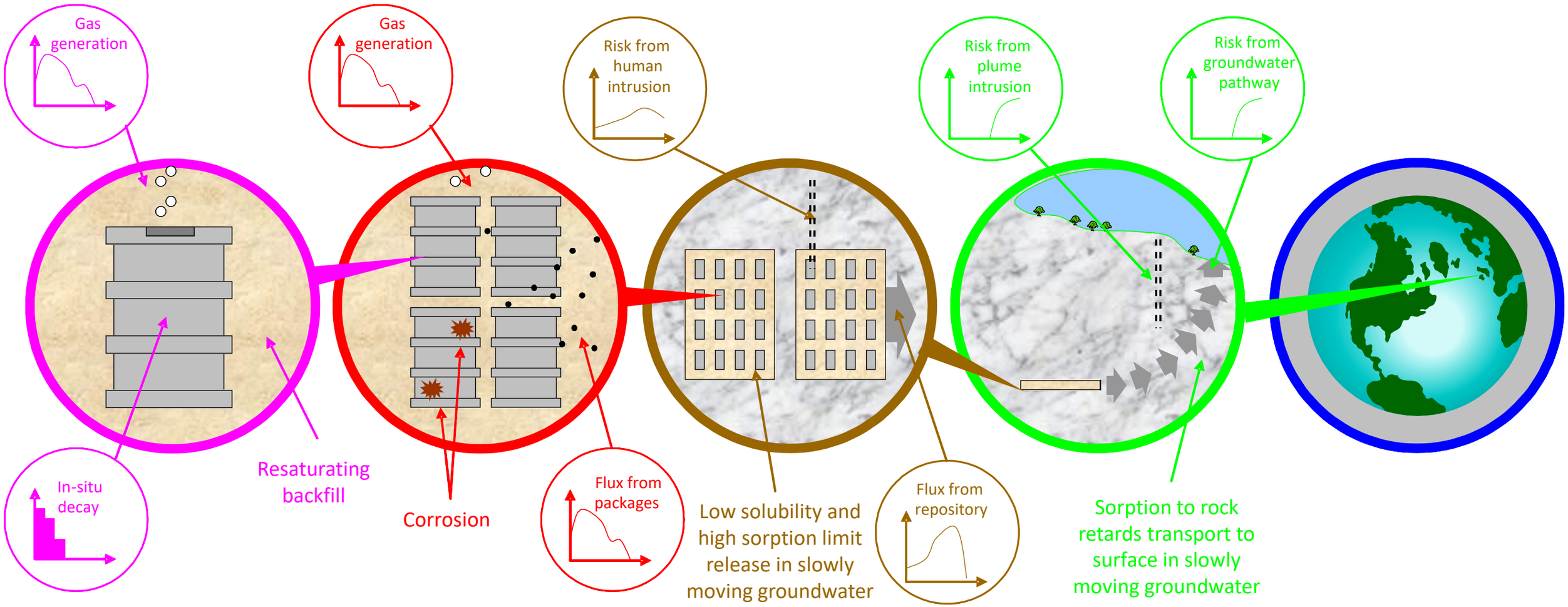
Multi-barrier system – engineering and rock working *together*



100s years: Containment

1000s years: Breakdown of the package

10,000s years: Role of buffer & backfill

100,000s years: Rock as a barrier

Million+ years: Isolation from environmental change e.g. ice ages

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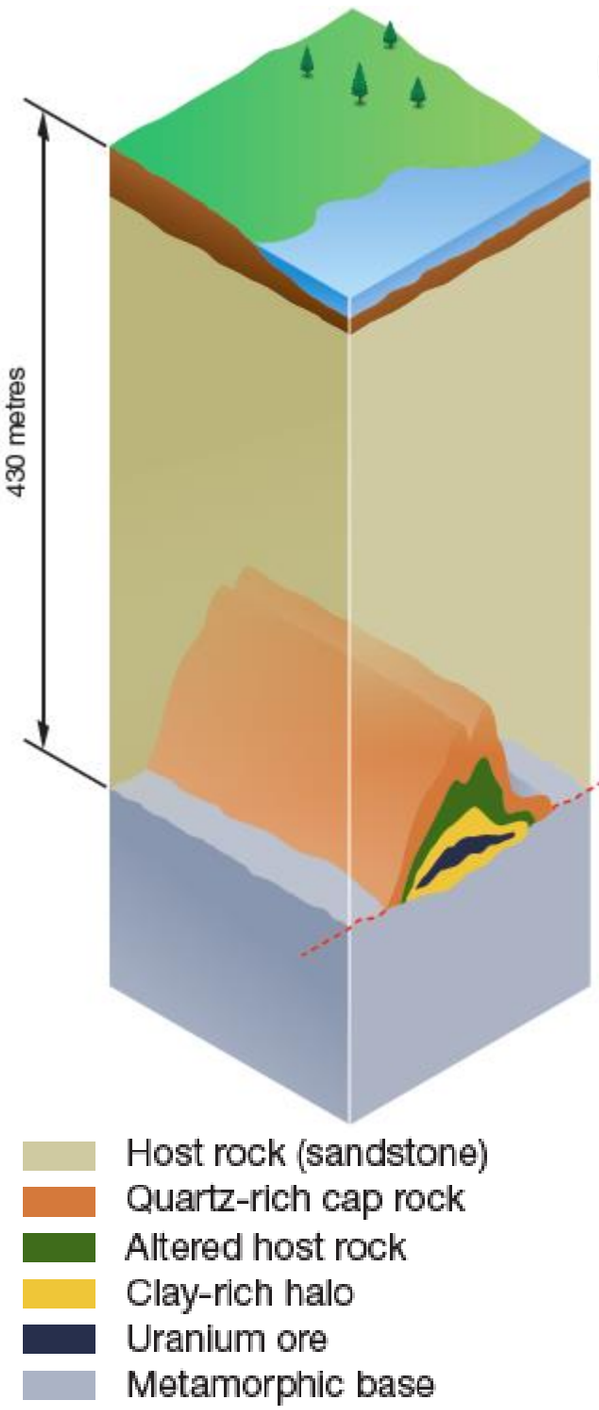
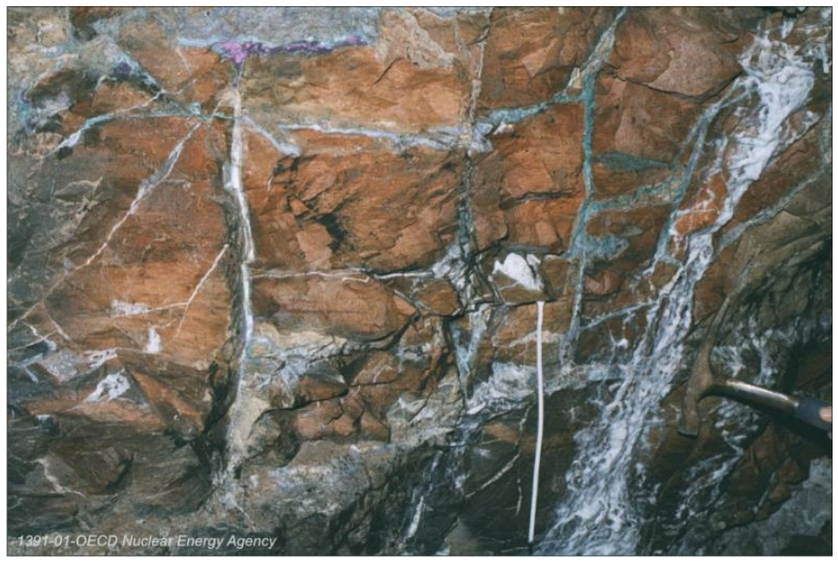
Natural examples demonstrating GDF safety…



