



**British
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL



Department
of Energy &
Climate Change

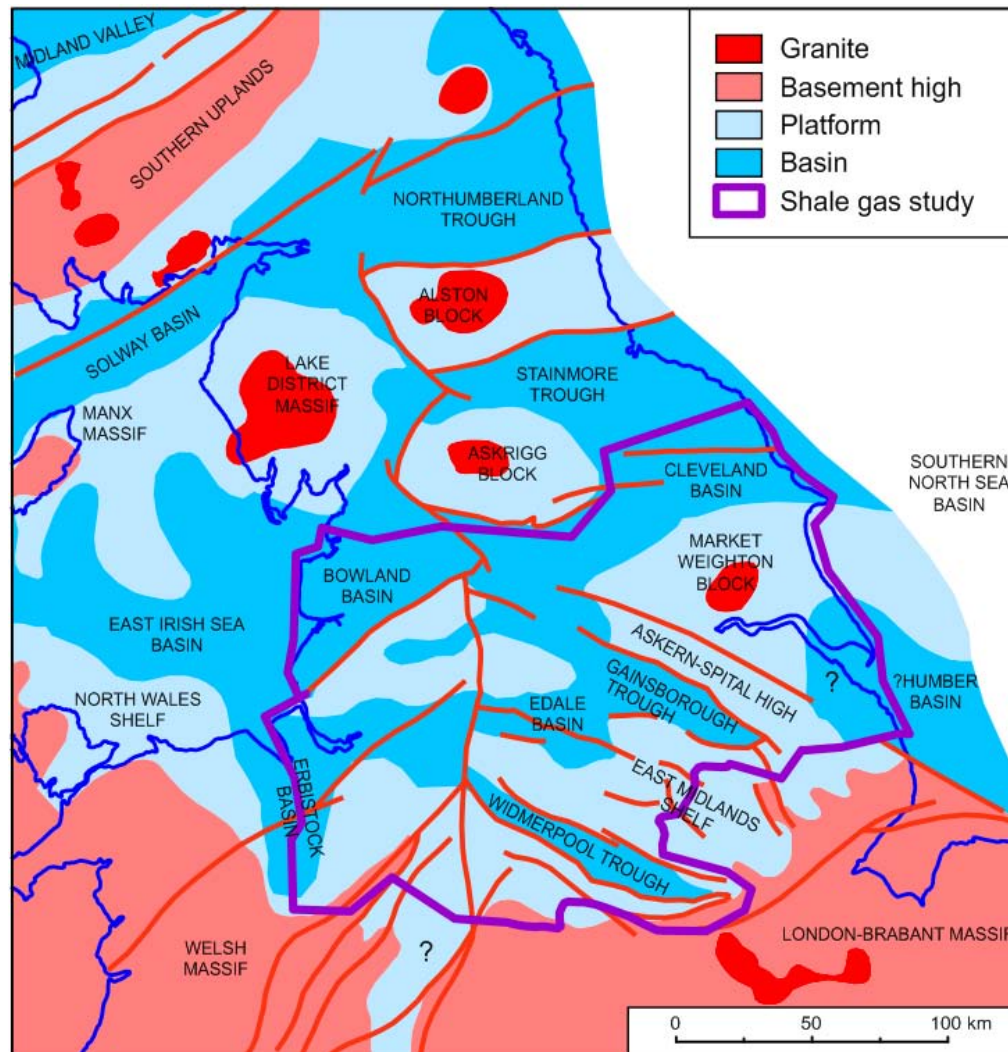
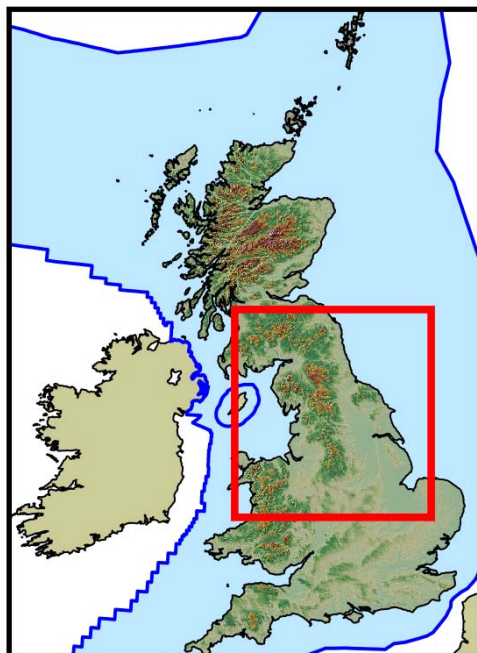
DECC - BGS Assessment of Resource Potential of the Bowland Shale, UK

Ian Andrews¹, **Toni Harvey**², Kevin Smith¹,
Nigel Smith³ & Ceri Vincent³

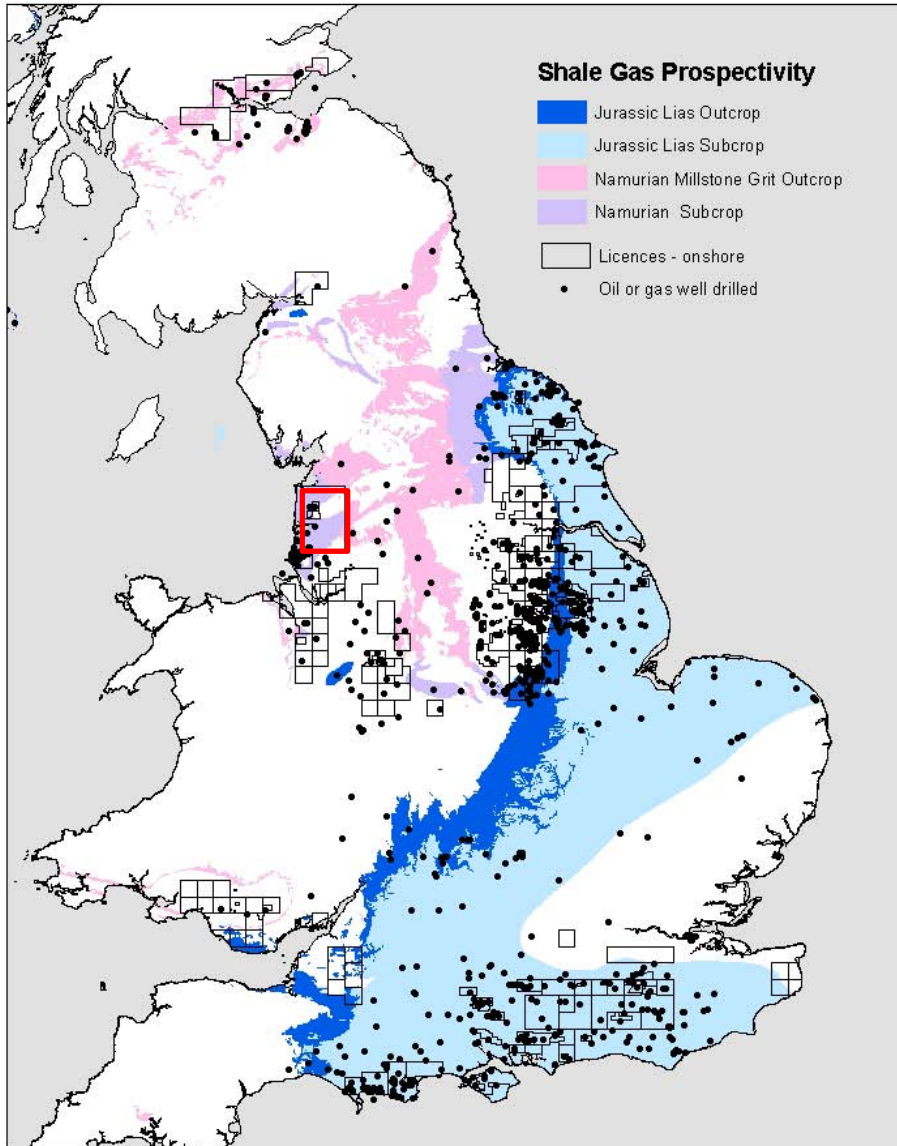
1. British Geological Survey, Edinburgh, UK
2. Department of Energy and Climate Change, London, UK
3. British Geological Survey, Keyworth, UK



Previous work in study area



2010 BGS Shale Gas Report



- 2010 DECC-commissioned BGS study estimated potential production-

- The UK Carboniferous (Upper Bowland Shale) shale gas play, if equivalent to the Barnett Shale of Texas, could potentially yield up to 4.7 tcf shale gas.*

- 2011 **Cuadrilla** 200 tcf (5,664 BCM) estimate for Gas in Place

So Cuadrilla claim 200 tcf **gas in place** on their licence where DECC estimate 4.7 tcf could **potentially be produced**.

Both may be right.

