

Putting people and the environment first: a Geological Disposal Facility for the UK



Introduction

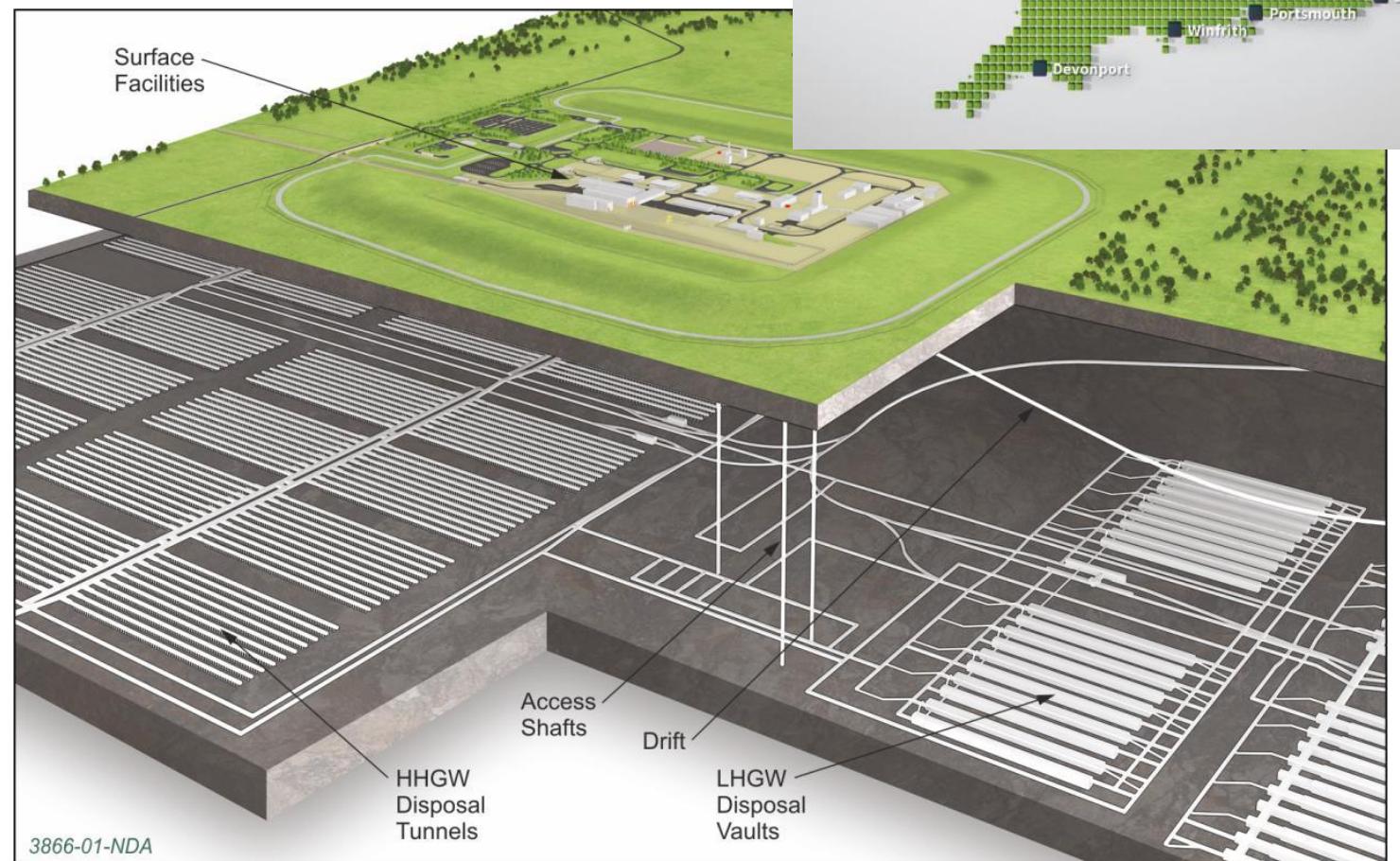


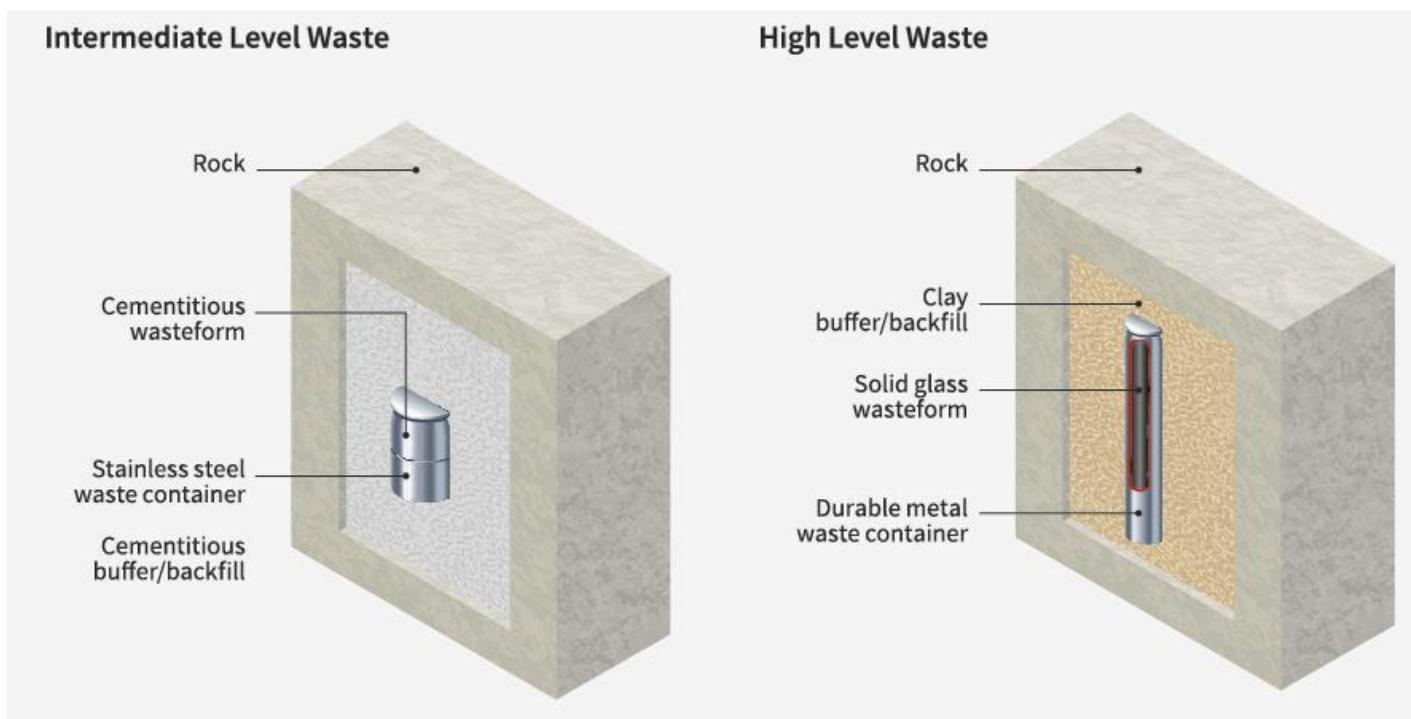
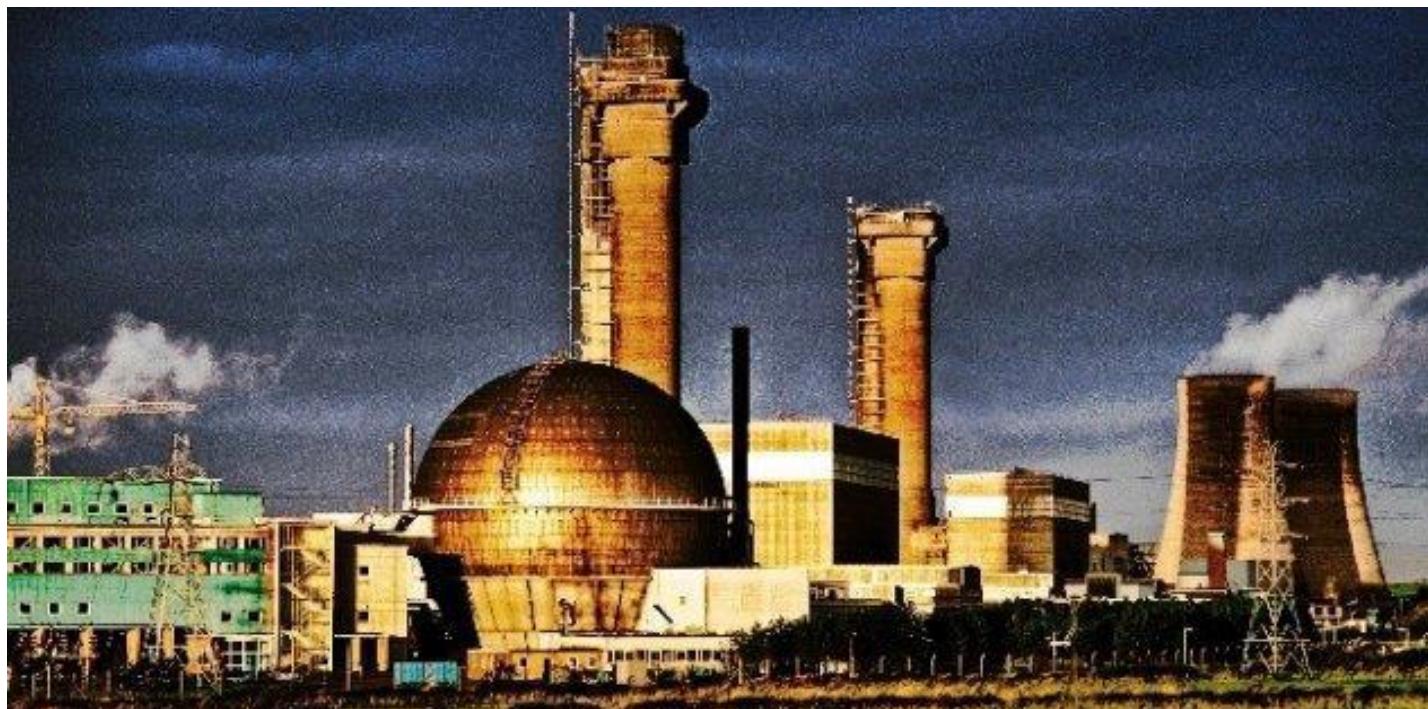
Jonathan
Turner
Chief Geologist

- 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

