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

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Previous work in study area

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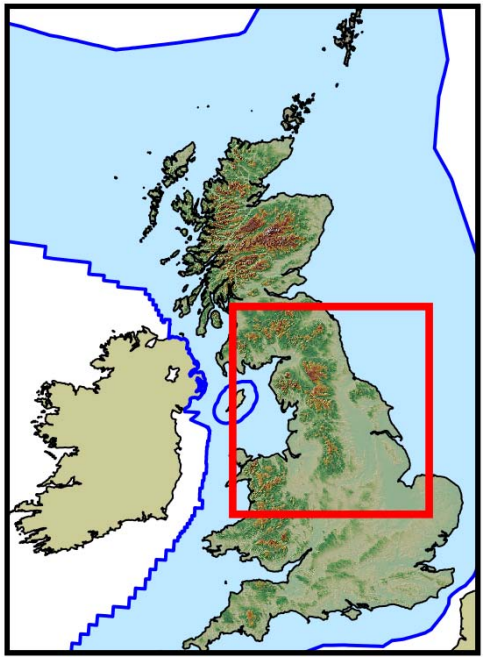

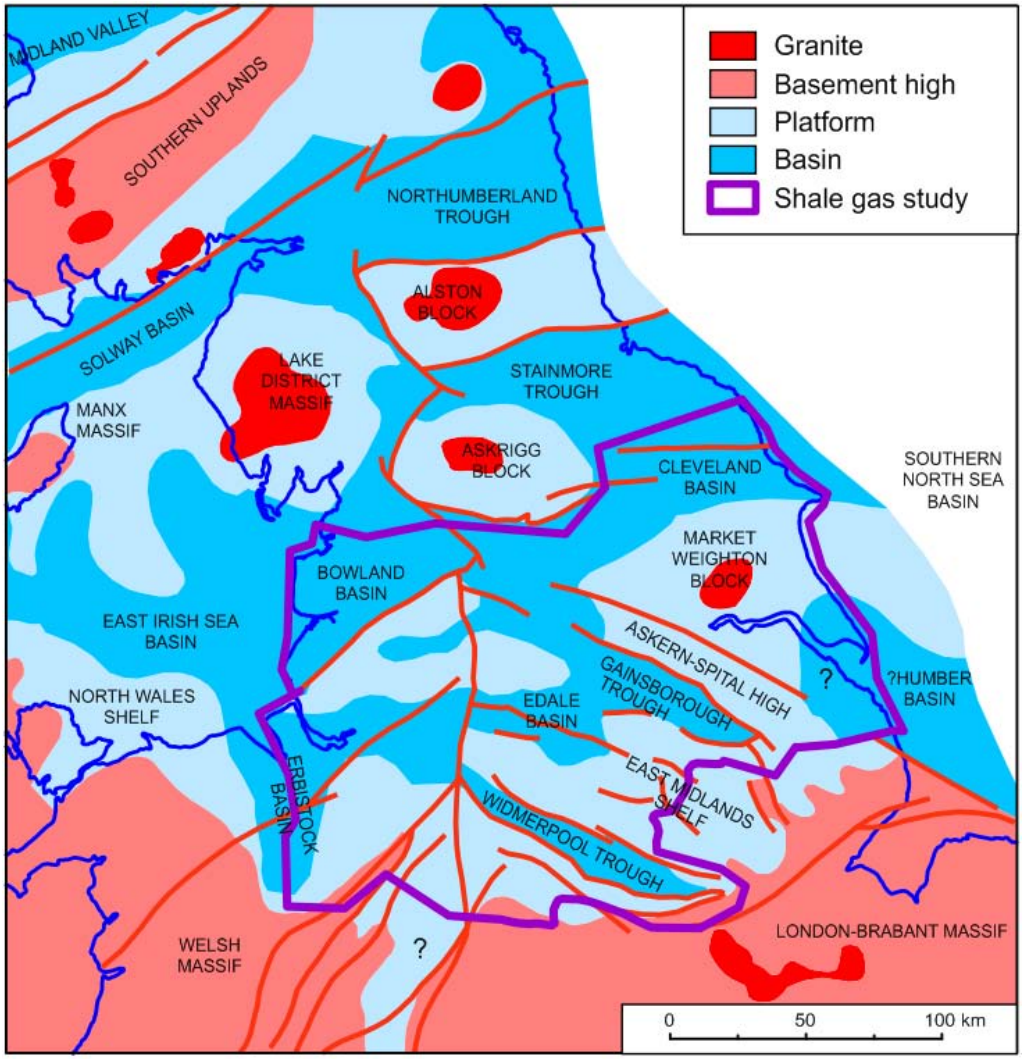

2010 BGS Shale Gas Report

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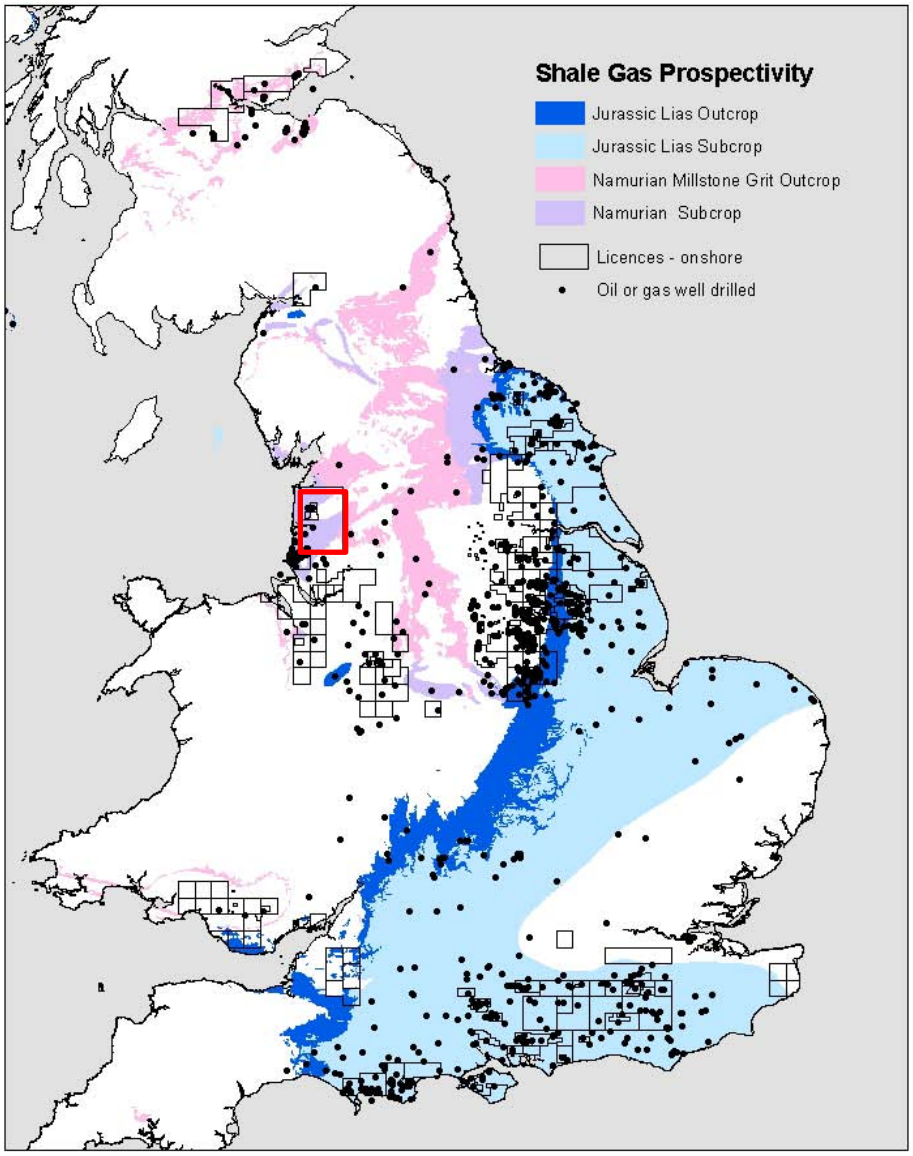

•2010 DECC-commissioned BGS study estimated potential production-