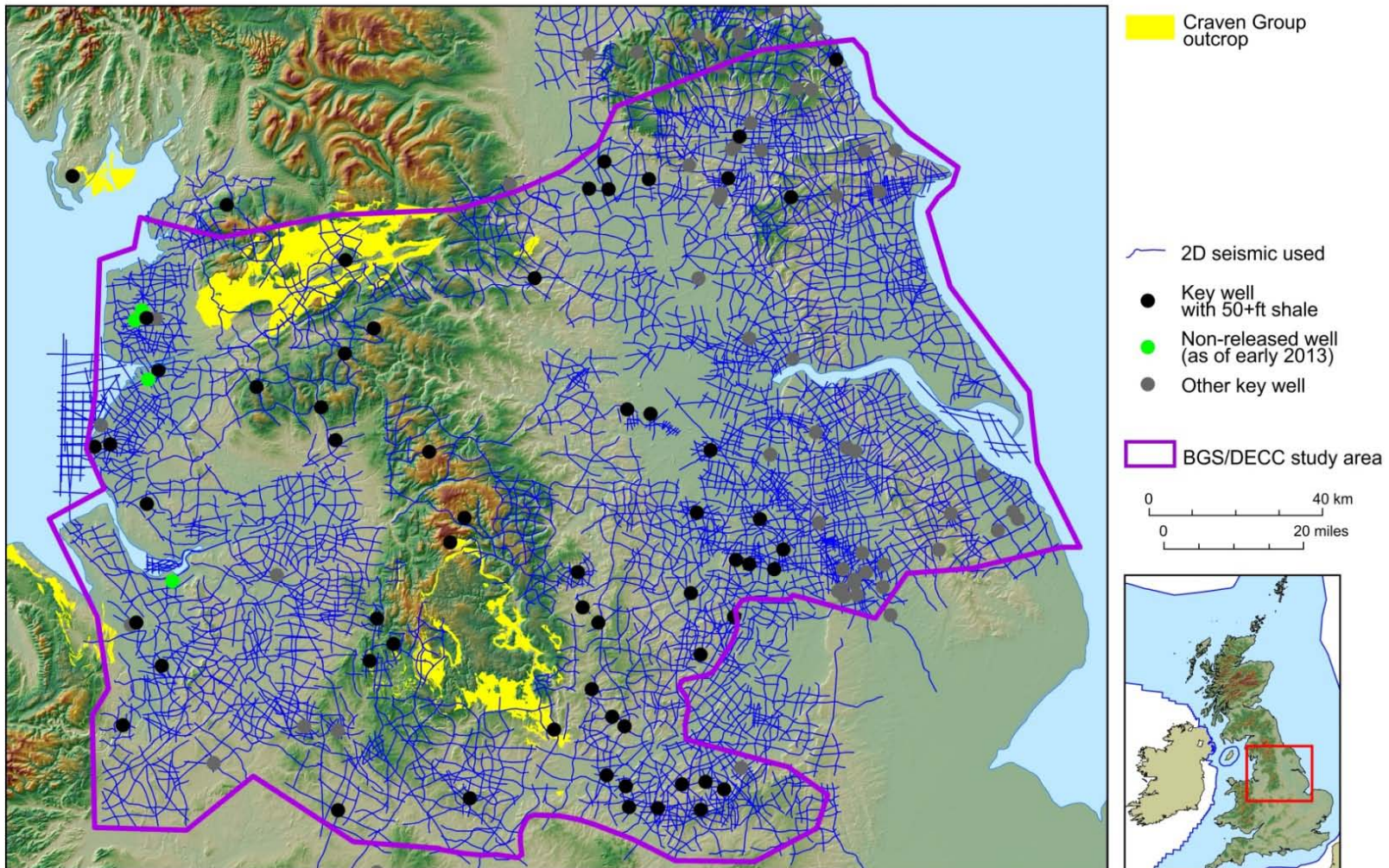
How to estimate shale gas resources

- **In-place resource estimates** based on a geological model, volumetrics and gas contents (**‘bottom-up approach’**), and
- **Technically recoverable resource estimates** based on well technology, well performance, well density (**‘top-down approach’**)

Data sources

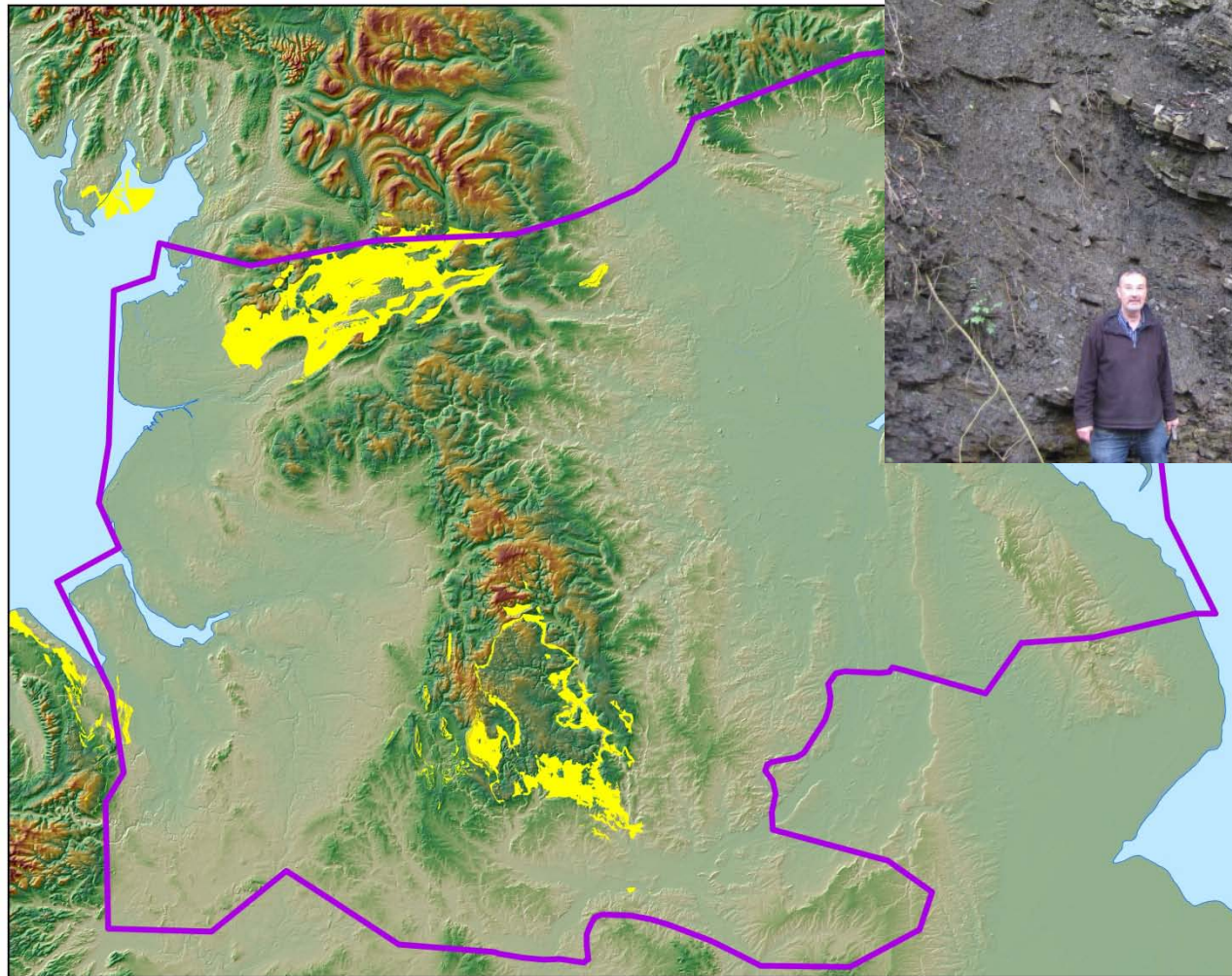


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15,000 miles of 2D and 400 sq miles 3D from www.ukogil.org.uk

Data sources

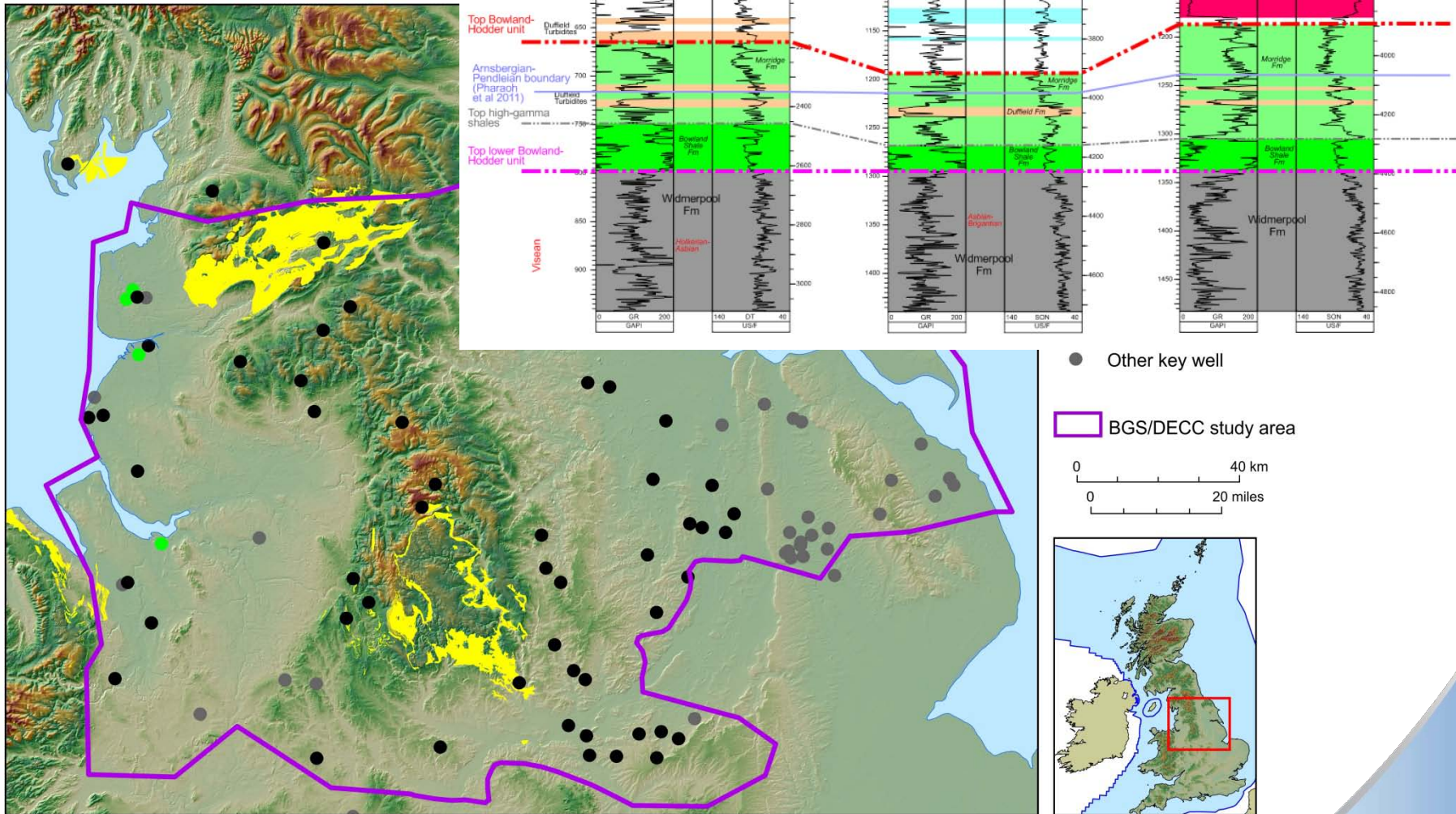


 BGS/DECC study area



Outcrop studies, BGS fault and surface geology, BGS Subsurface Memoirs, gravity and magnetic data