Cigar Lake, Canada –
1.3 billion year-old
'natural GDF' –
clay rocks surrounding
20% U ore have prevented
release of radionuclides
at the surface



Maqarin, Jordan –
hyperalkaline fluid-
rock interactions

400-year-old cannon barrel –
one half buried in anoxic mud
and much better preserved

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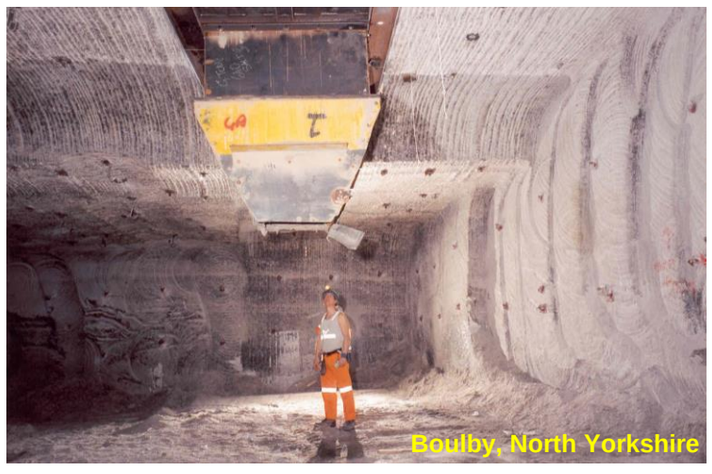
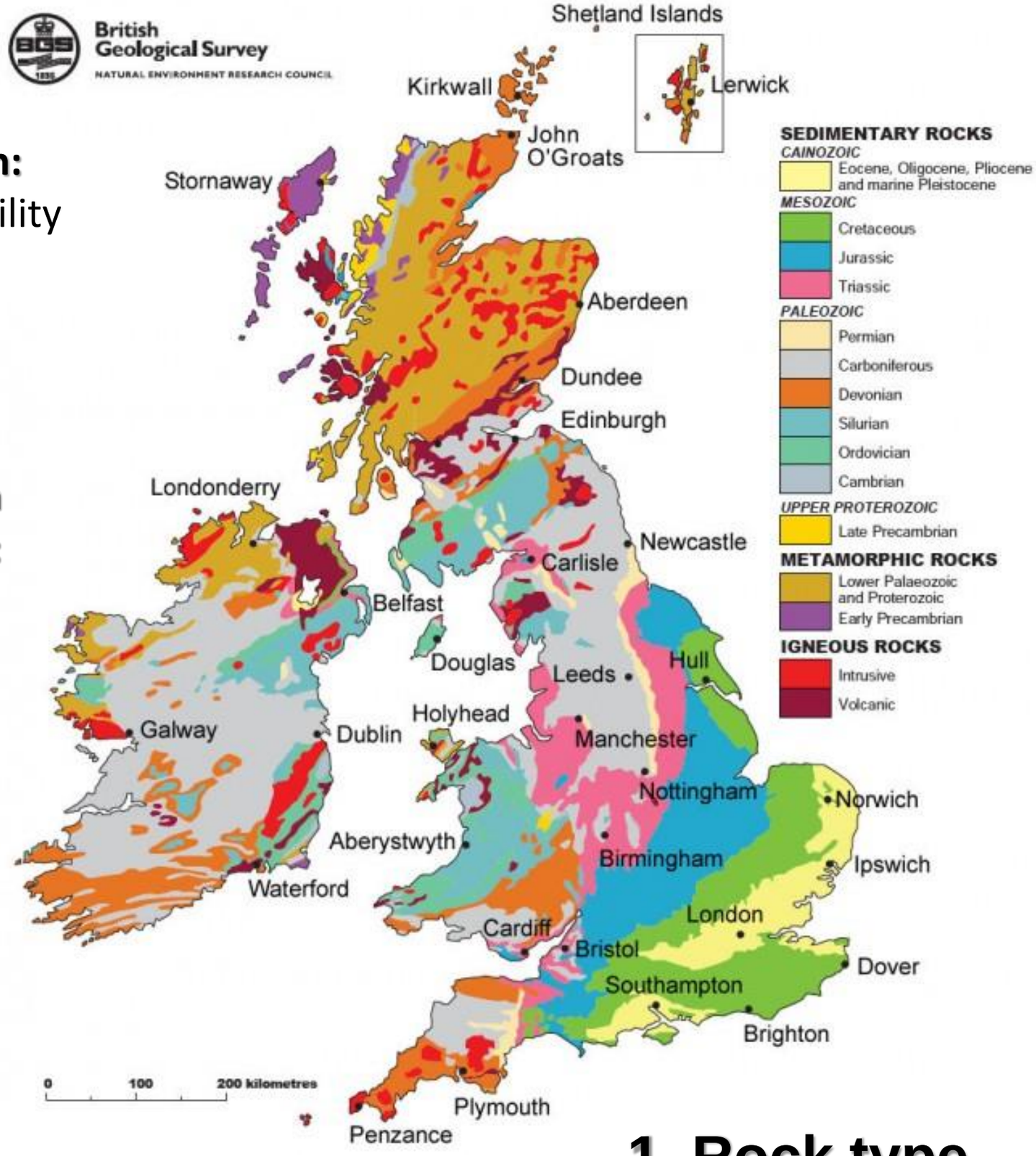
High-strength: low permeability +/- fractures