> •*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.

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How to estimate shale gas resources

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- **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**’)

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Data sources

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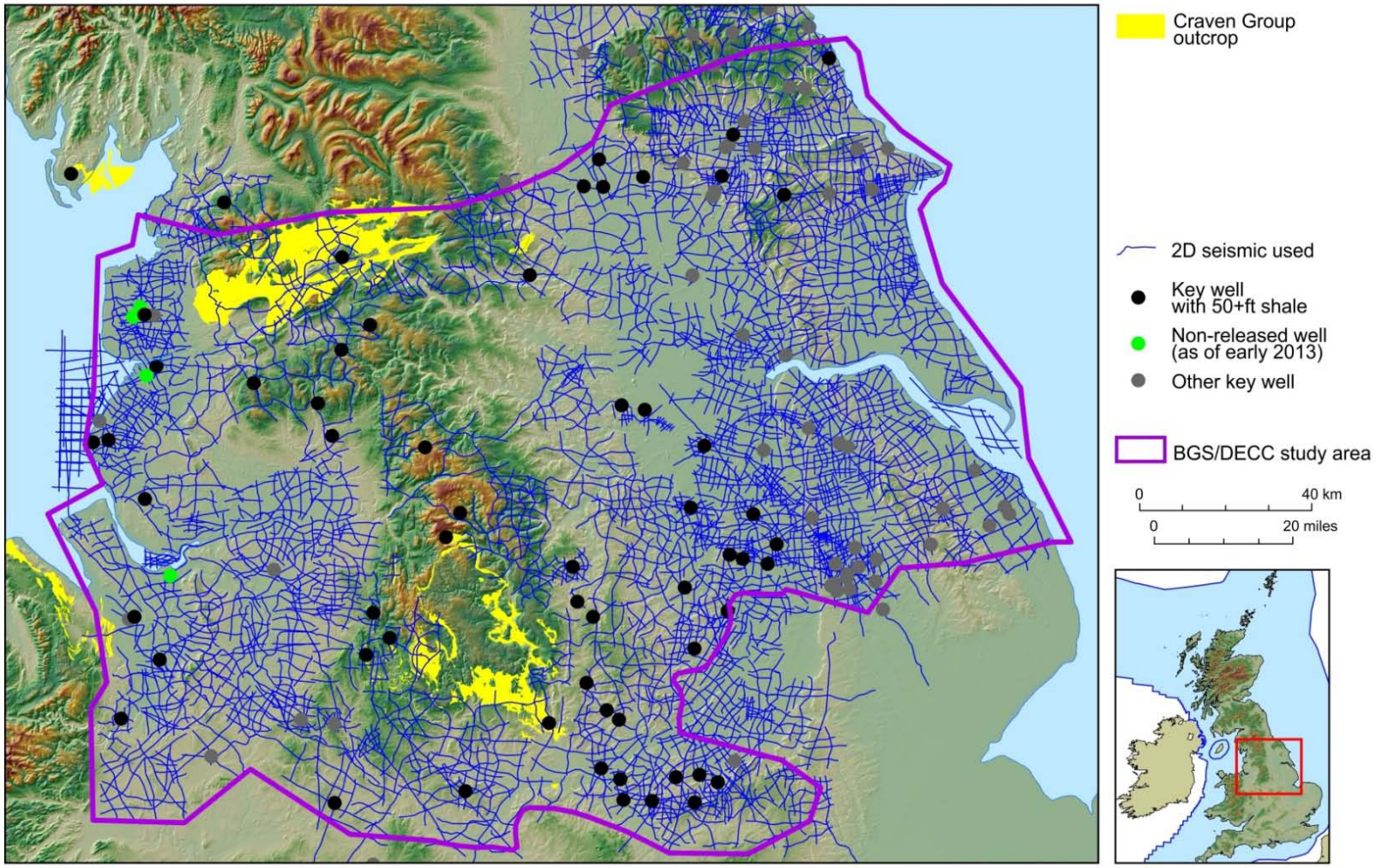