Geological Disposal Facility (GDF)

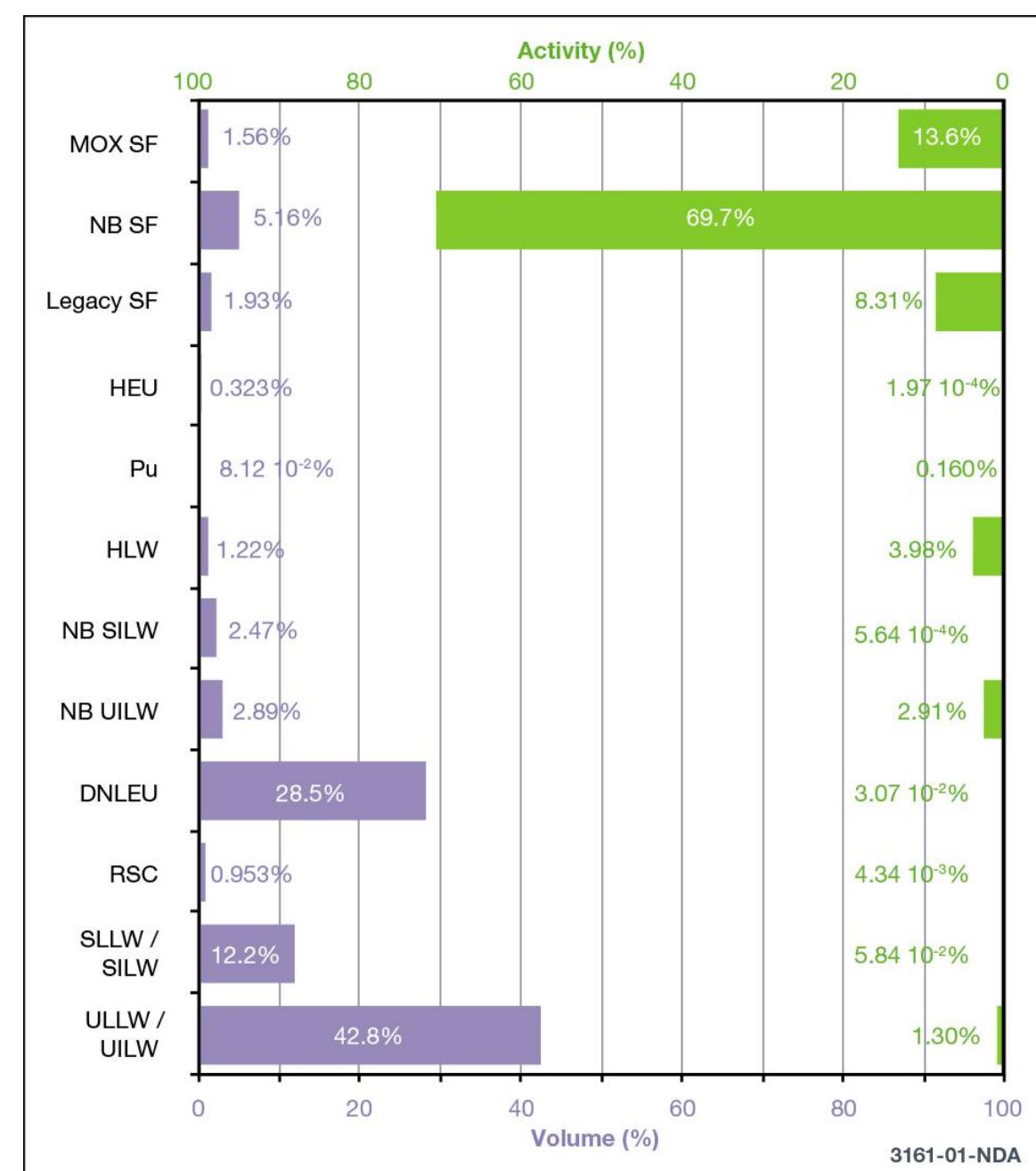
- UK's largest environmental project
- Requires 1) a willing community,
2) a suitable site (design and safety case),
3) suitably packaged waste
- Highly engineered – ***containment, isolation, passive safety***
- Disposal not “storage”