Low-strength sedimentary: diffusion-dominated



Salt: dry, impermeable



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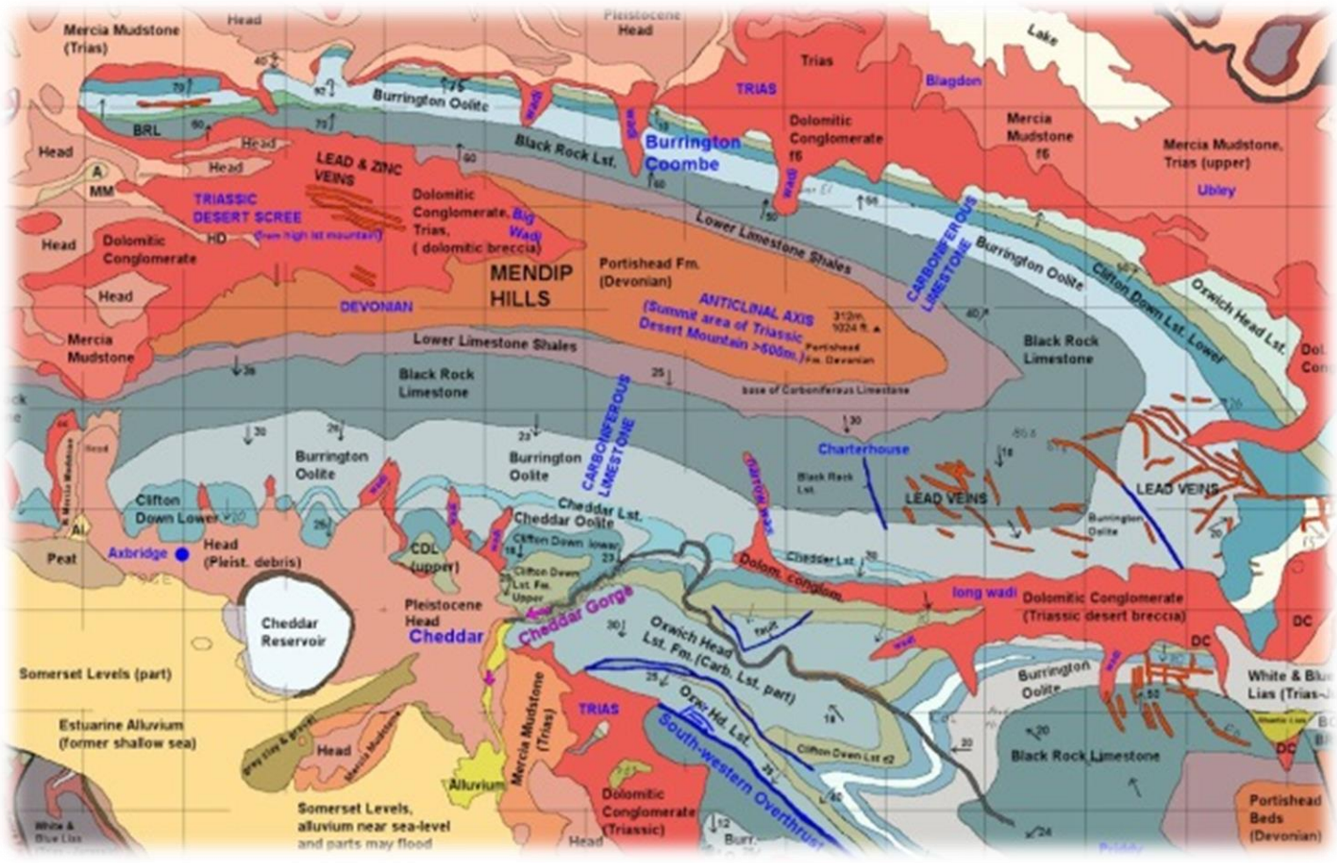
1. Rock type