15,000 miles of 2D and 400 sq miles 3D from www.ukogl.org.uk

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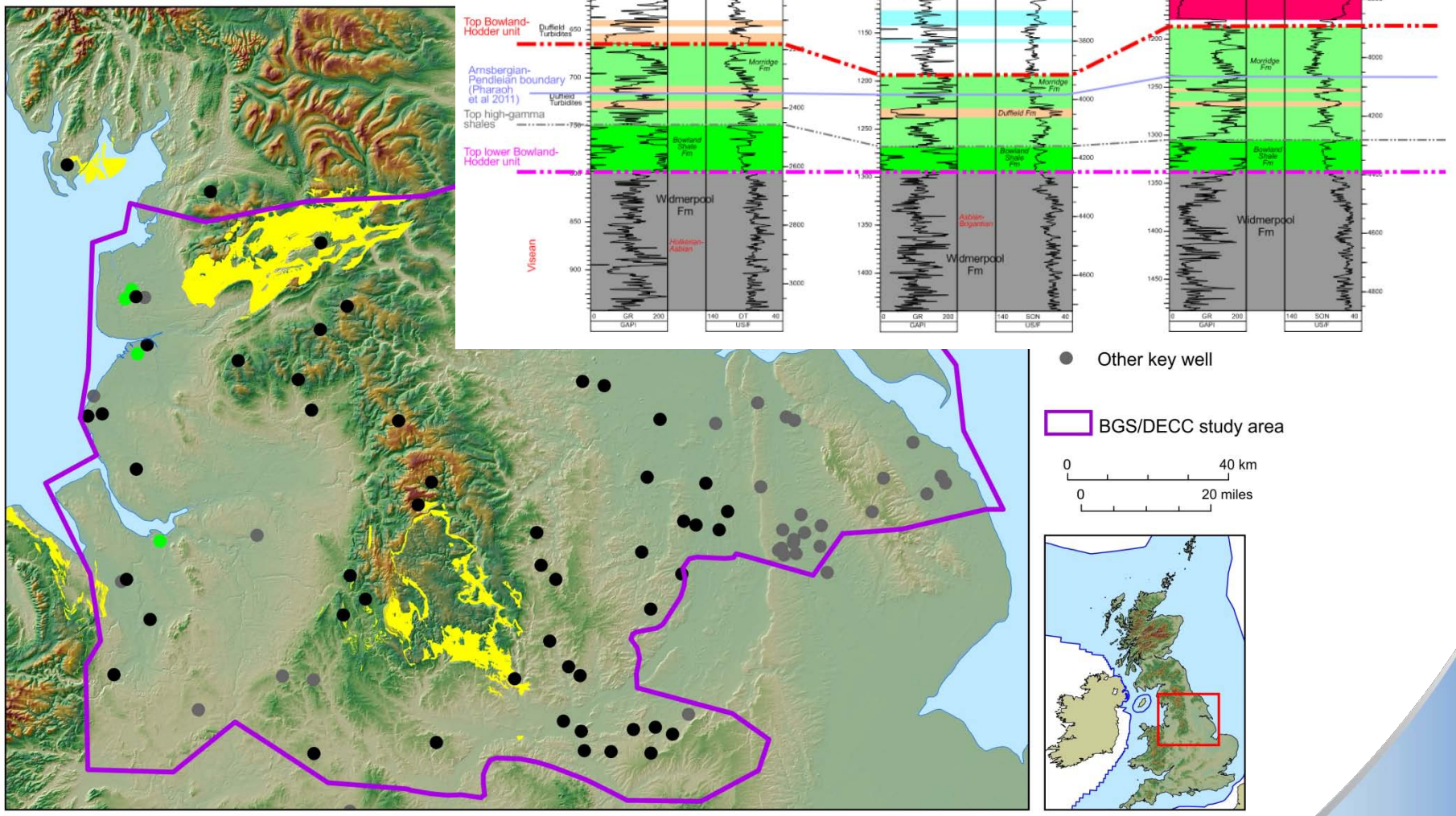
Data sources

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)

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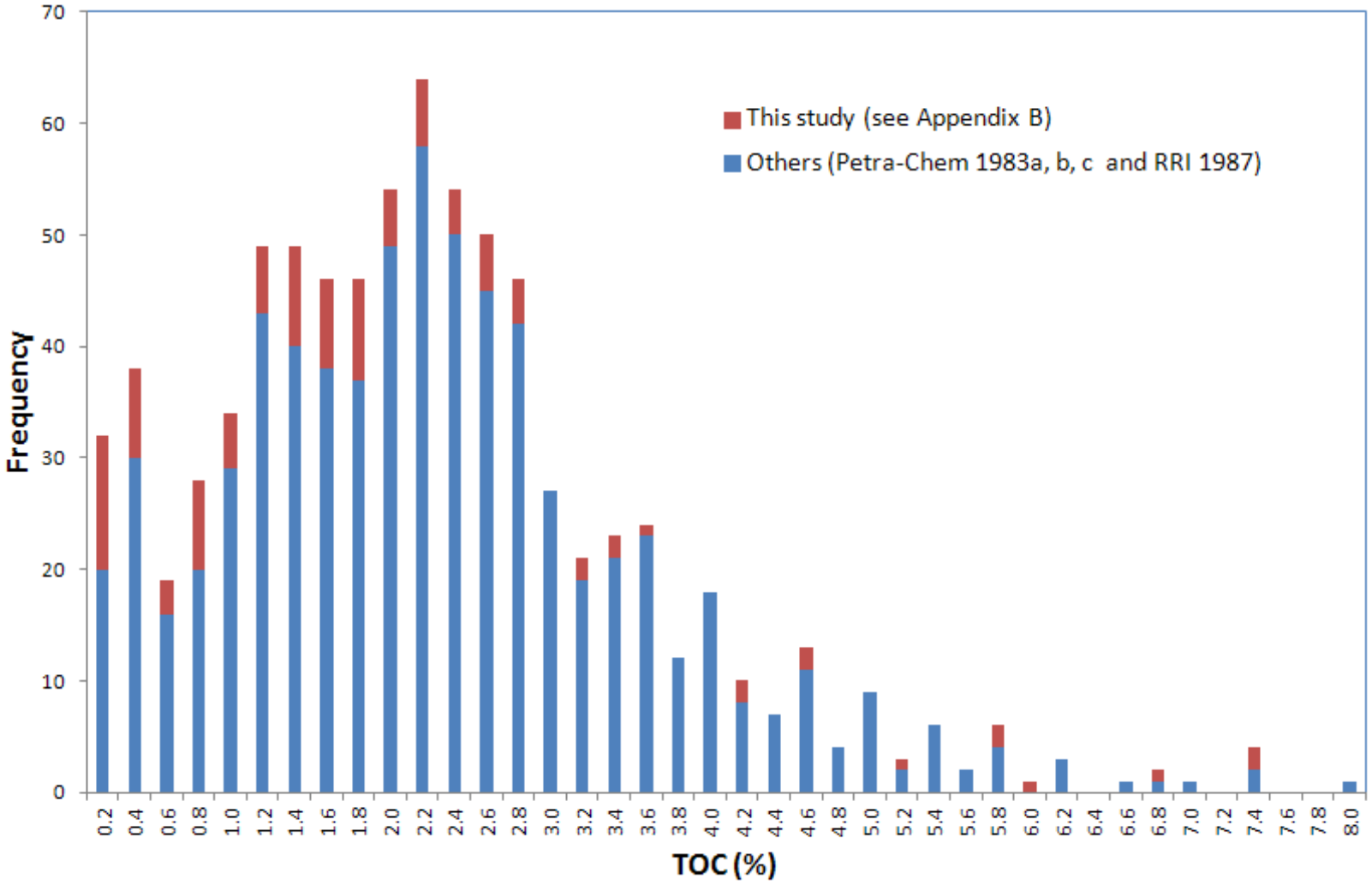