 **Radioactive Waste Management**

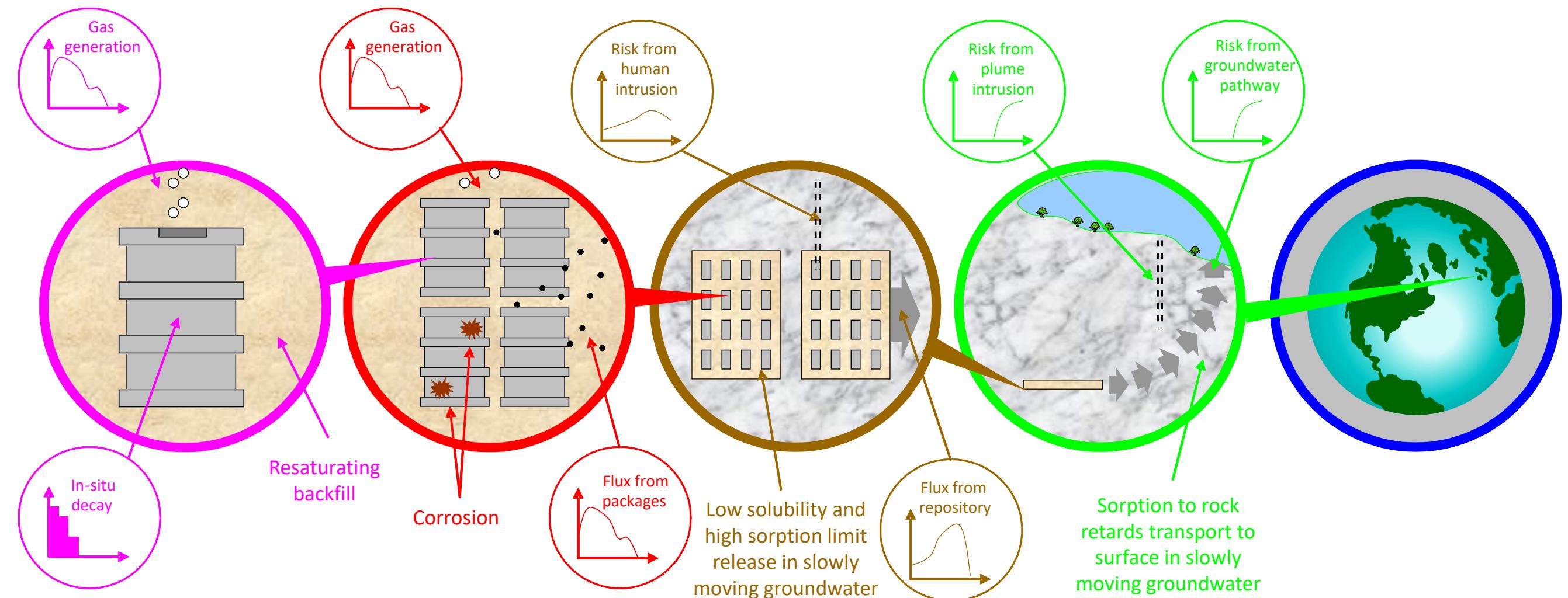
Inverse relationship between activity levels and waste volumes



What might a GDF look like at the surface?



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



100s years:
Containment

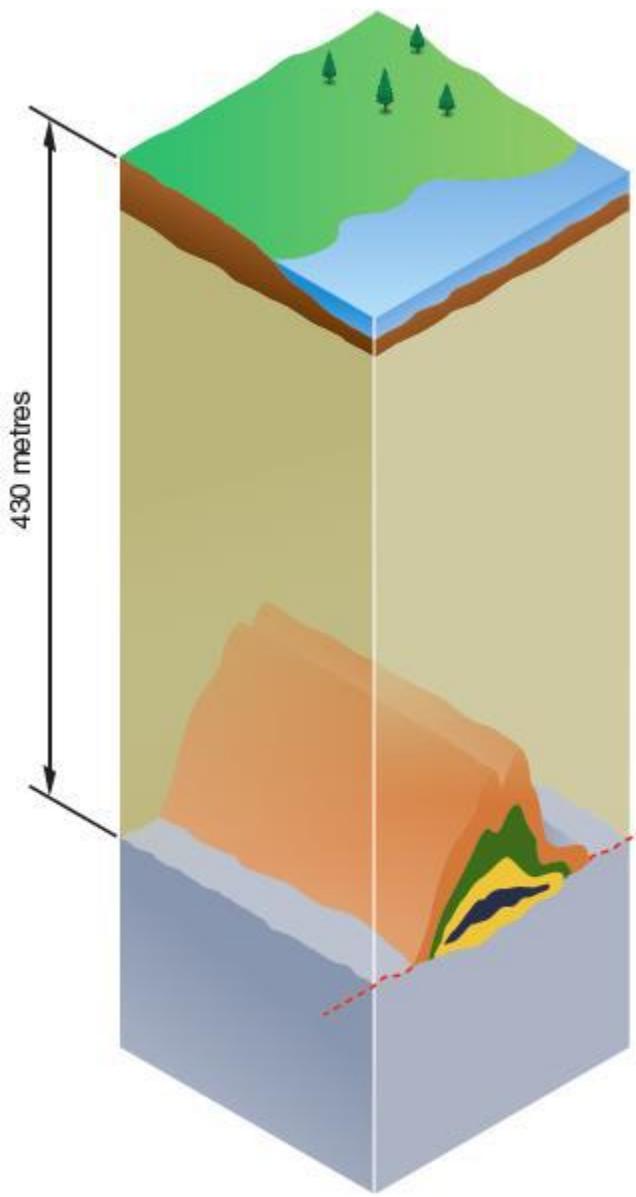
1000s years:
Breakdown of
the package

10,000s years:
Role of buffer
& backfill

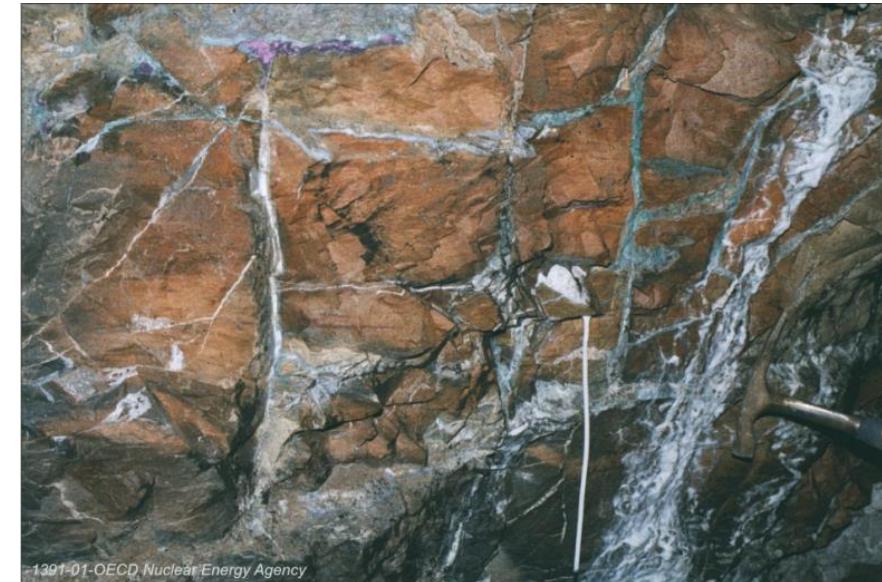
100,000s years:
Rock as a barrier

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

Natural examples demonstrating GDF safety...