2. Geological structure

Structurally uncomplicated is better

Mendip Hills: fractured limestone with deep cave systems, 45ºC hot springs, major fault lines, but…

GDF footprint <20km^2



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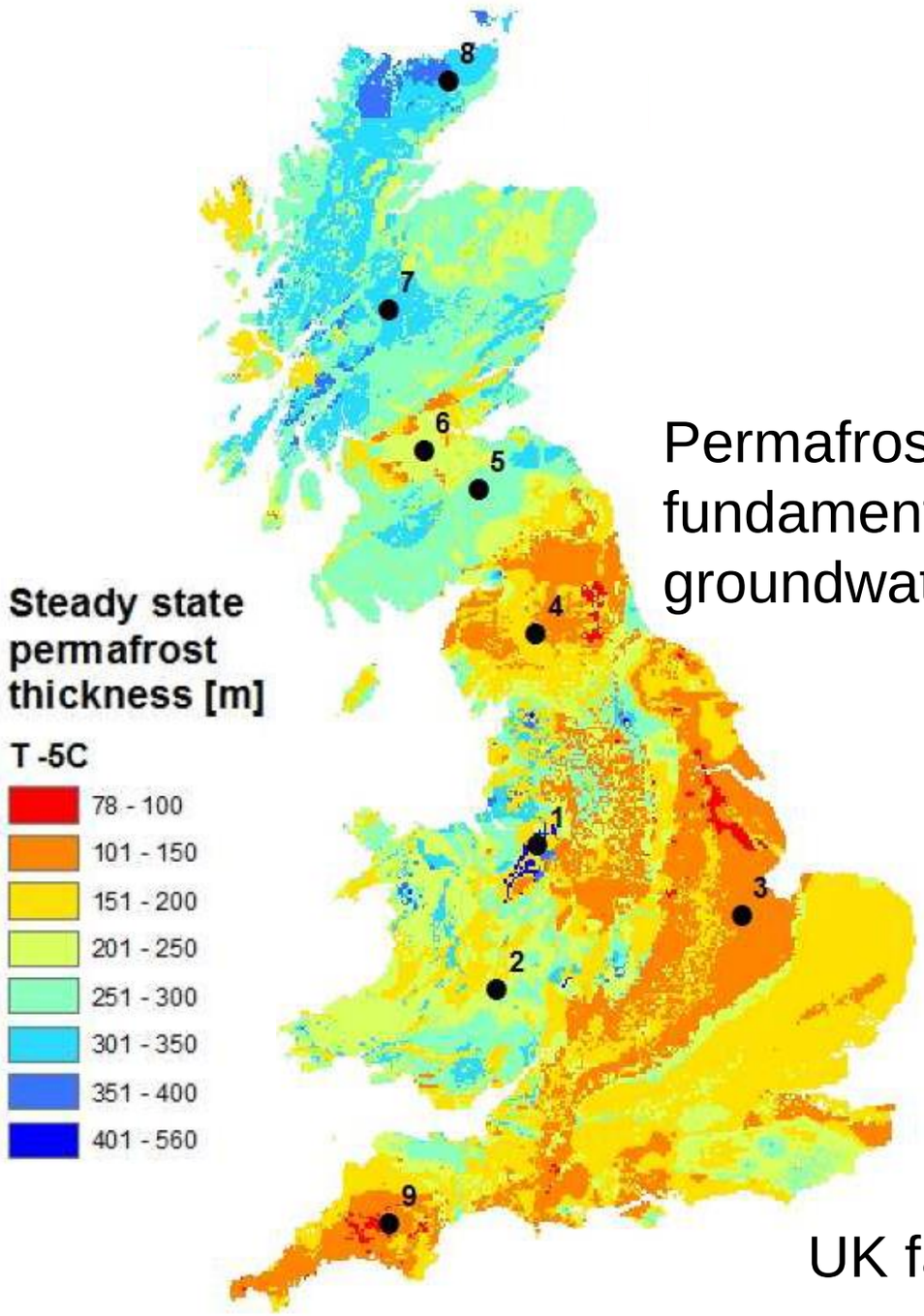
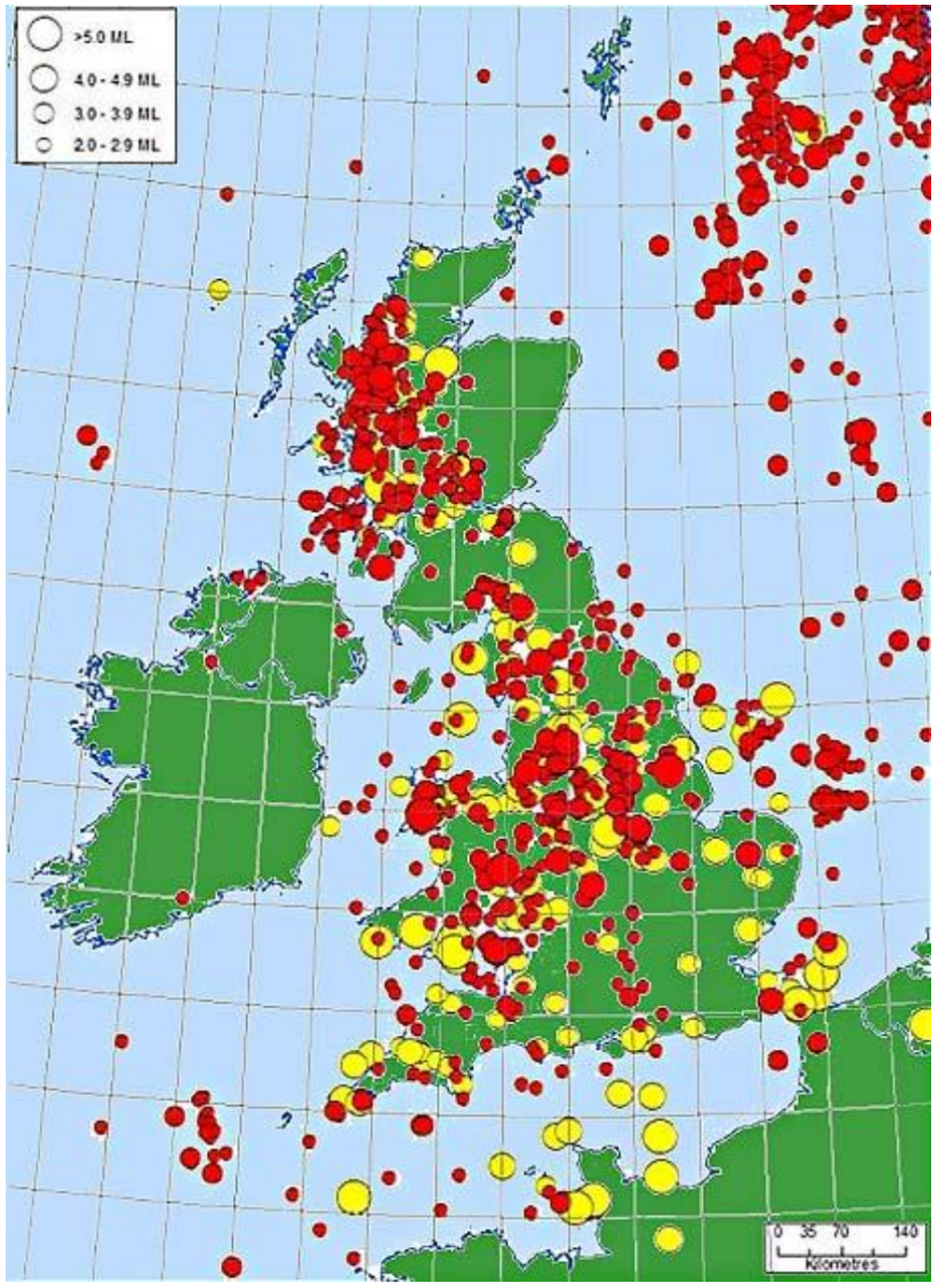
3. Natural processes: i) glaciation/climate change, ii) earthquakes