Barnett shale - up to 10%, average 3.7%

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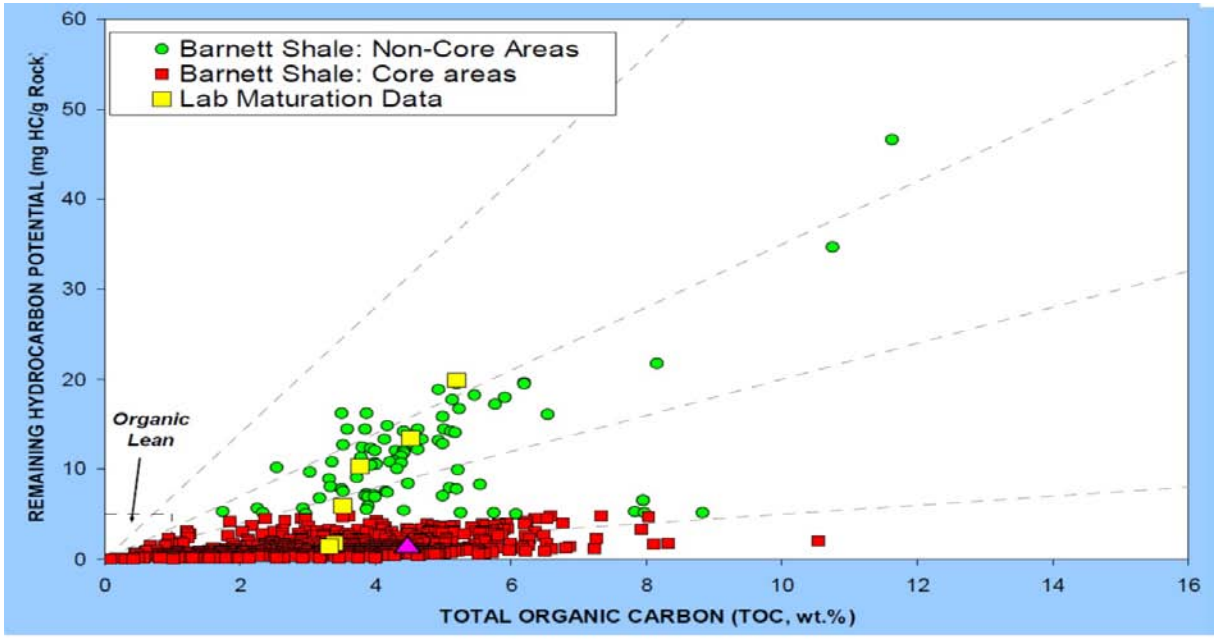

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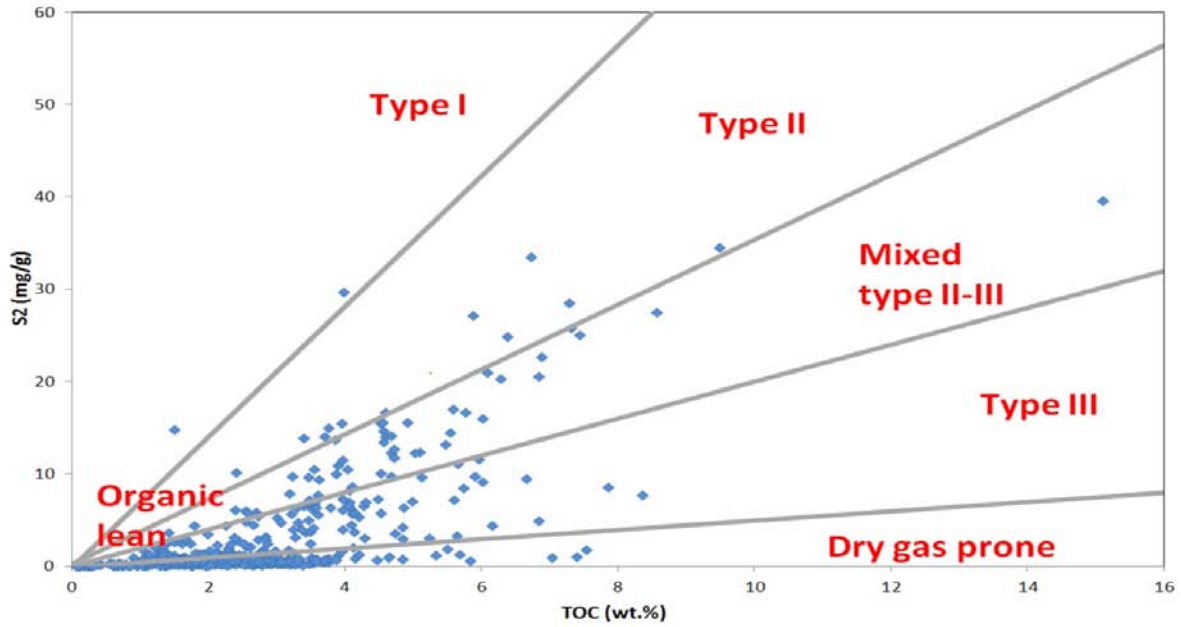
Comparison of Barnett Shale (Jarvie, 2008)



vs Bowland shale geochemical data.