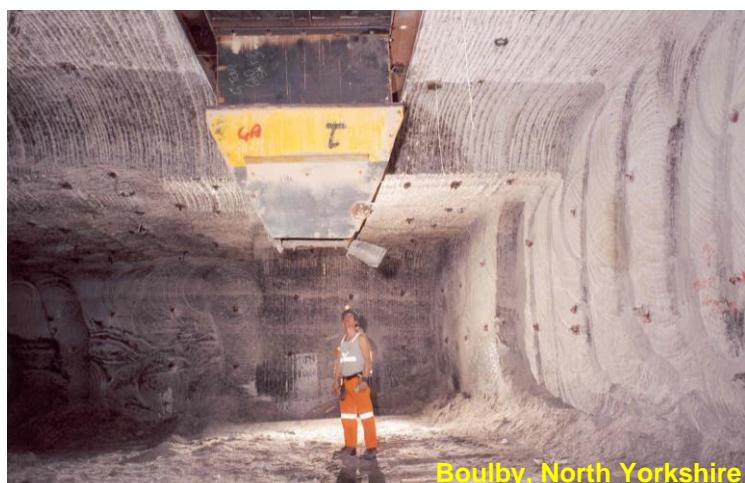
- Host rock (sandstone)
- Quartz-rich cap rock
- Altered host rock
- Clay-rich halo
- Uranium ore
- Metamorphic base



Maqrarin, Jordan –
hyperalkaline fluid-rock interactions



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



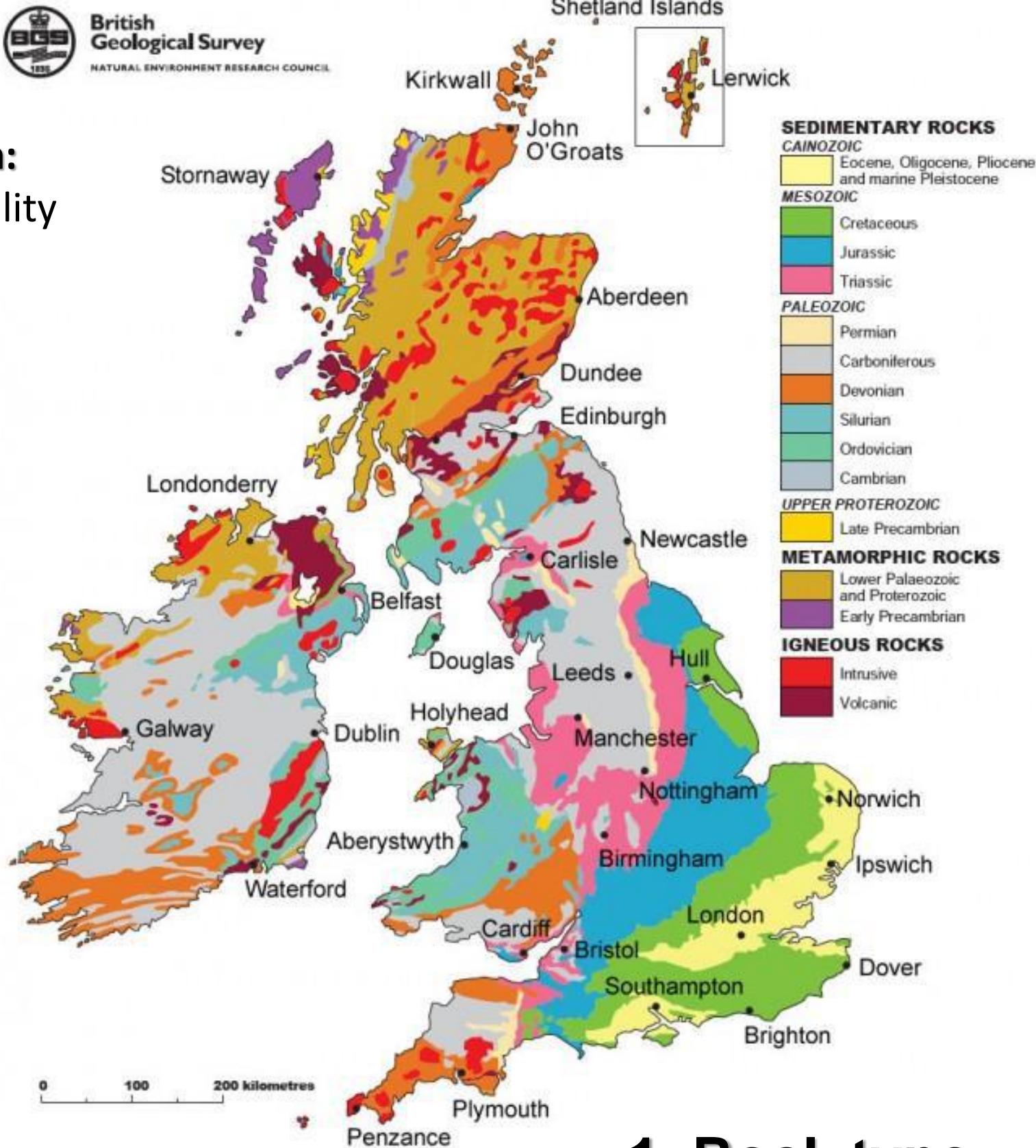
High-strength:
low permeability
+/- fractures