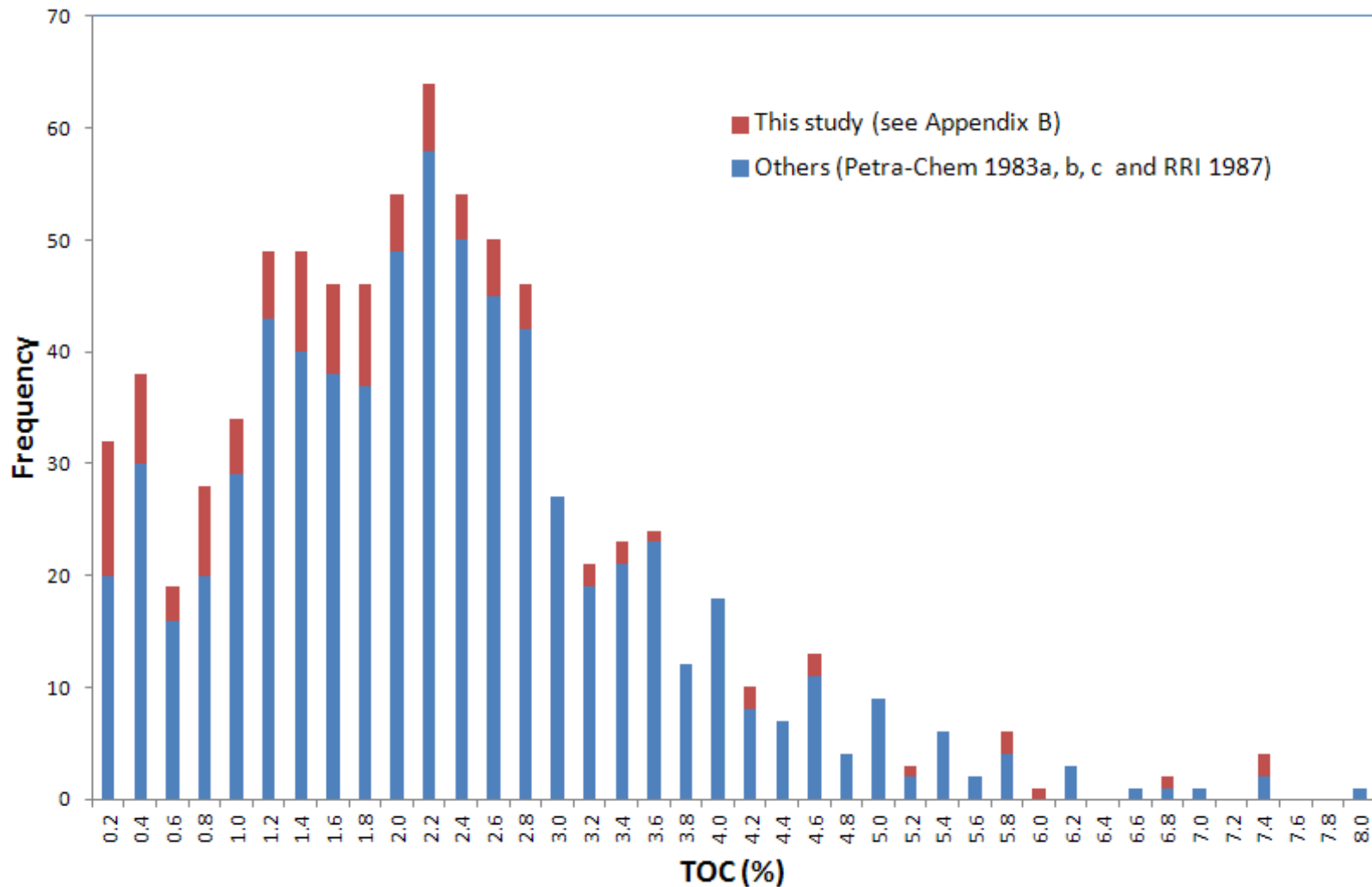
Data sources



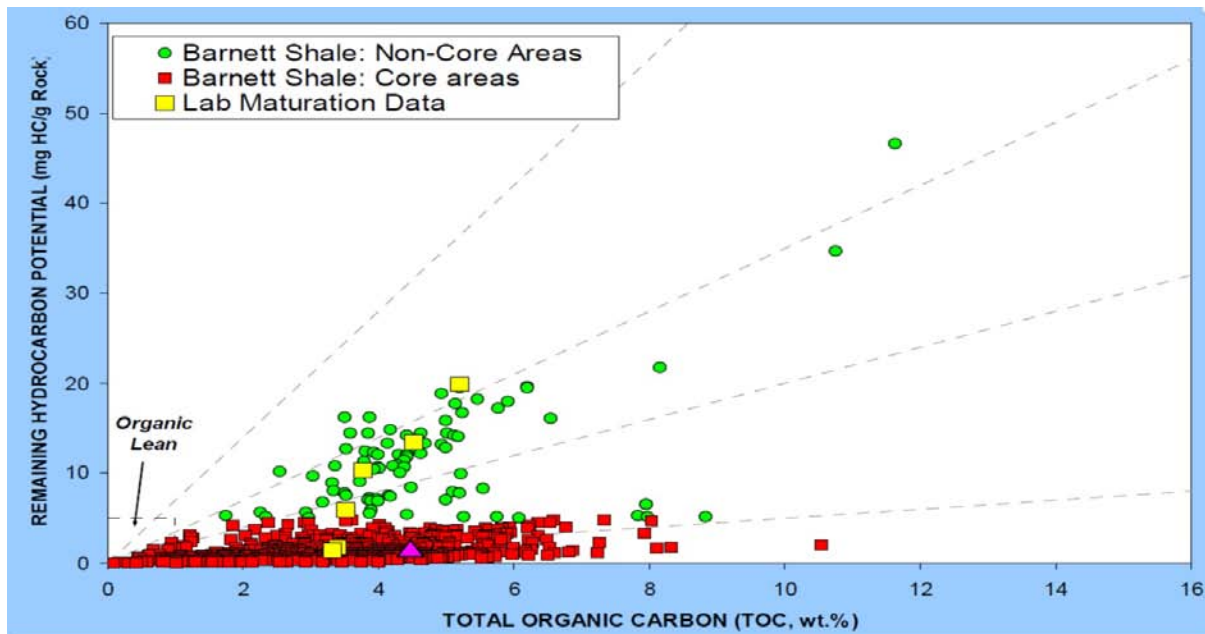
Over 1000 wells in study area and 64 key wells (>50 ft net shale)



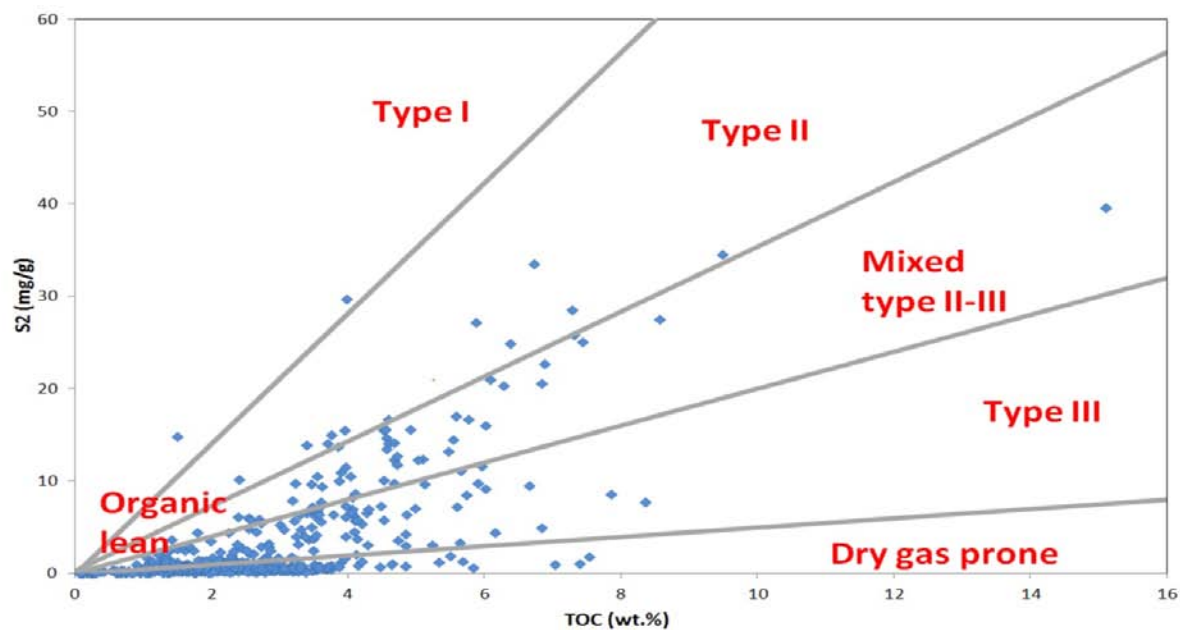
Organic carbon content (TOC)



Barnett shale - up to 10%, average 3.7%



Comparison of
Barnett Shale
(Jarvie, 2008)