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Depth to Top Bowland

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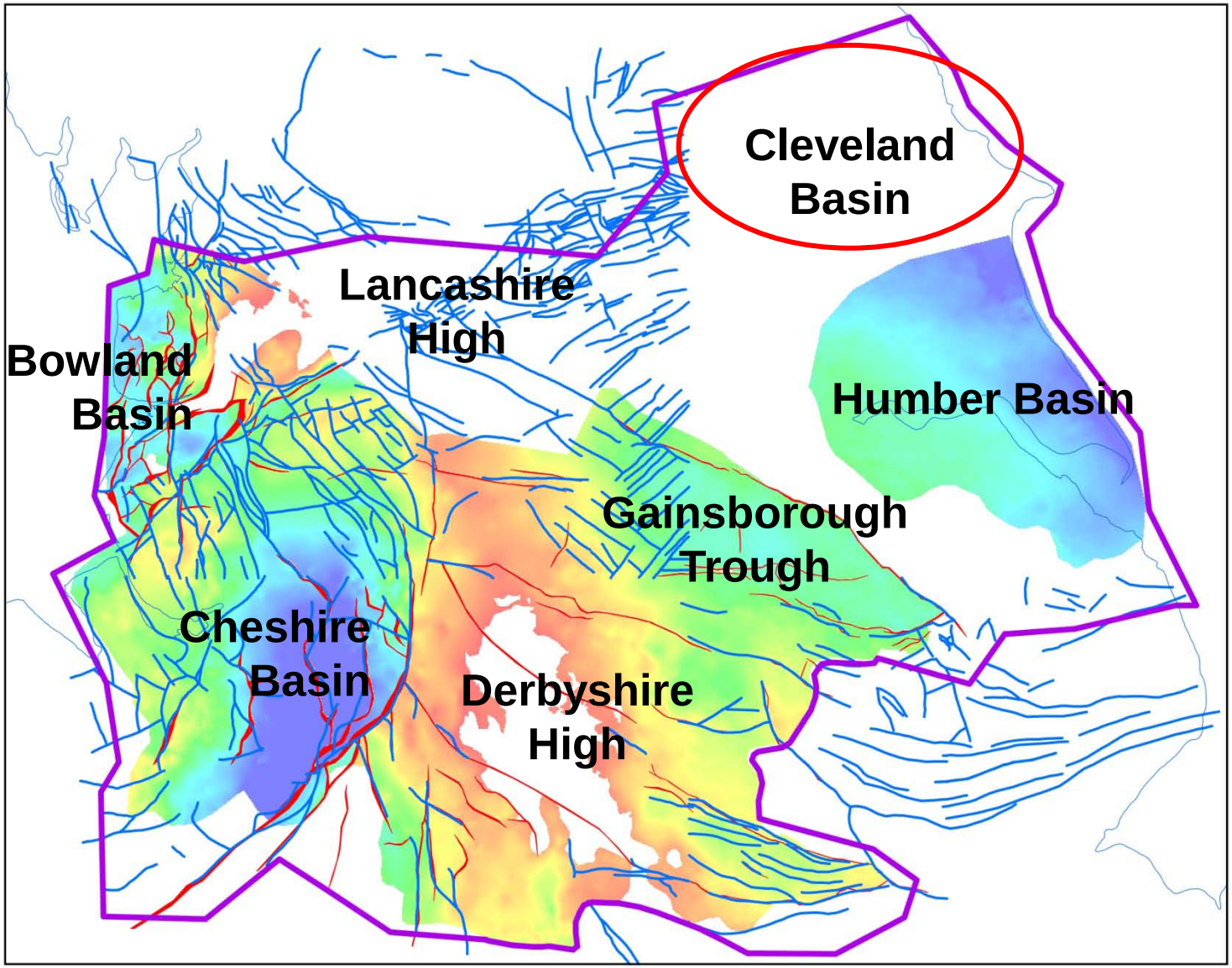
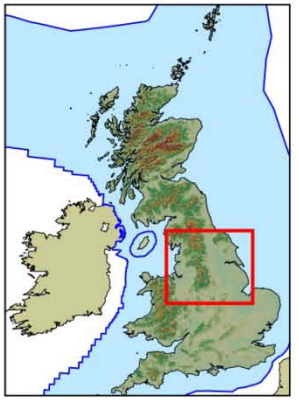


Top Dinantian faults (BGS subsurface memoirs)