Low-strength sedimentary:
diffusion-dominated

Salt: dry,
impermeable



British
Geological Survey
NATIONAL ENVIRONMENT RESEARCH COUNCIL



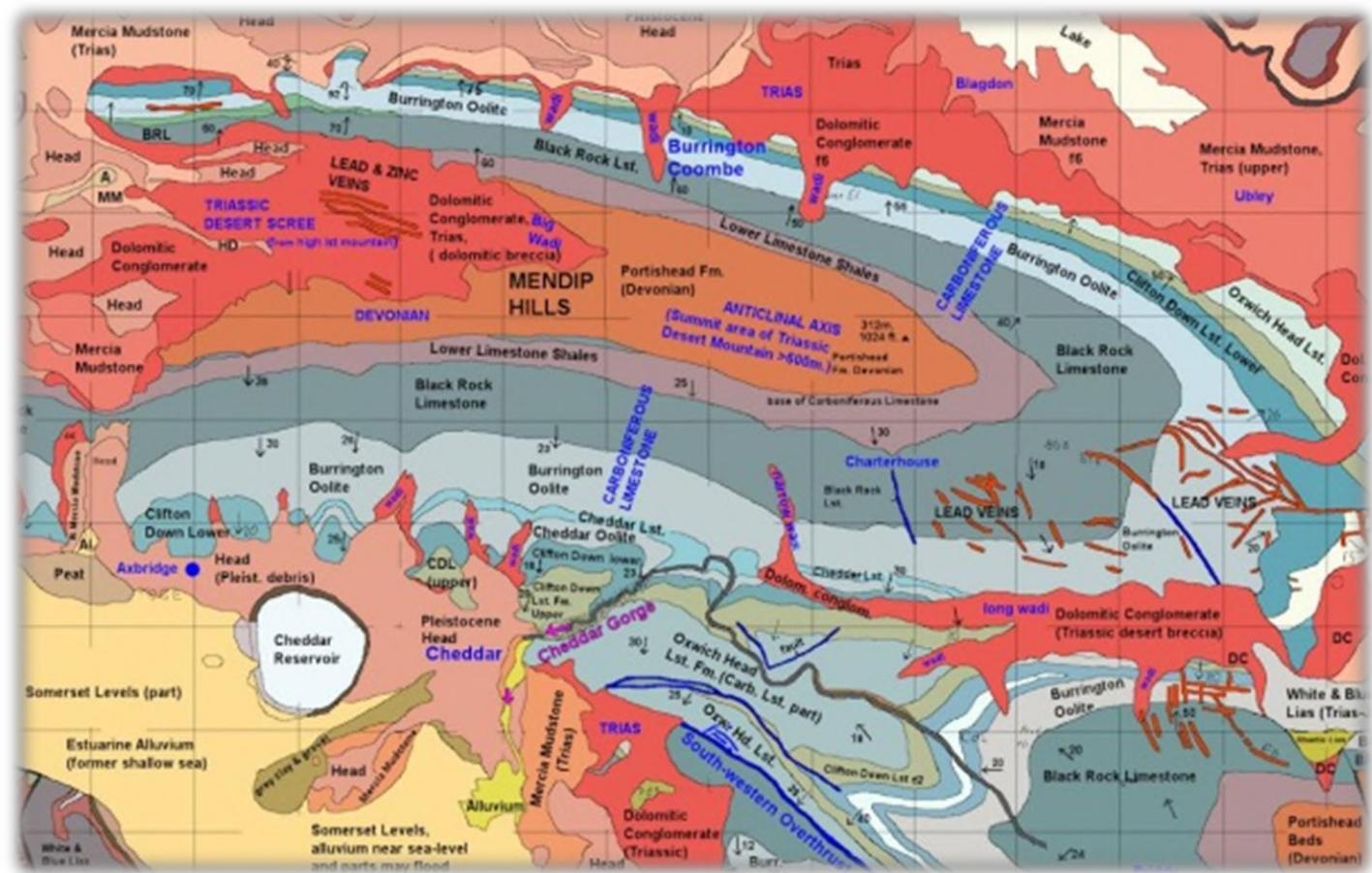


2. Geological structure

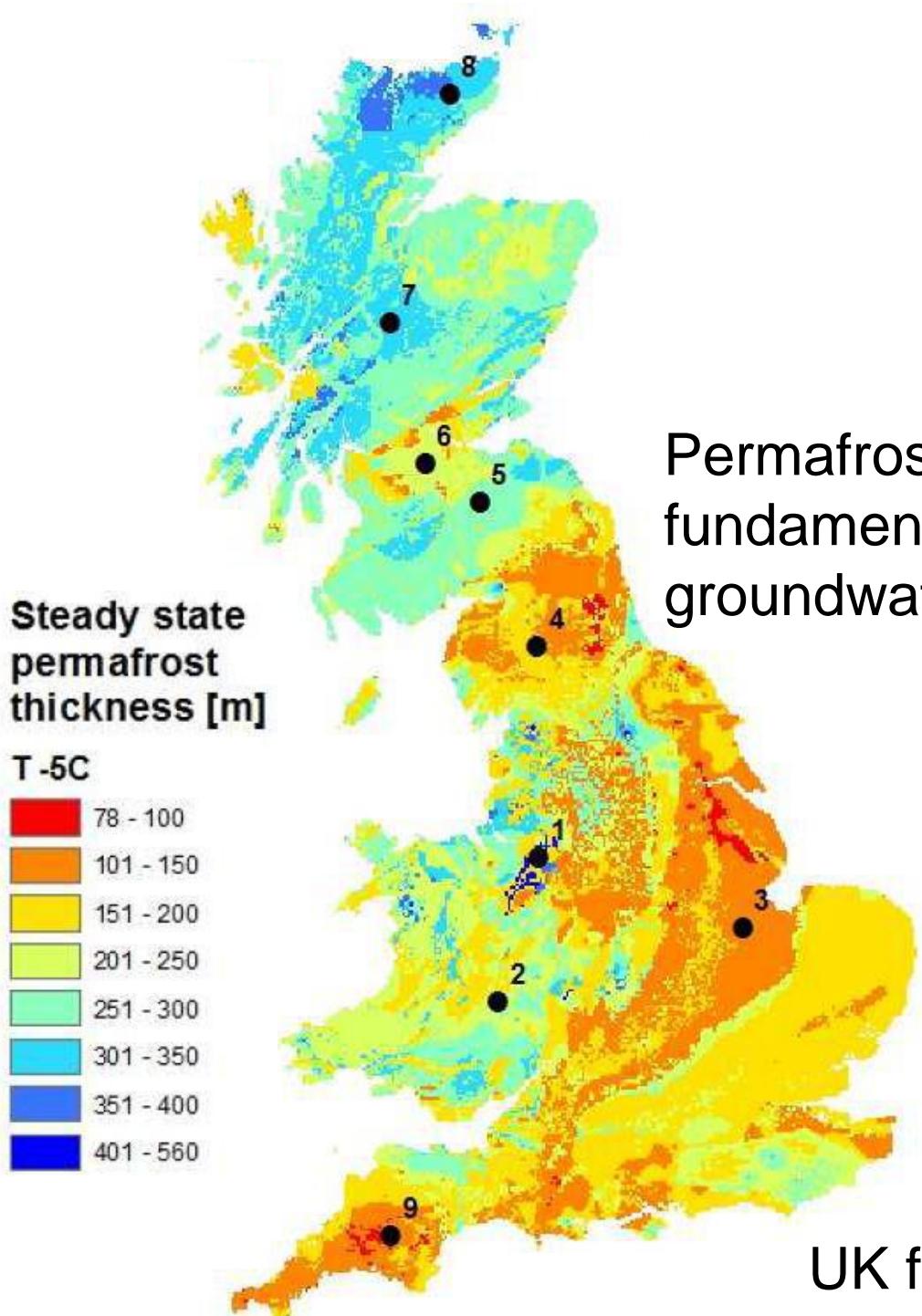
Structurally uncomplicated is better

Mendip Hills: fractured limestone with deep cave systems, 45°C hot springs, major fault lines, but...