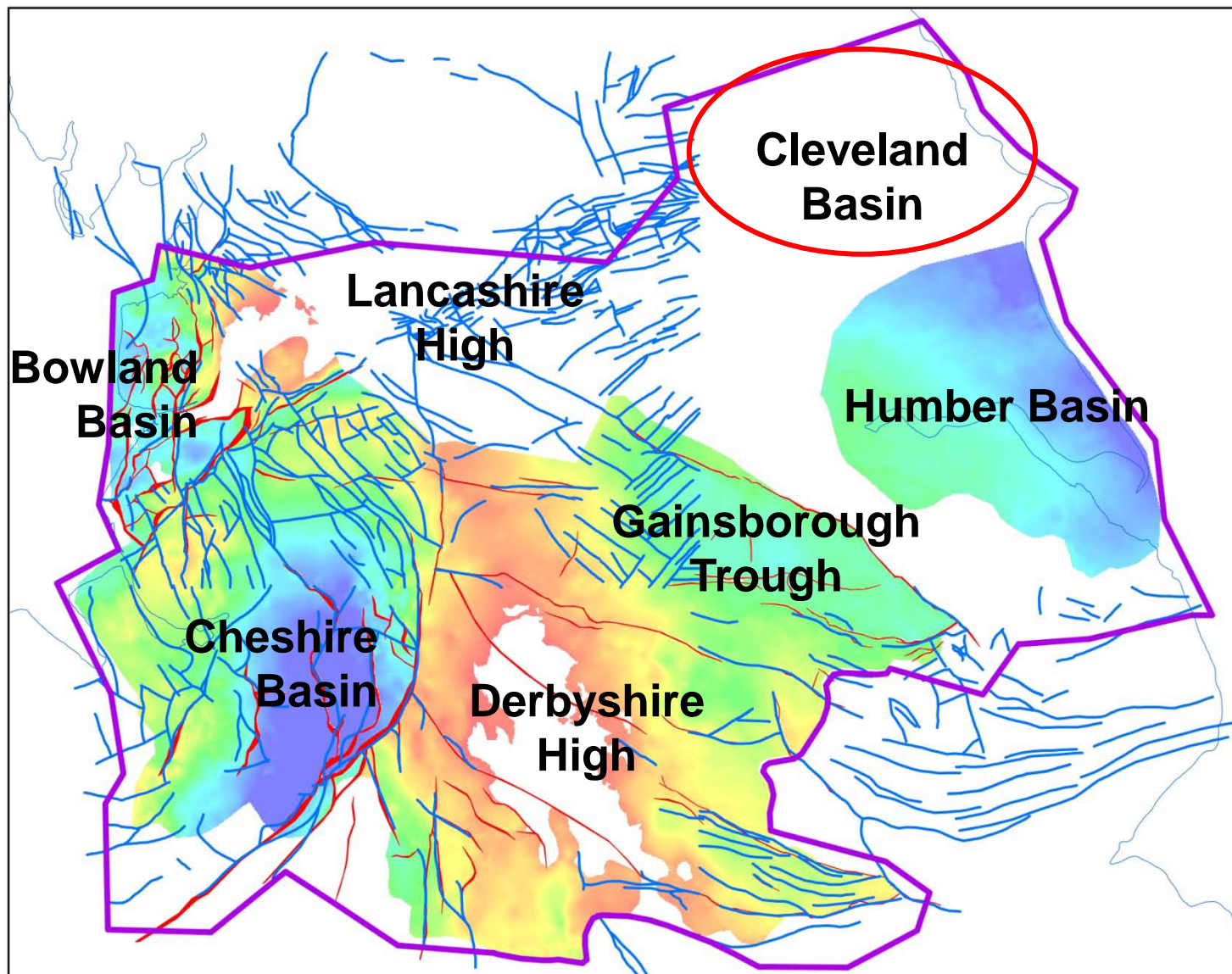



vs Bowland shale
geochemical data.

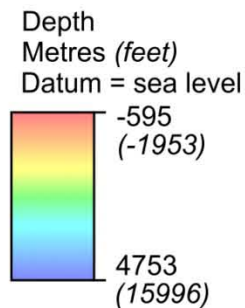
Depth to Top Bowland



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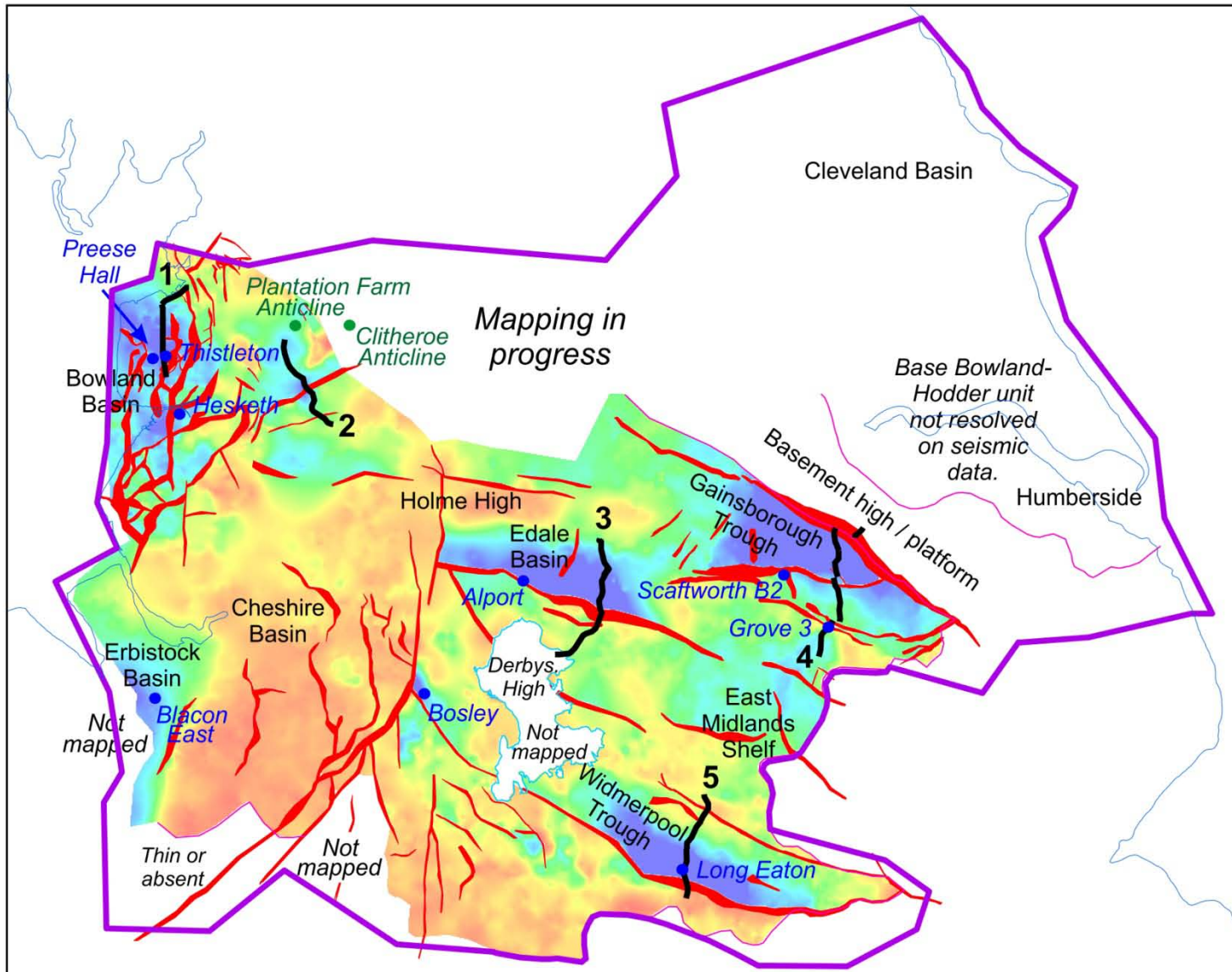
 Top Dinantian faults (BGS subsurface memoirs)



Thickness of Bowland-Hodder Unit



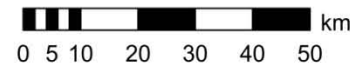
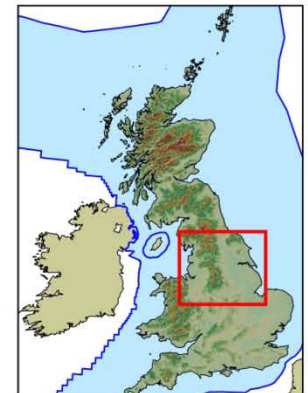
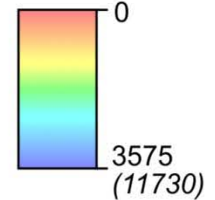
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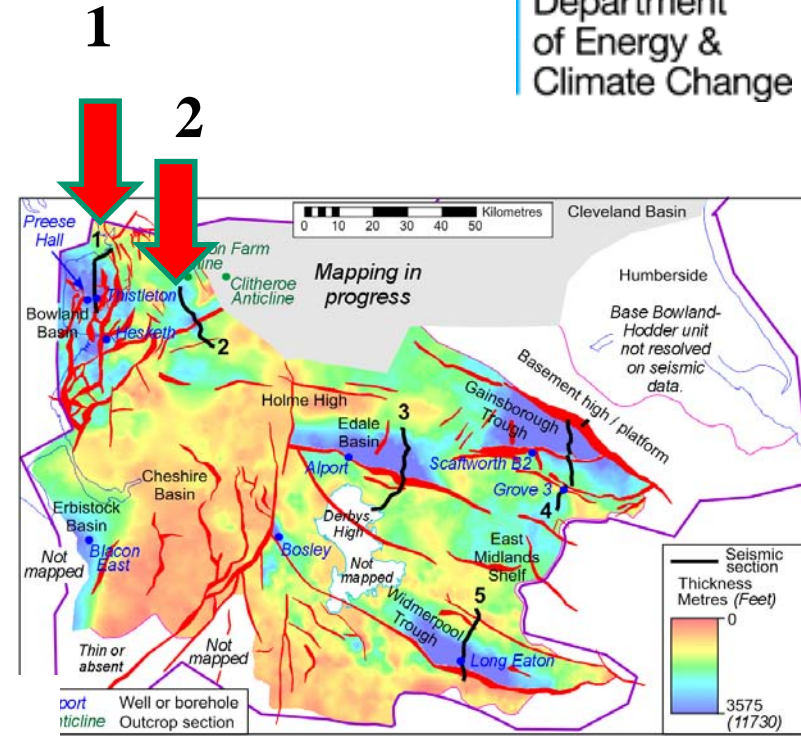
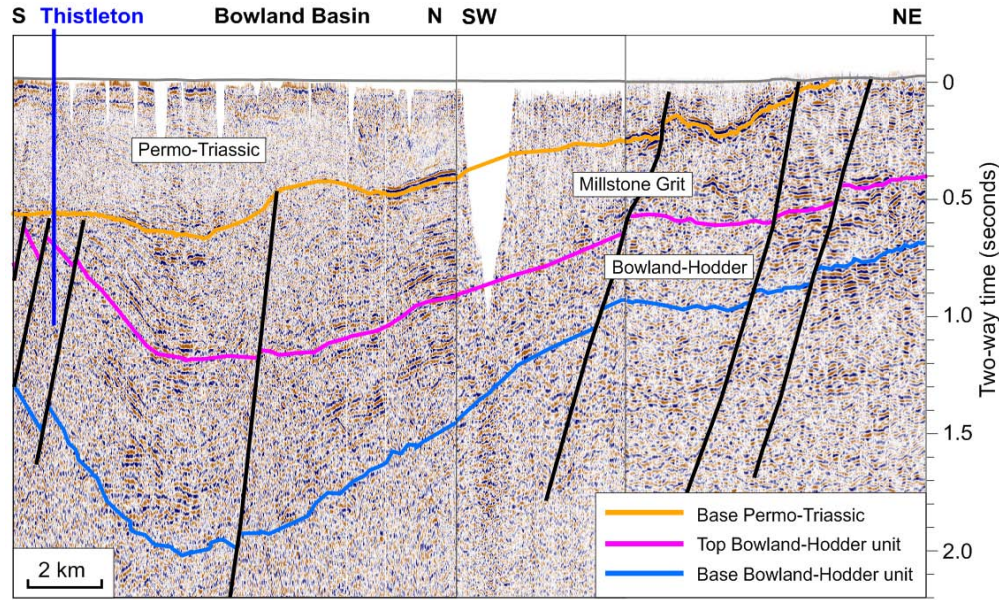
- *Alport* Well or borehole
- *Anticline* Outcrop section