Depth
Metres *(feet)*
Datum = sea level

-595 *(-1953)*

4753 *(15996)*



Thickness of Bowland-Hodder Unit

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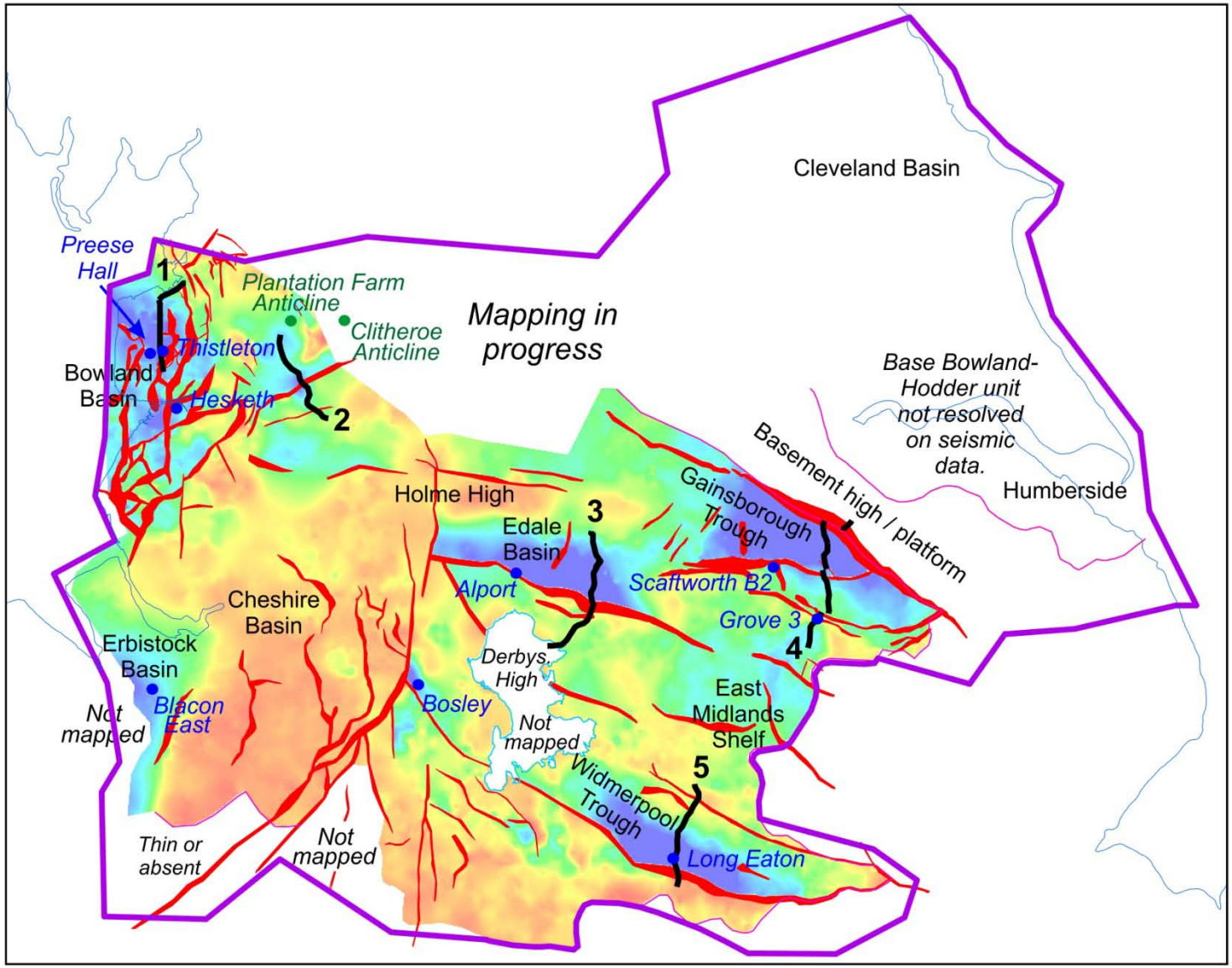
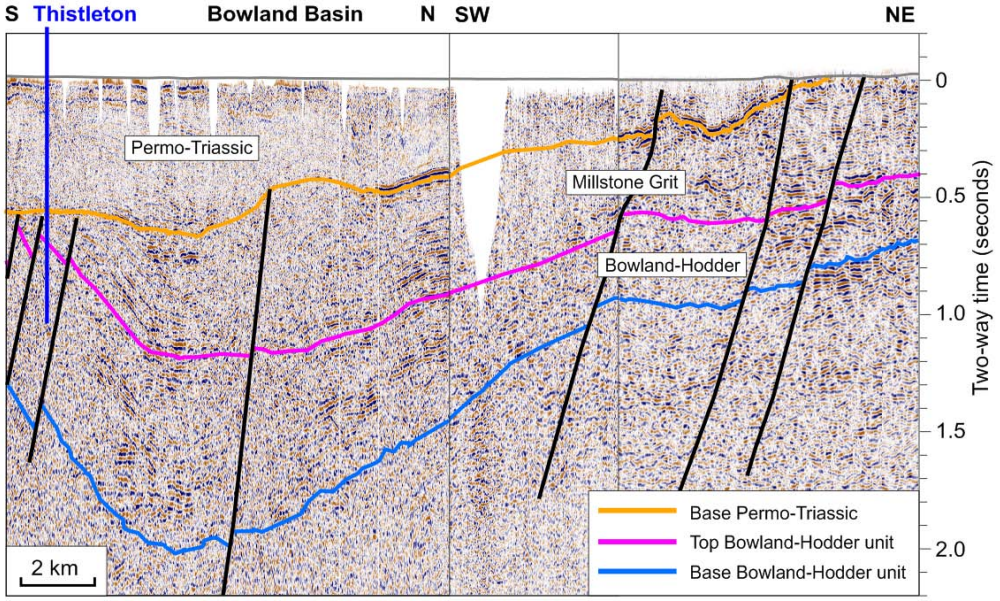
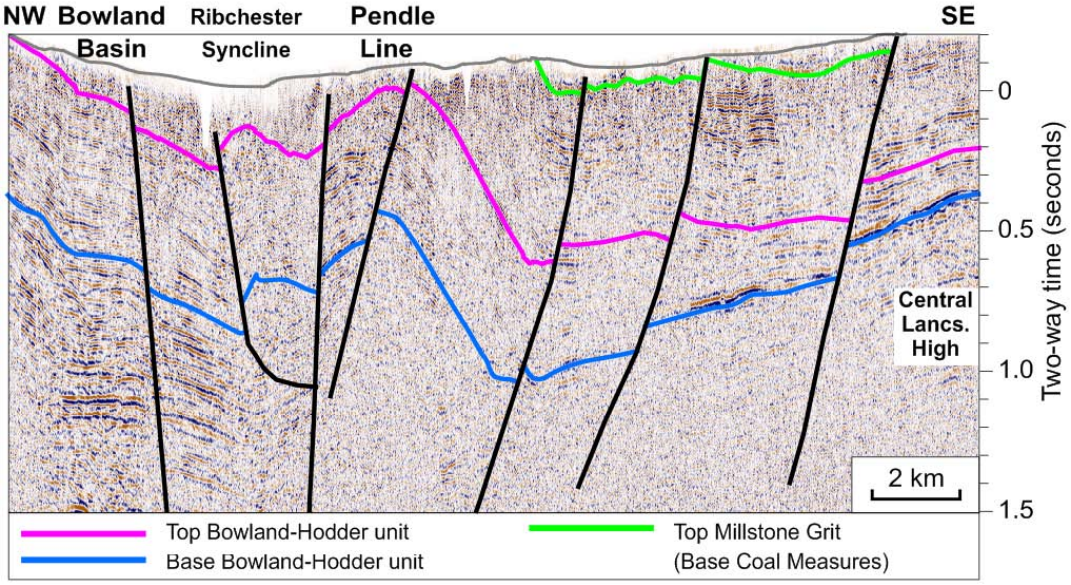