GDF footprint <20km²

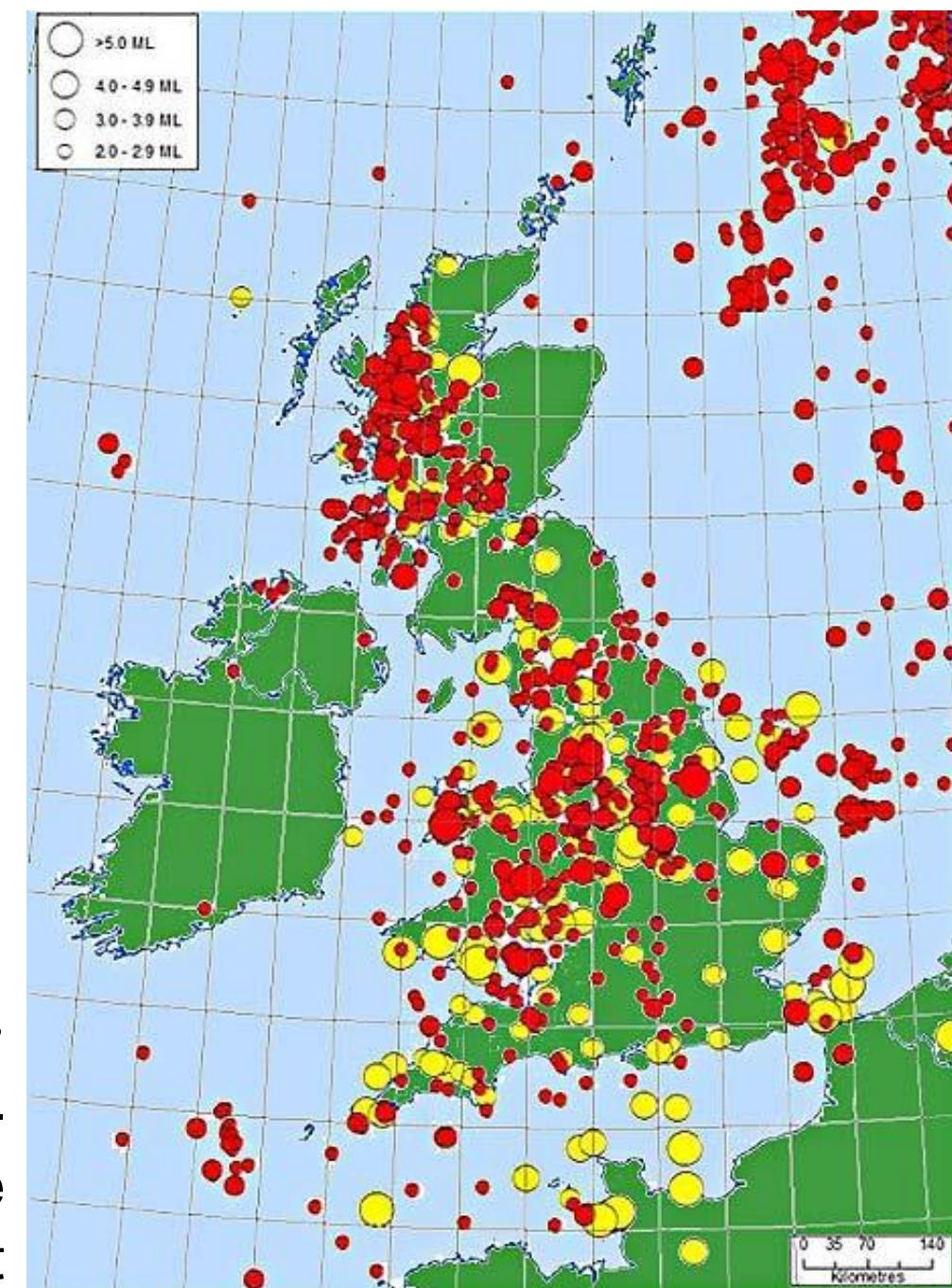


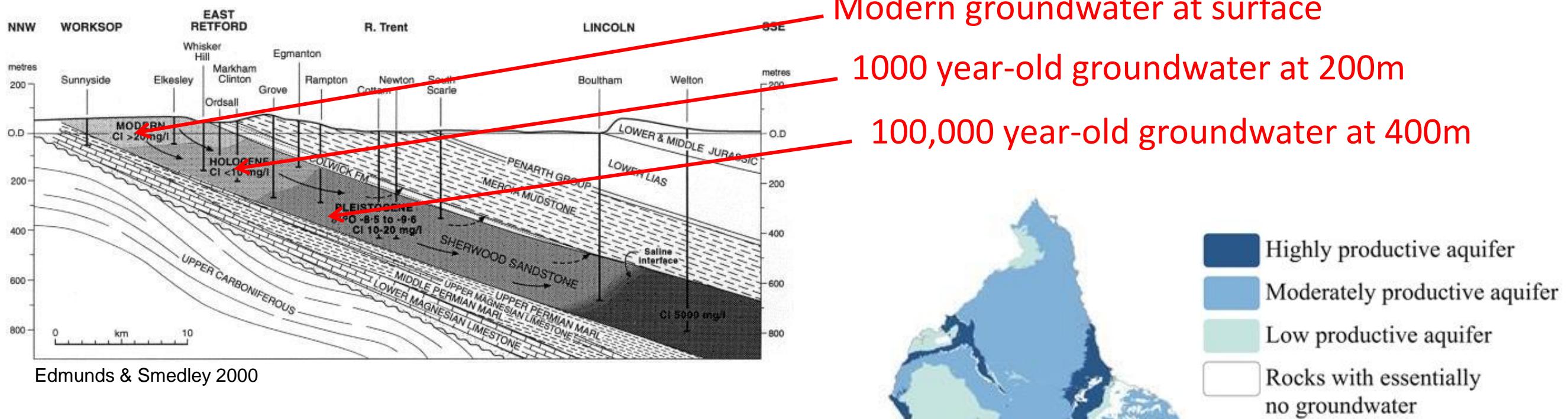
3. Natural processes: i) glaciation/climate change, ii) earthquakes