Permafrost events fundamentally alter groundwater flow



UK fairly low seismicity…

…but recent fracking-induced tremors have intensified public interest

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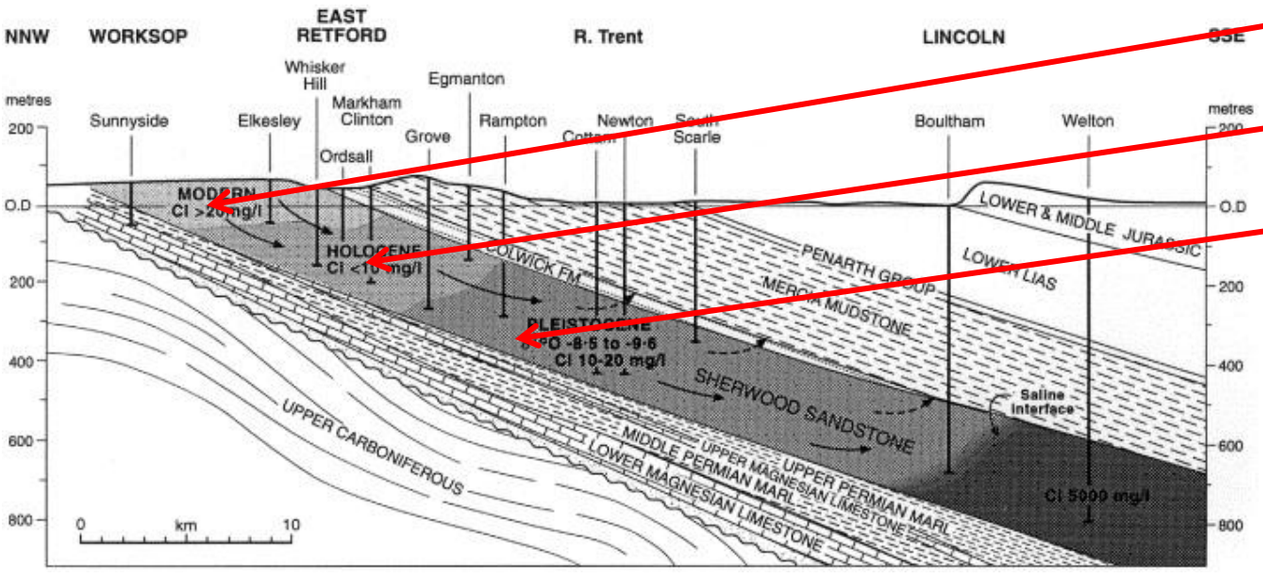
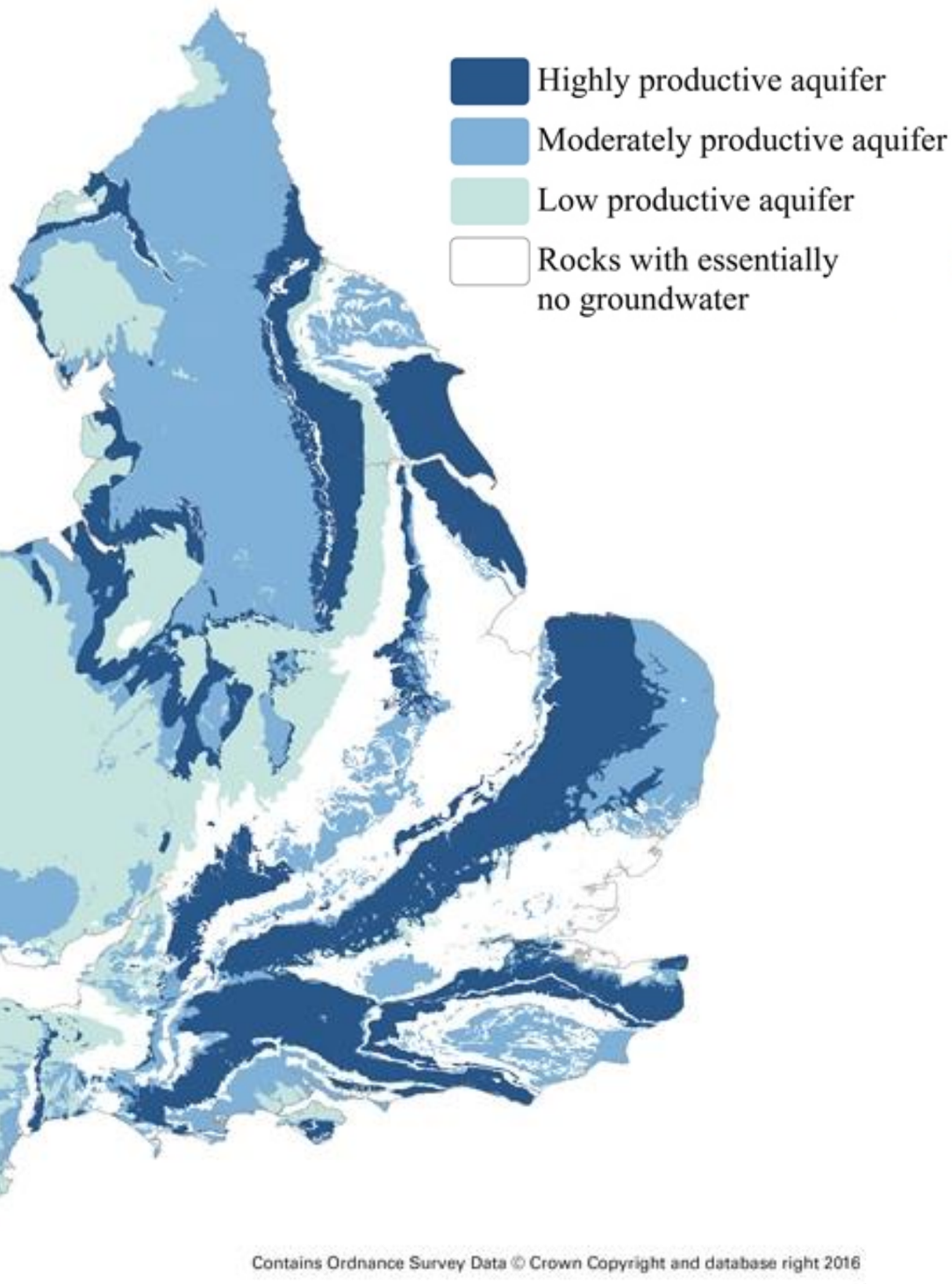


Edmunds & Smedley 2000

Modern groundwater at surface

1000 year-old groundwater at 200m

100,000 year-old groundwater at 400m



4. Groundwater

Site a GDF where deep groundwater is absent, or where deep groundwater systems are slow-moving with long return times to surface