1 Northern Bowland Basin



2 Eastern Bowland Basin



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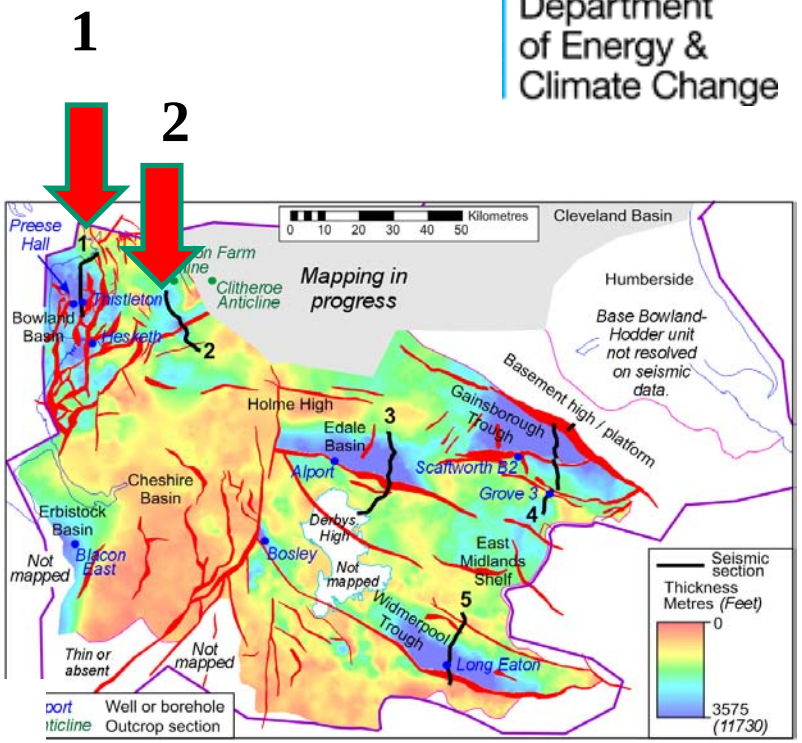
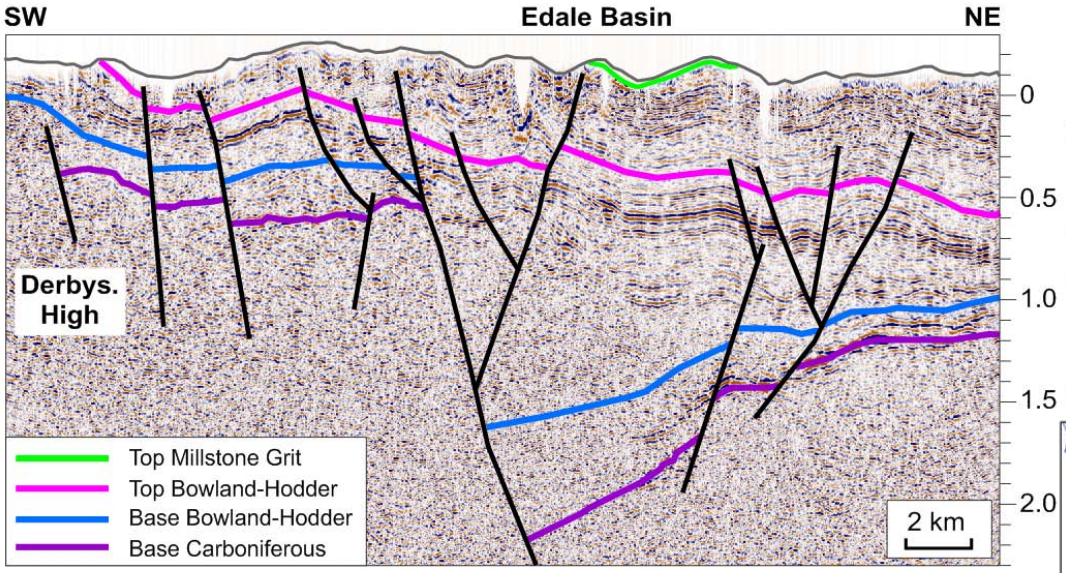


3 Edale Basin



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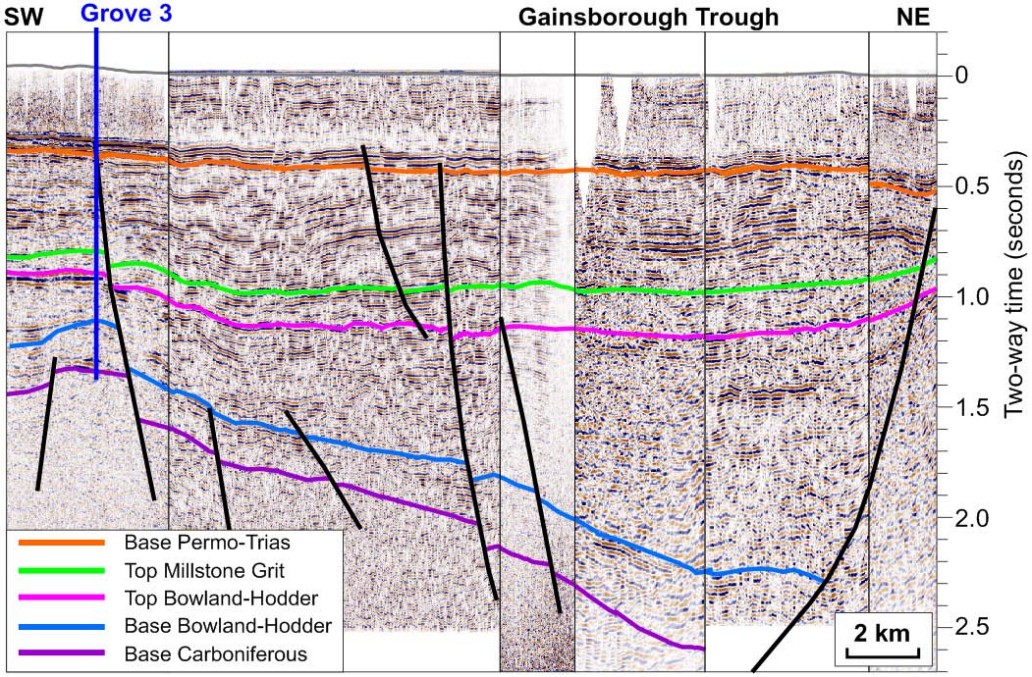
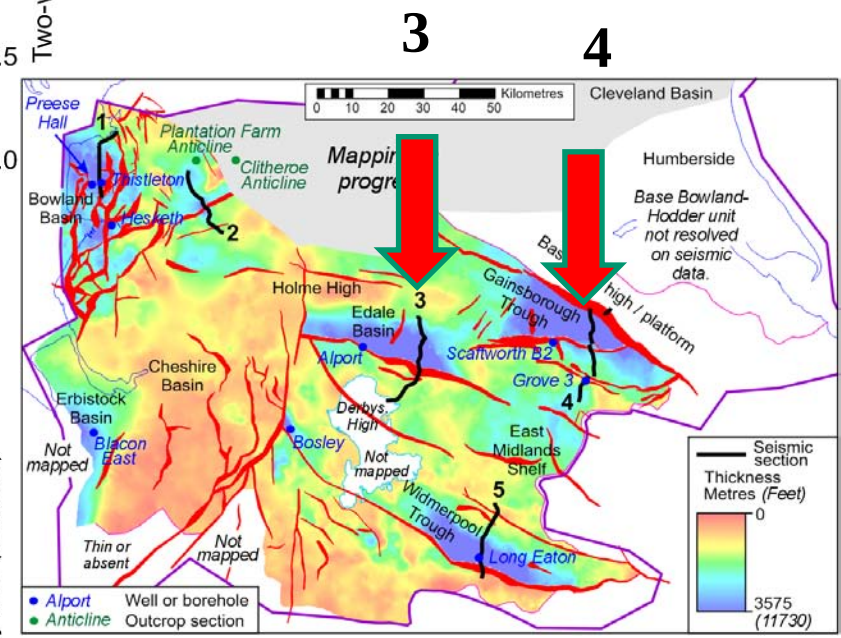
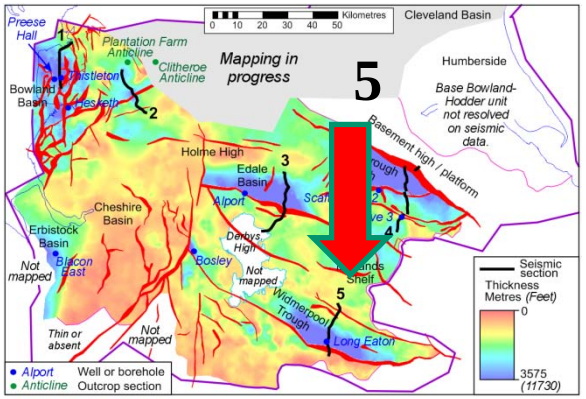
4 Gainsborough Trough