Permafrost events
fundamentally alter
groundwater flow

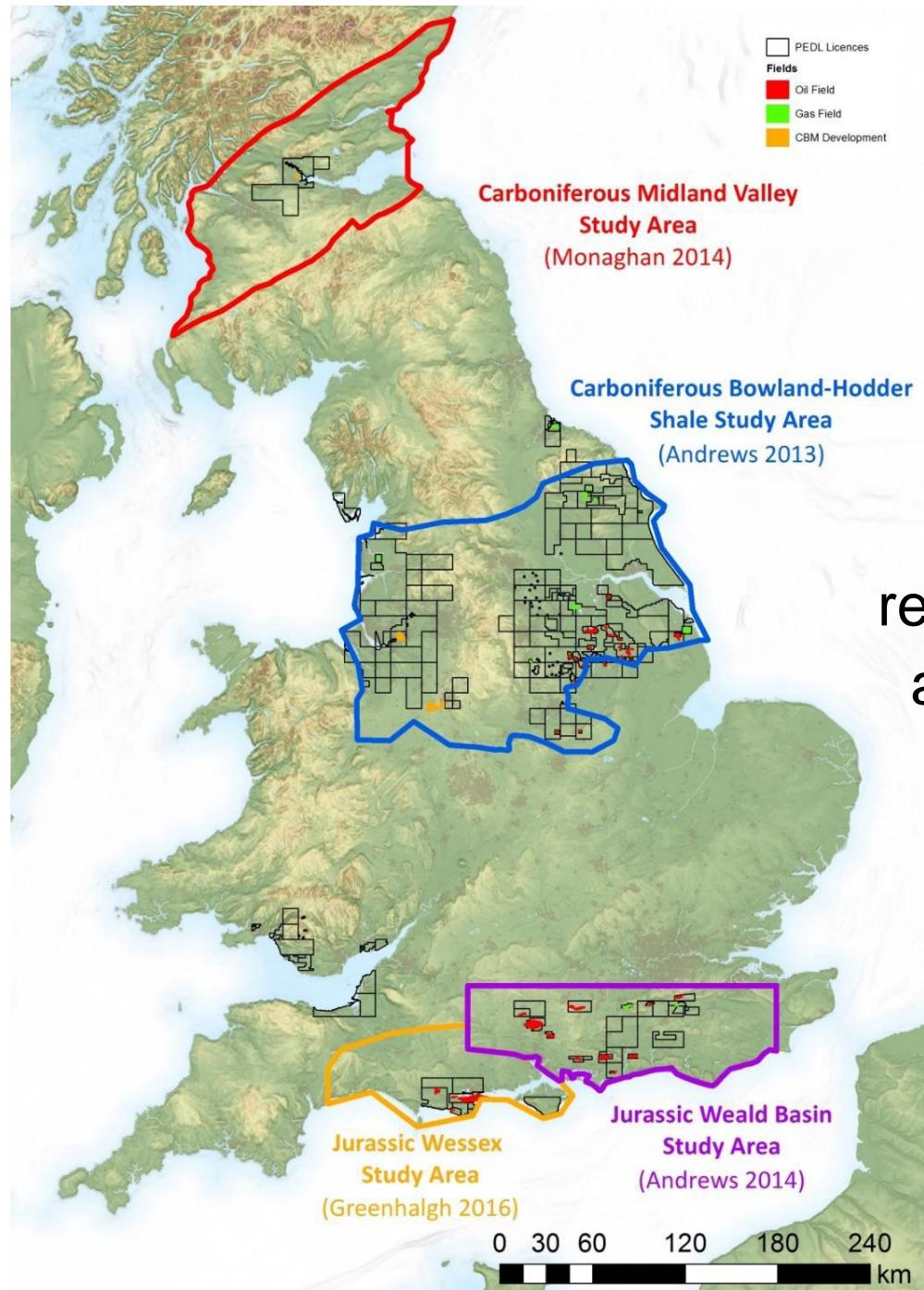
UK fairly low seismicity...
...but recent fracking-
induced tremors have
intensified public interest