— Seismic section

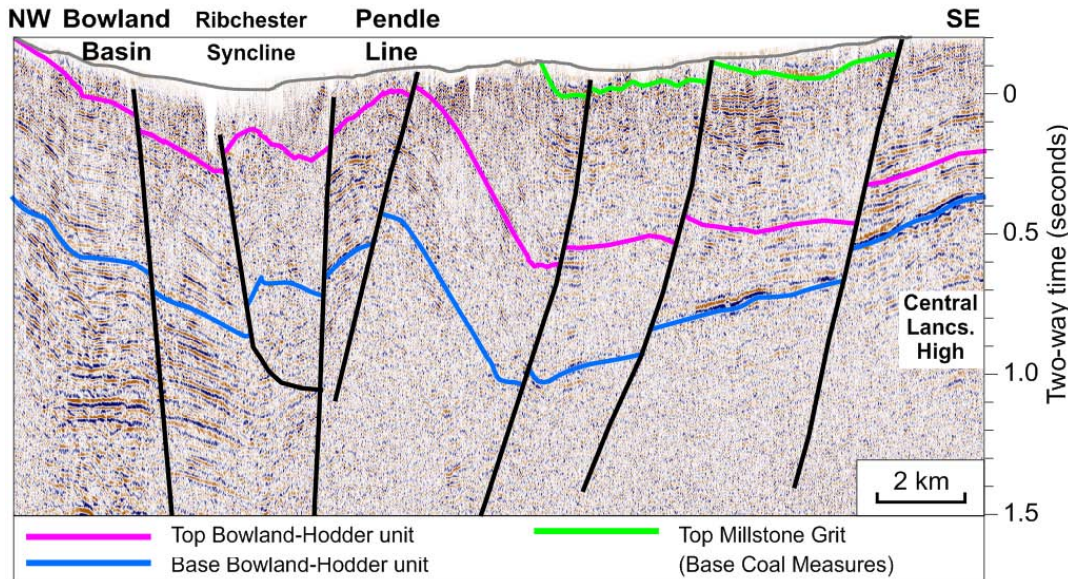
Thickness
Metres (Feet)



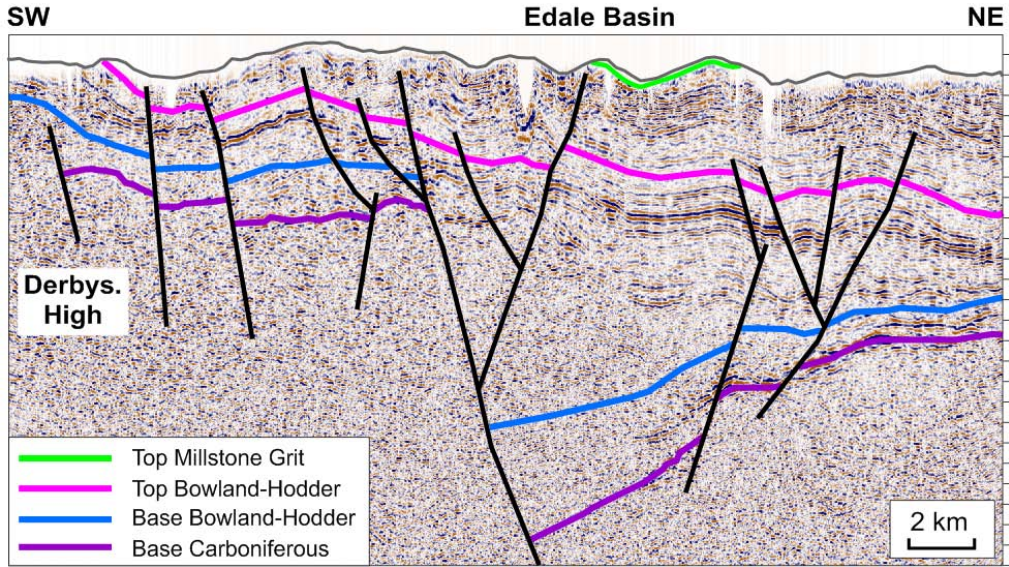
1 Northern Bowland Basin



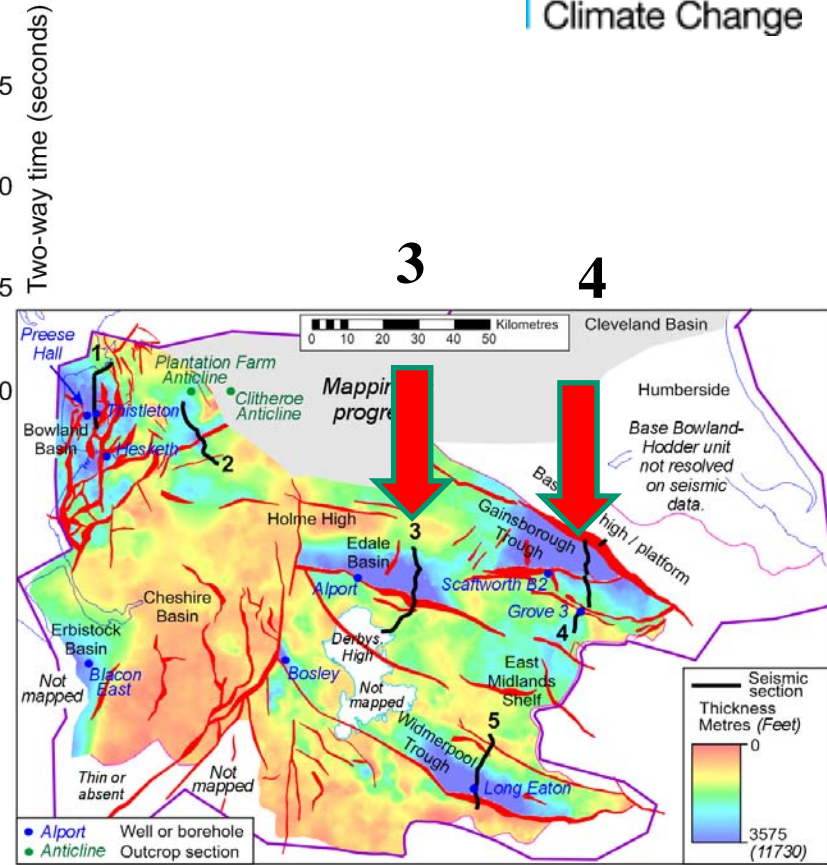
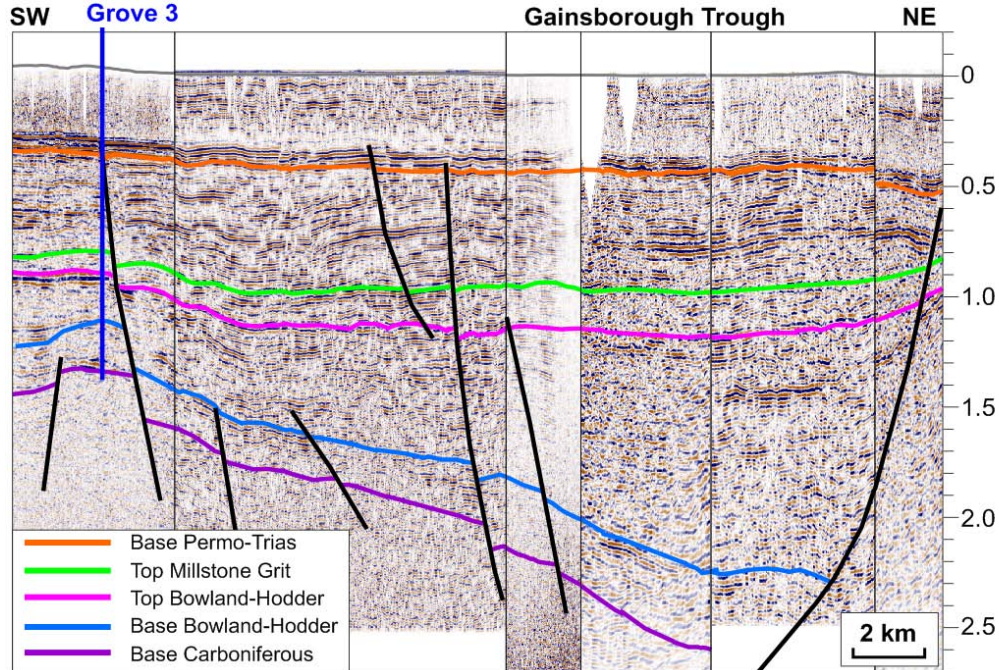
2 Eastern Bowland Basin