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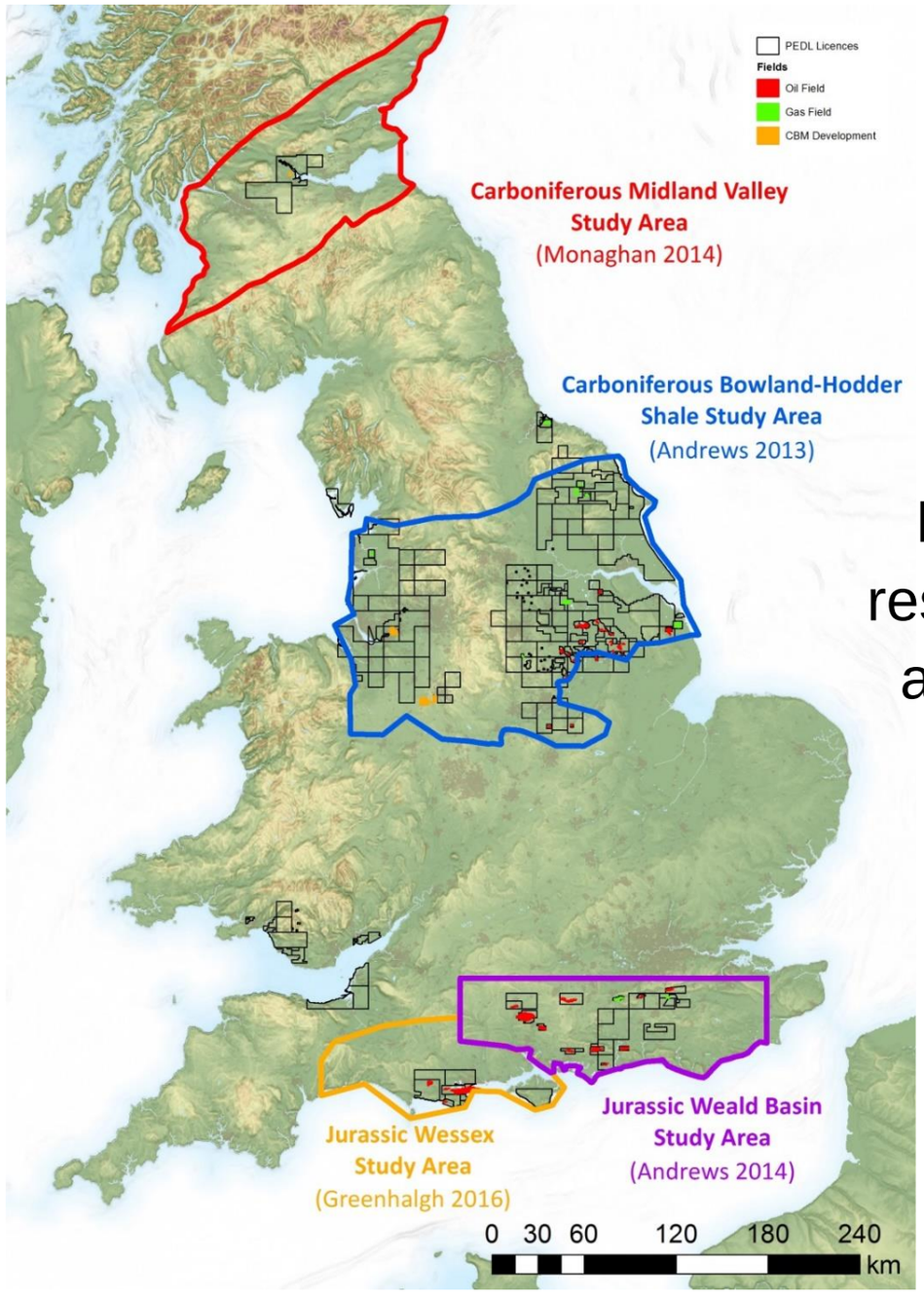
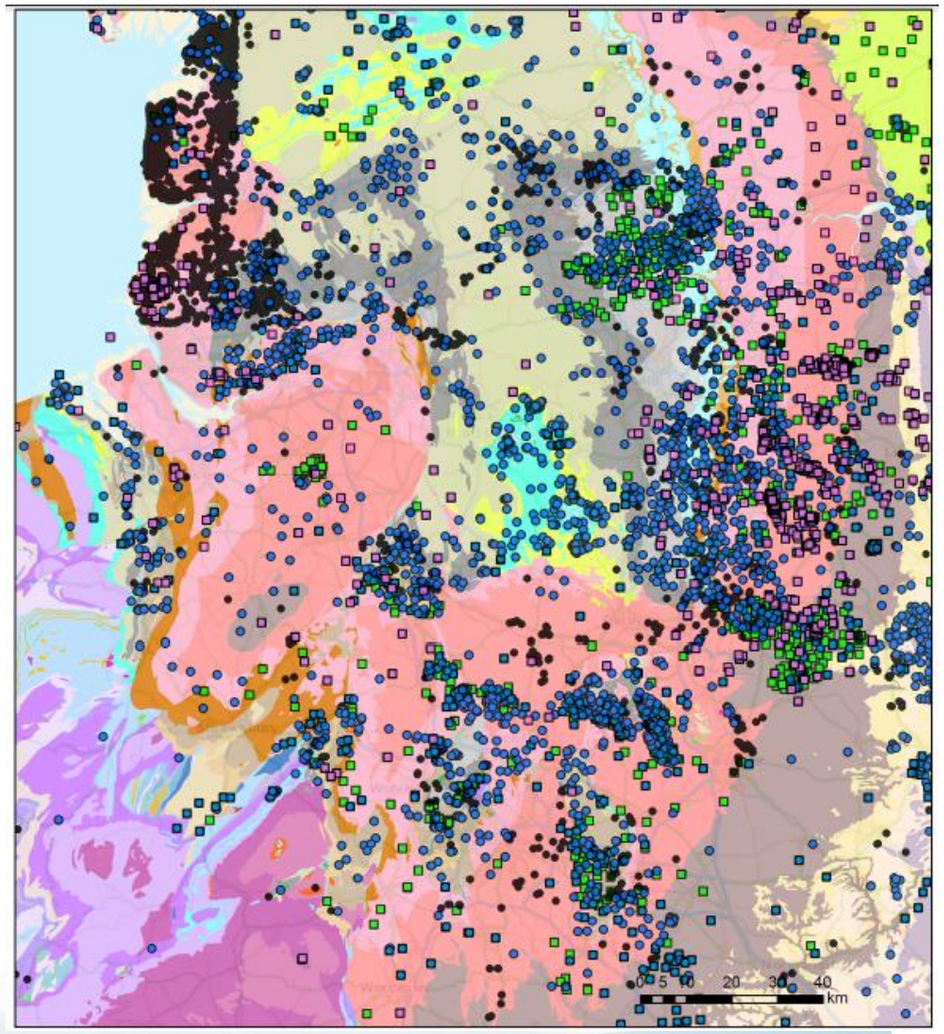


5. Resources

Exploitation of natural resources past, present and future could affect the isolation and containment capabilities of a GDF