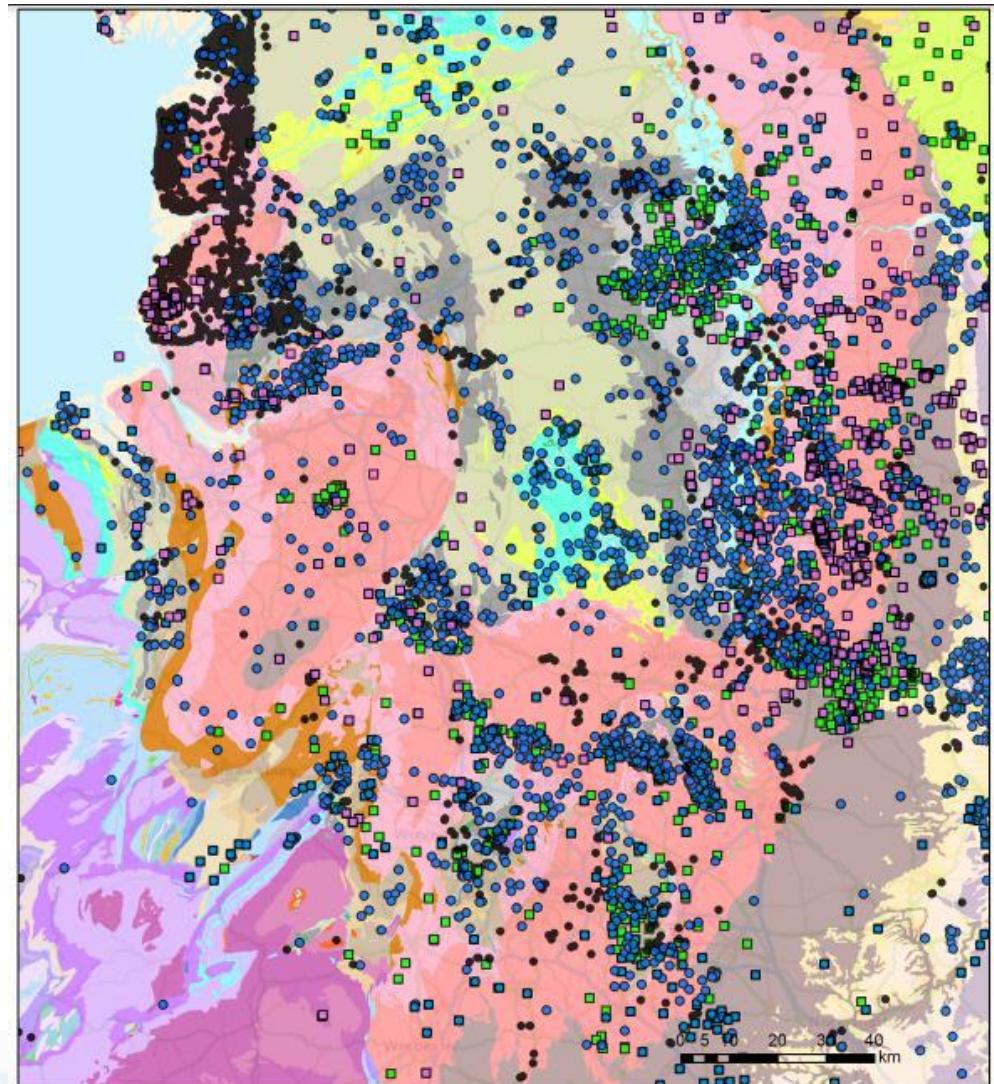
4. Groundwater

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



5. Resources

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





Nagra, N Switzerland



Nagra, N Switzerland



SKB, Aspö



ANDRA, Bure

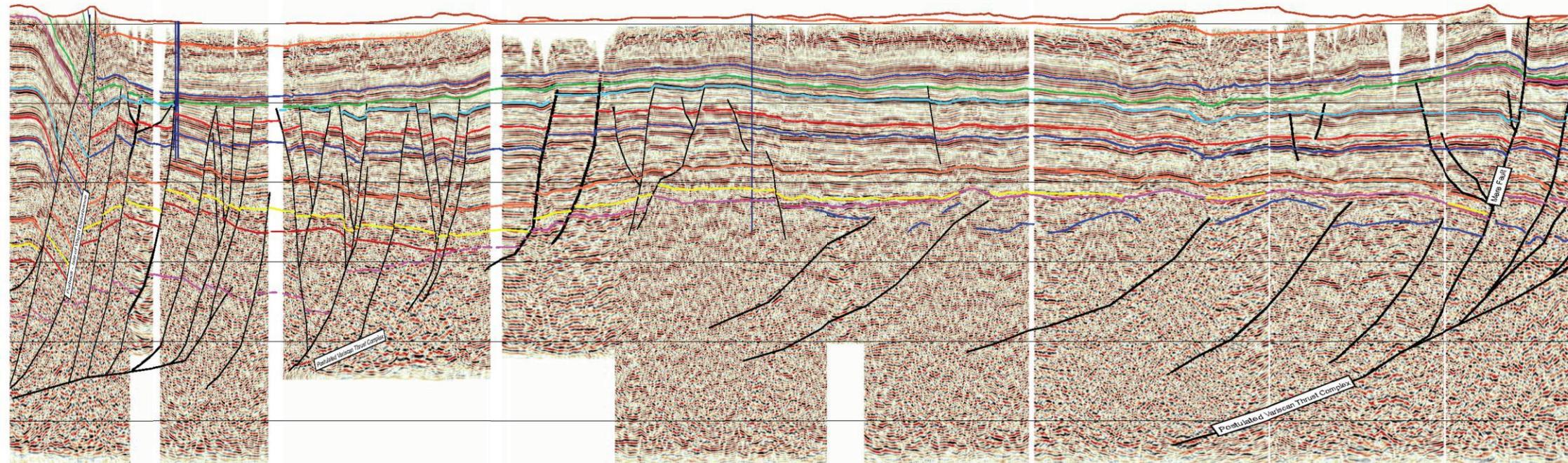
PORLAND-WIGHT BASIN

WYTCH FARM OILFIELD

CERNE TROUGH

CRANBORNE-FORDINGBRIDGE HIGH

WARDOUR BASIN



10 KM

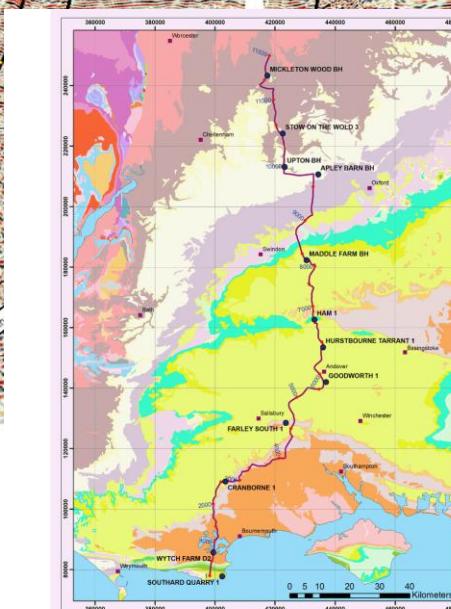
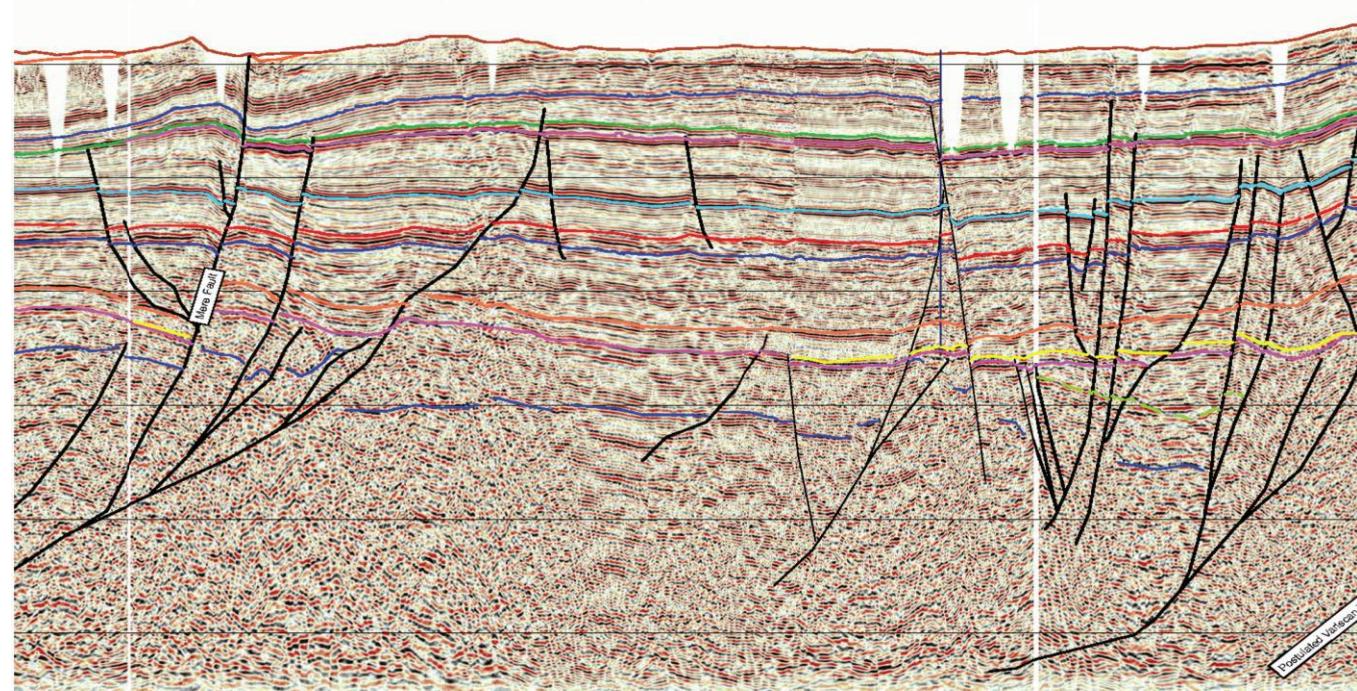
Courtesy <https://ukogl.org.uk/>

WARDOUR BASIN

PEWSEY BASIN

HAMPSHIRE DOWNS

MARLBOROUGH DOWNS



Horizons
004-01 Base Tertiary
004-12 Base Chalk
004-14 Base L Greensand
004-19 Base Cretaceous
004-21 Purbeck Anhydrite
004-24 Corallian
004-26 Corribash
004-28 Inferior Oolite
004-31 Penarth/Rhaetic
004-35 Sherwood/Bunter Sand
004-41 Permian
004-49 Base Permo-Trias
004-54 Base Coal Measures
004-59 Base Dinantian
004-63 Acadian Unconformity
004-75 Tremadocian
004-82 Hollybush Sandstone
004-82a Hollybush SS repeat 2
004-82b Hollybush SS repeat 2
004-91 Pre-Cambrian



Radioactive Waste Management

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