3 Edale Basin

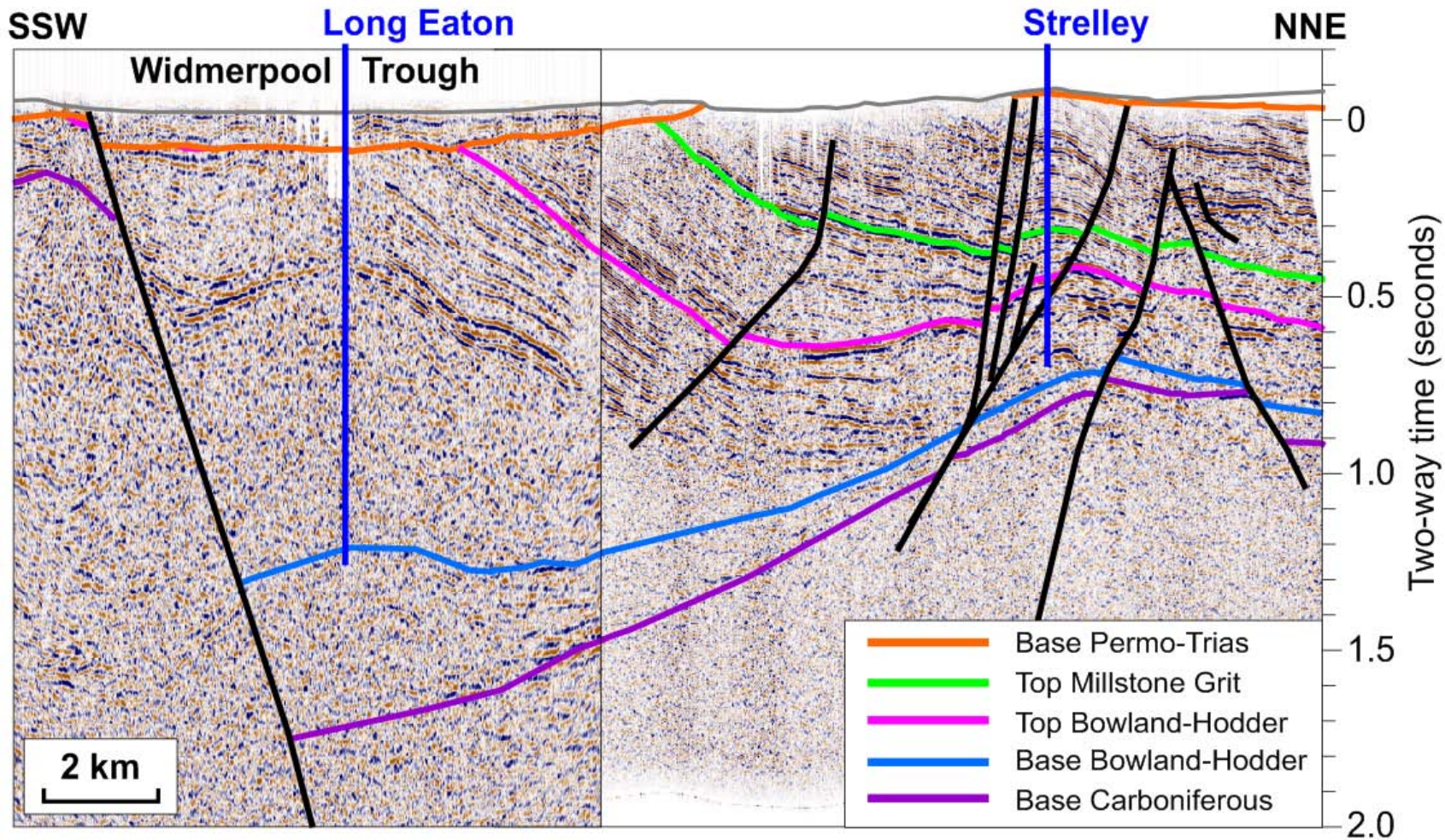
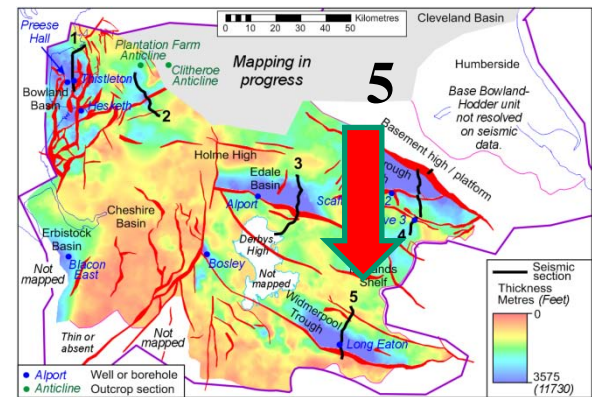


4 Gainsborough Trough



Inversion – Permo-Triassic on 8000 ft of Bowland-Hodder unit

5 Widmerpool Trough





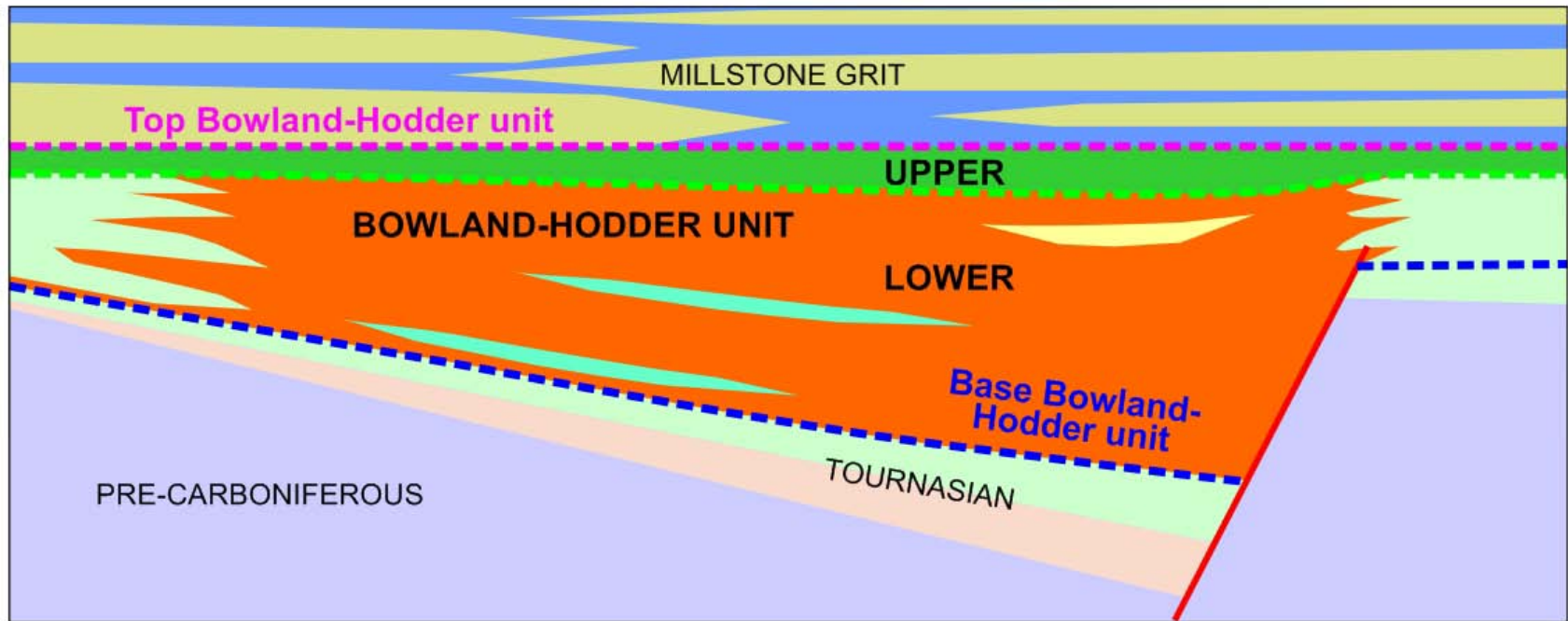
North American Shale Gas Analogies


Shale Gas	Barnett - Fort Worth Basin TX	Eagle Ford South Texas	Haynesville Texas/LA	Horn River BC	Marcellus- Appalachia	Bakken – Williston Basin	Bowland N England
Age	Mississippian 340 MYA	Cretaceous 100 MYA	U Jurassic 170 MYA	U. Devonian 370 MYA	M Devonian 385 MYA	U Dev/L Mississ. 360 MYA	L. Carbonifeous (Mississ) 327 MYA
Lithology	Siliceous mudst	Bituminous shales	Argill/ Calcareous	Brittle Shale	Argill mudst	Sst/Siltst/ Carbonate	Brittle Shale
Depth (ft)	7,500	11,500	12,000	8,800	7,000	10,000	10,000
Thickness (ft)	300	250	225	450	350	150	Over 6000 in basin centre

source: www.transformsw.com/papers-and-presentations/studies.html




Early Carboniferous half graben model



-  'Millstone Grit' lithofacies with hemipelagics
-  Continental and peritidal lithofacies

-  Platform/ramp carbonate lithofacies

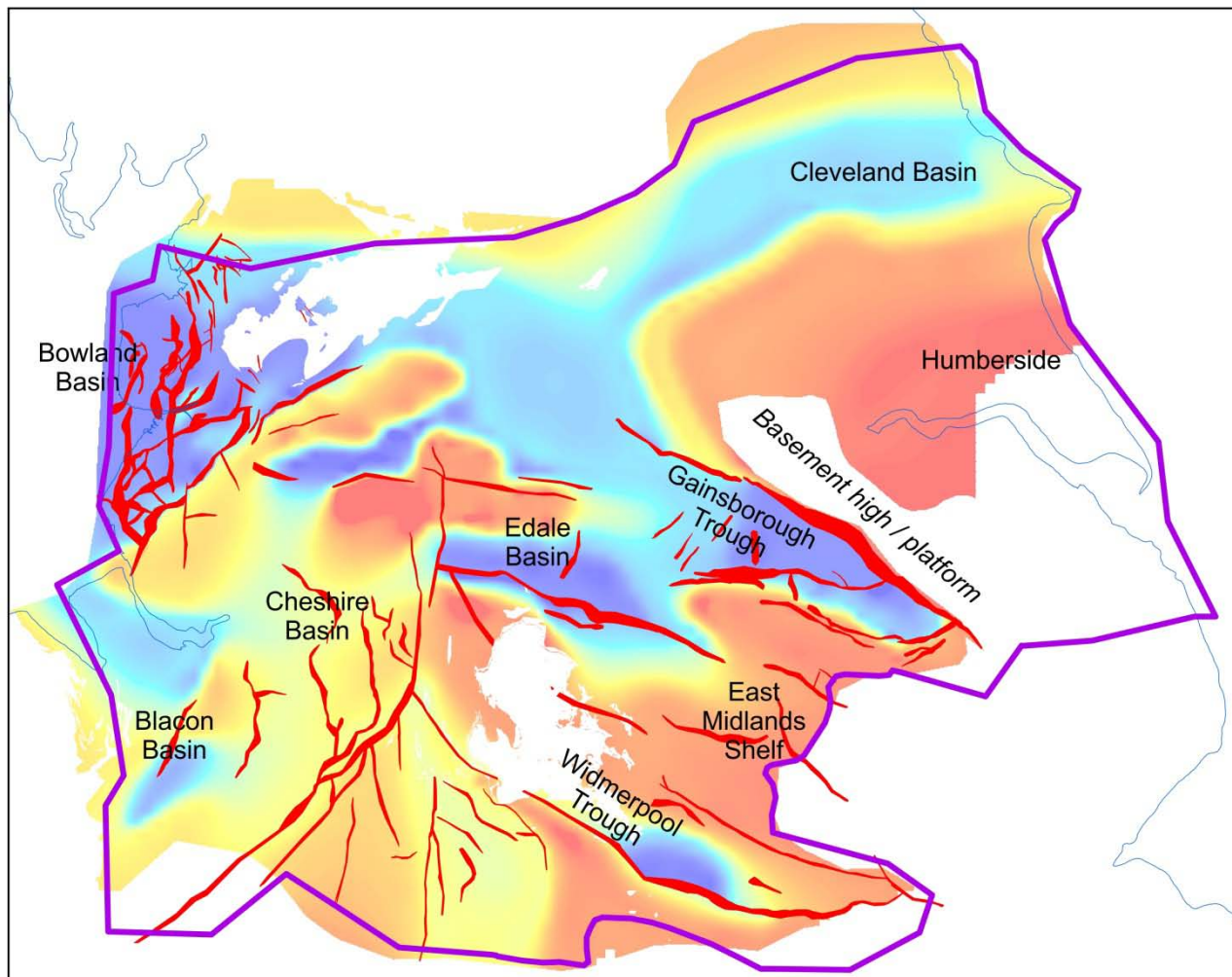
-  Hemipelagic lithofacies (with mass-flow limestones and sandstones)