Merthyr Tydfil, Glamorgan

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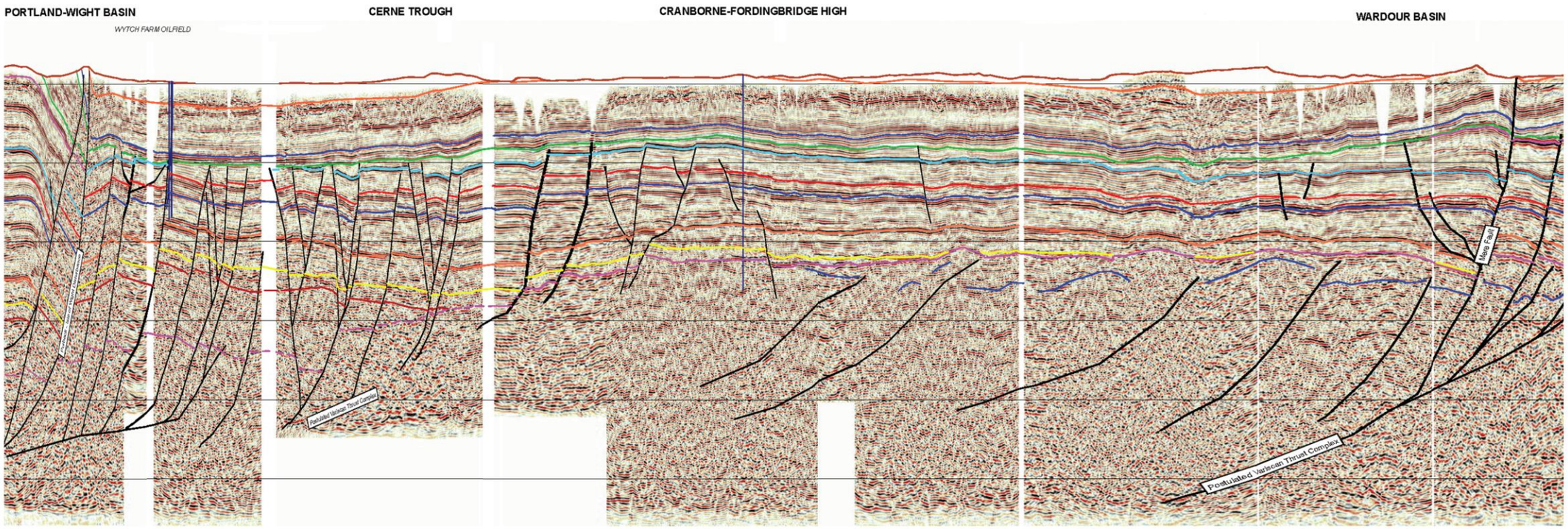
Nagra, N Switzerland


Nagra, N Switzerland


SKB, Aspö


ANDRA, Bure



Courtesy https://ukogl.org.uk/

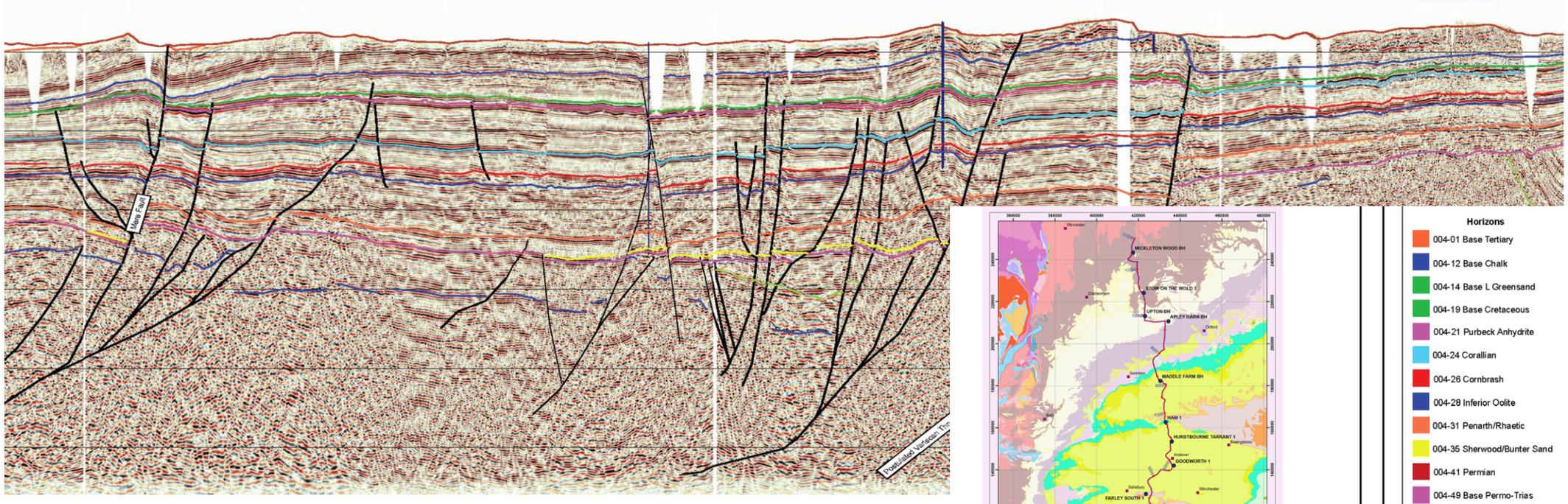


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Plate 4

Butler, M and Jamieson, R, 2013. *Preliminary interpretation of six regional seismic profiles across onshore basins of England*. UK Onshore Geophysical Library

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https://geologicaldisposal.campaign.gov.uk/