-  Base of upper unit

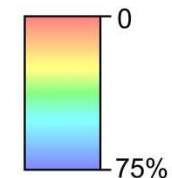
Shale percentage (lower unit)



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Percent shale

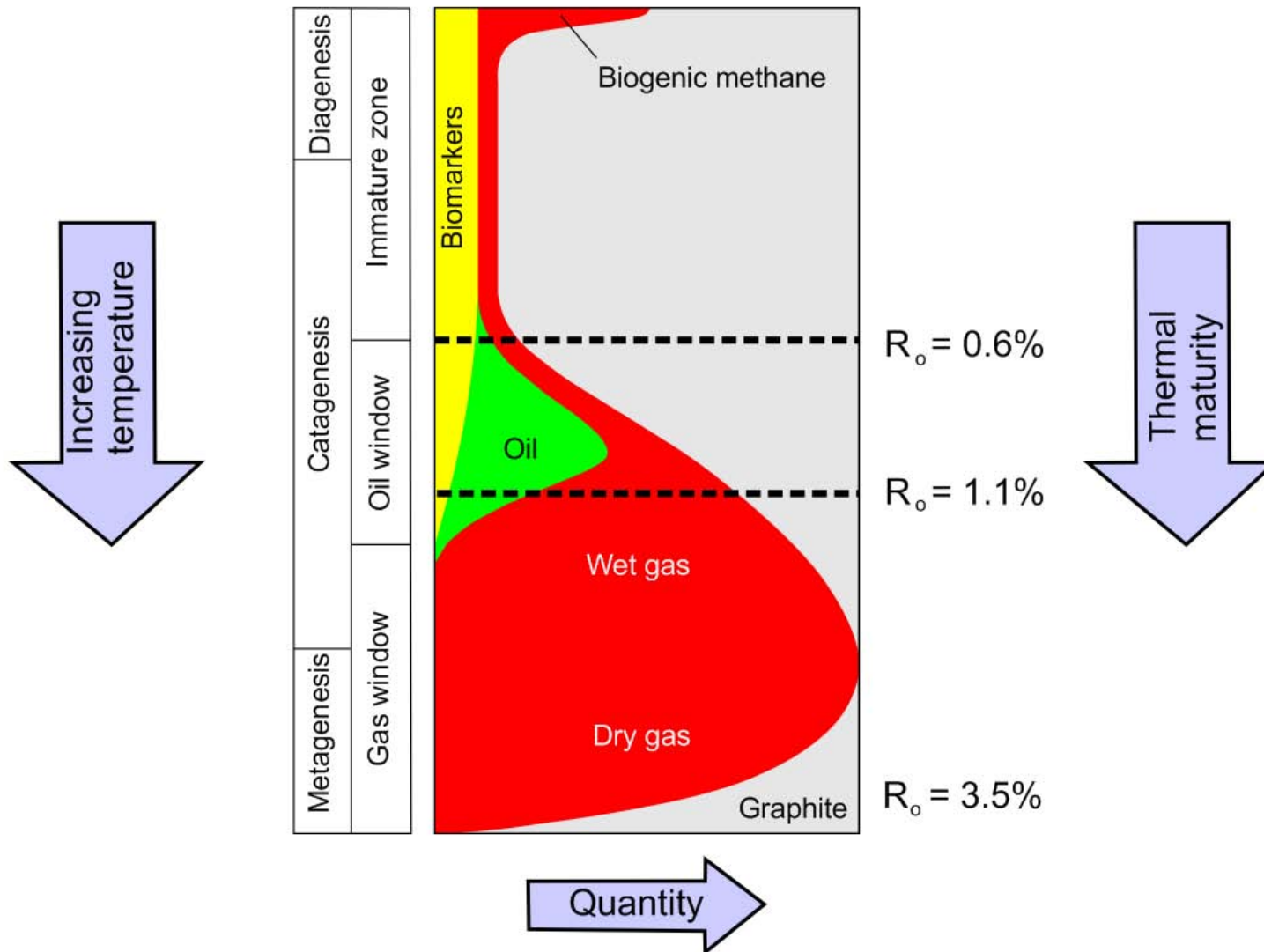


BGS/DECC study area

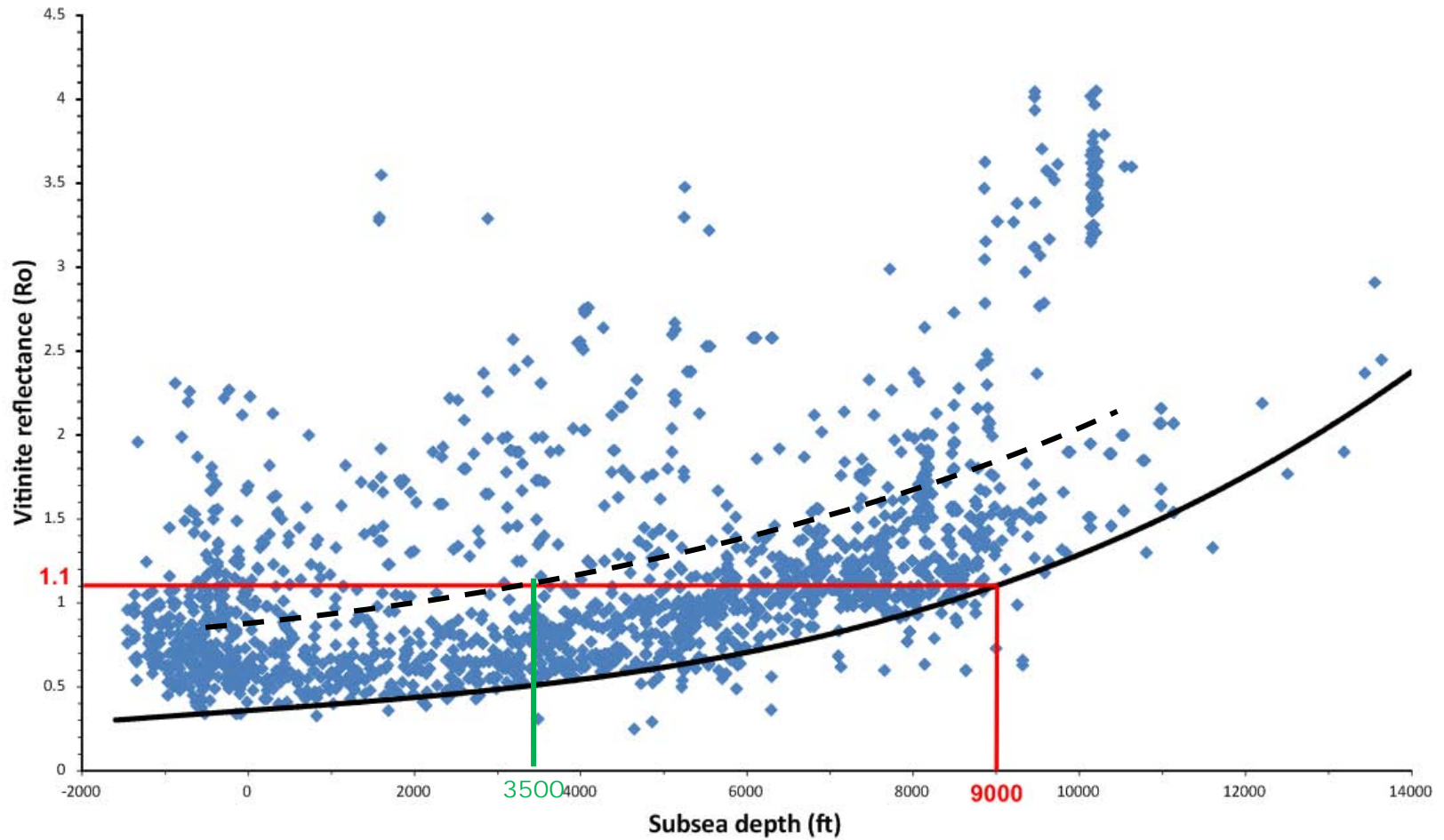




Onset of gas generation



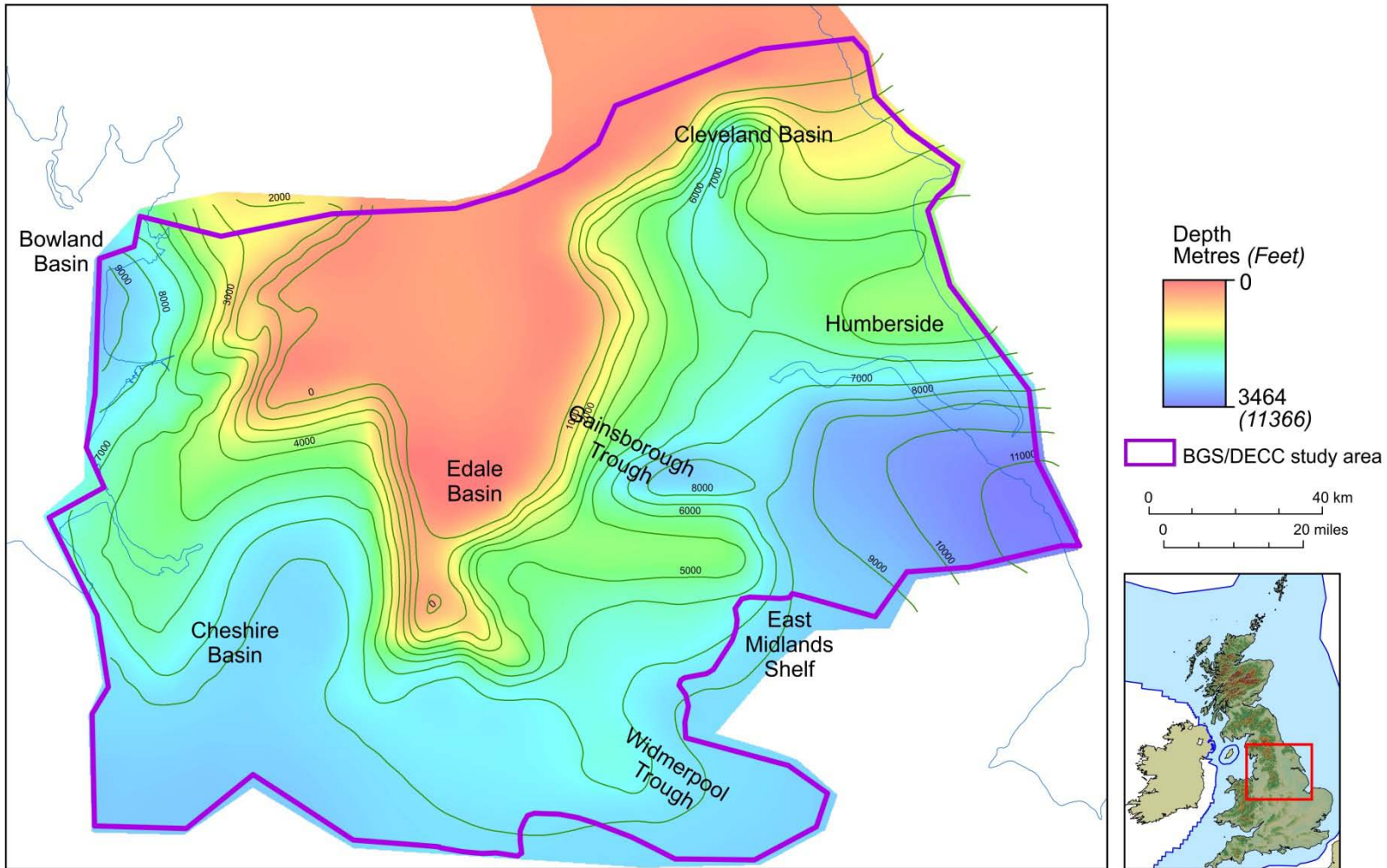
Maturity data



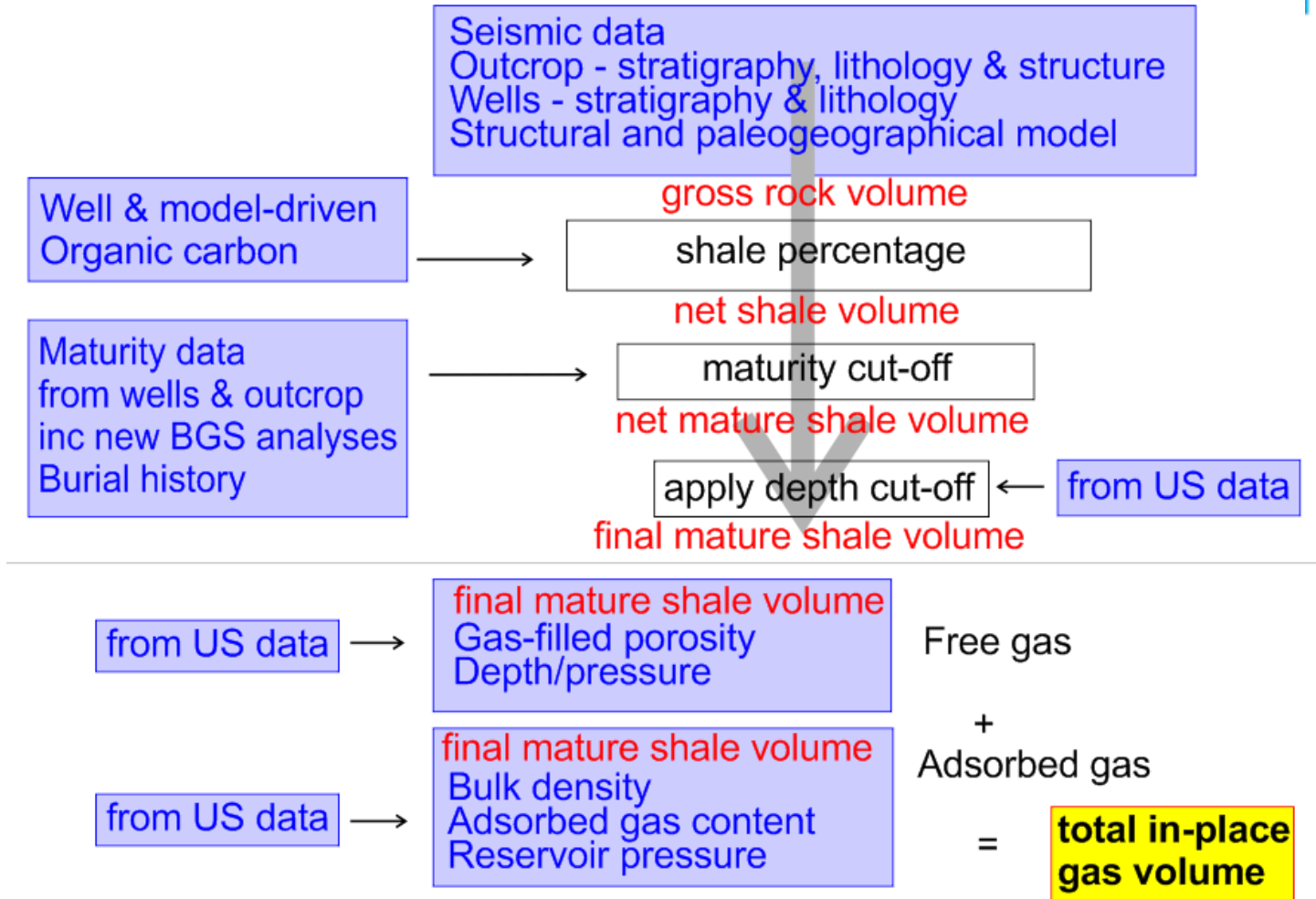
Maturity interpretation: depth to gas window



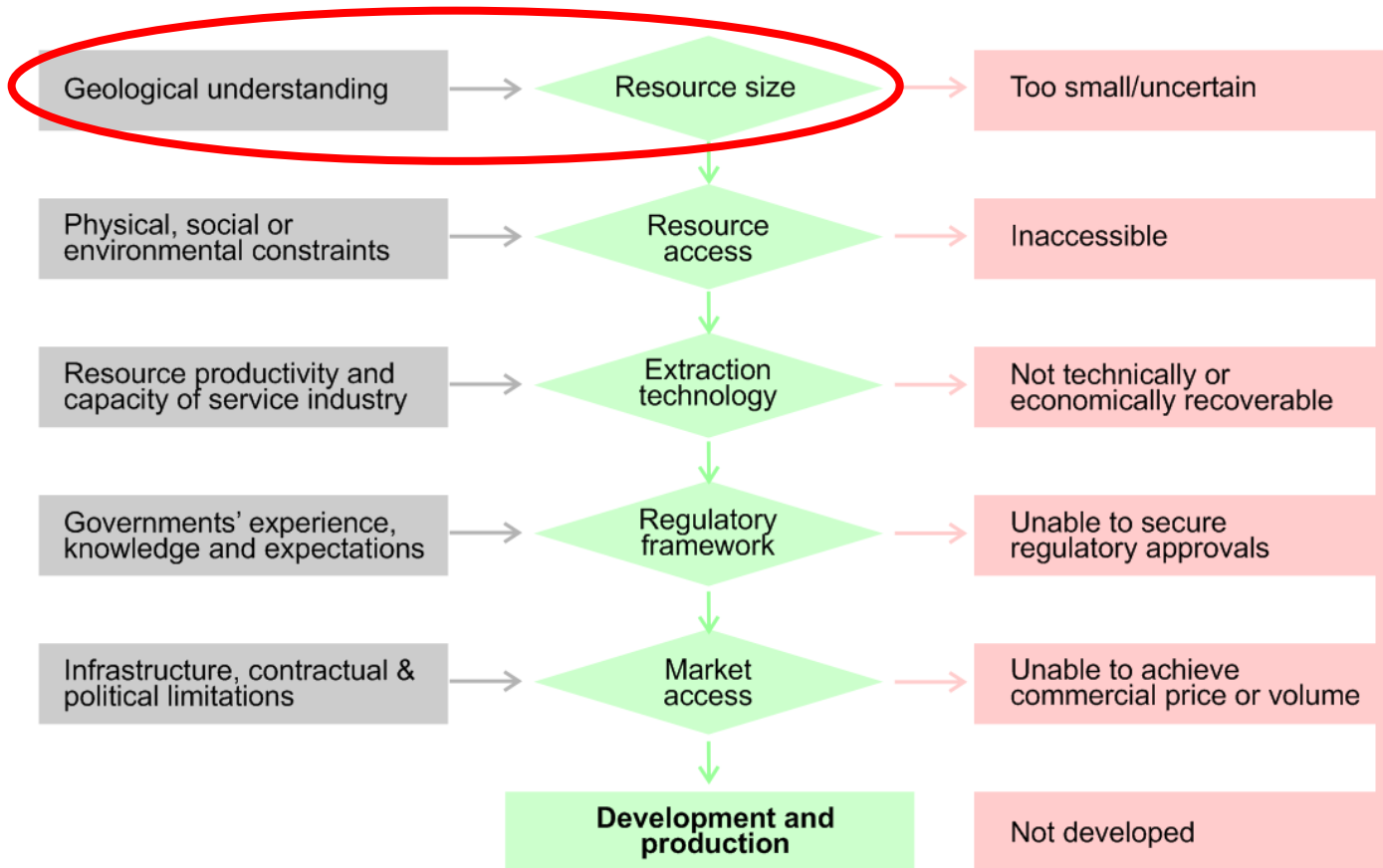
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Workflow



Factors determining the viability of natural gas developments (IEA 2011)





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Oil and gas: onshore exploration and production

Publications, guidance and data including mapping, seismic activity, wells, and licensing and regulation for onshore oil and gas.

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Overview

Information, publications, guidance and data relating to onshore exploration and production, including mapping, seismic activity, wells, and licensing and regulation.

Mapping

- [mapping data – onshore maps and GIS shapefiles](#)
- [onshore licence data](#)
- [guidance on onshore co-ordinates](#)

Onshore reports

- [Interim report on BGS Bowland Shale Resource Evaluation 13 Dec 2012](#) [MS Word Document, 7.34MB]
- [RockEval data used in BGS Interim report](#) [MS Excel Spreadsheet, 108KB]
- [Slides presented at PROSPEX Fair 13 Dec 2012](#) [PDF, 5.75MB, 28 pages]
- [House of Commons DECC Select Committee on Shale Gas Report - volume 1](#) [PDF, 1.52MB, 180 pages]
- [House of Commons DECC Select Committee on Shale Gas Report - volume 2](#) [PDF, 1.1MB, 43 pages]
- [Shale Gas: Government Response to the Committee's Fifth Report of Session 2012](#) [PDF, 1.22MB, 15 pages]
- [Unconventional gas post note](#) [PDF, 407KB, 4 pages]

Seismic and wells

- [PON 14b Notification of intention to carry out onshore \(landward\) geophysical surveys](#) [MS Word Document, 37.5KB]
- [DECC policy on data release](#)
- [UK Onshore Geophysical Library \(UKOGL\) – release agent for onshore seismic data](#)

In-place gas figure

.... will be announced by DECC later this summer

See press release or visit

www.gov.uk/oil-and-gas-onshore-exploration-and-production