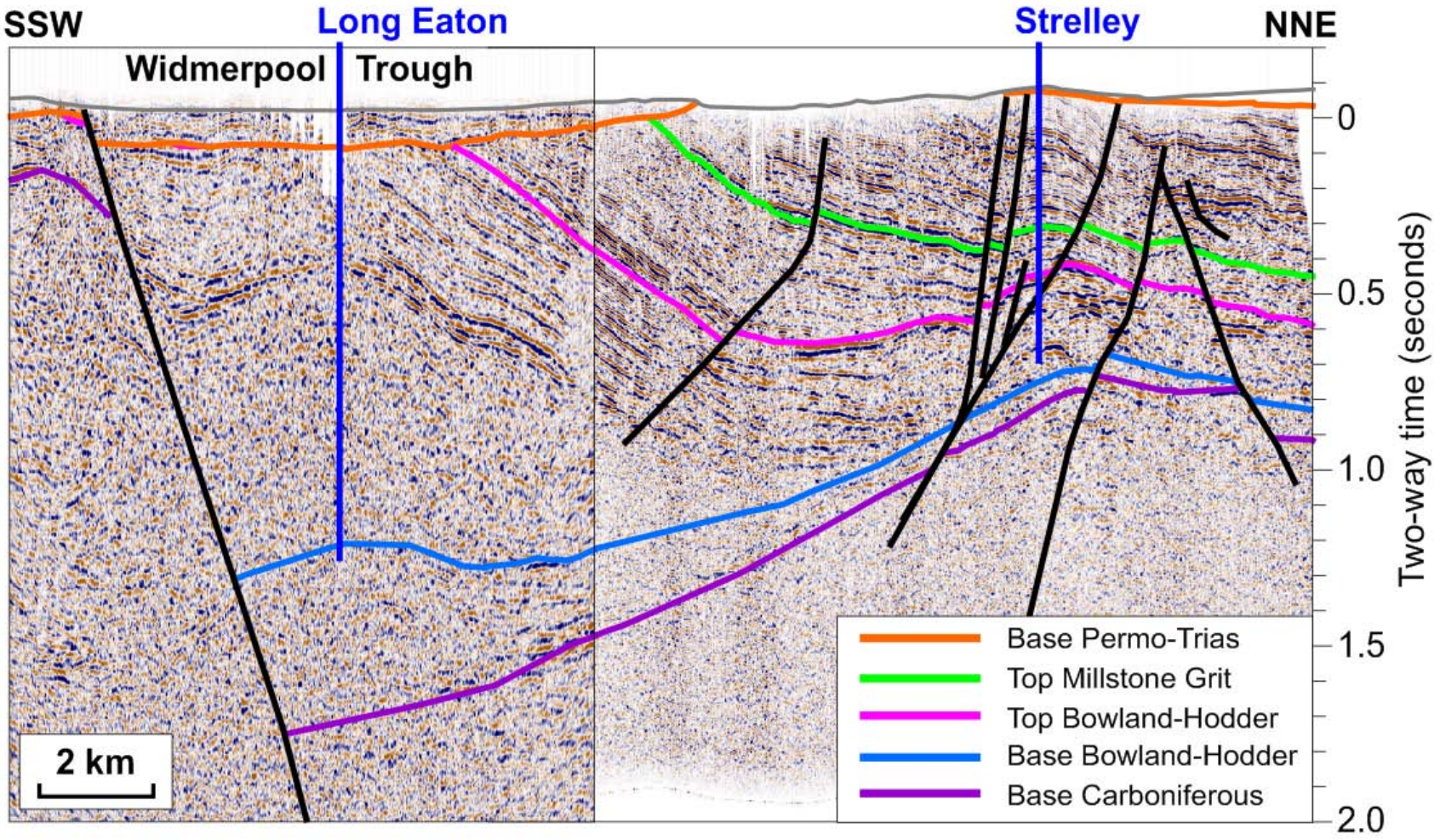




Inversion – Permo-Triassic on 8000 ft of Bowland-Hodder unit

5 Widmerpool Trough





North American Shale Gas Analogies

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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	Mississipian 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

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Early Carboniferous half graben model

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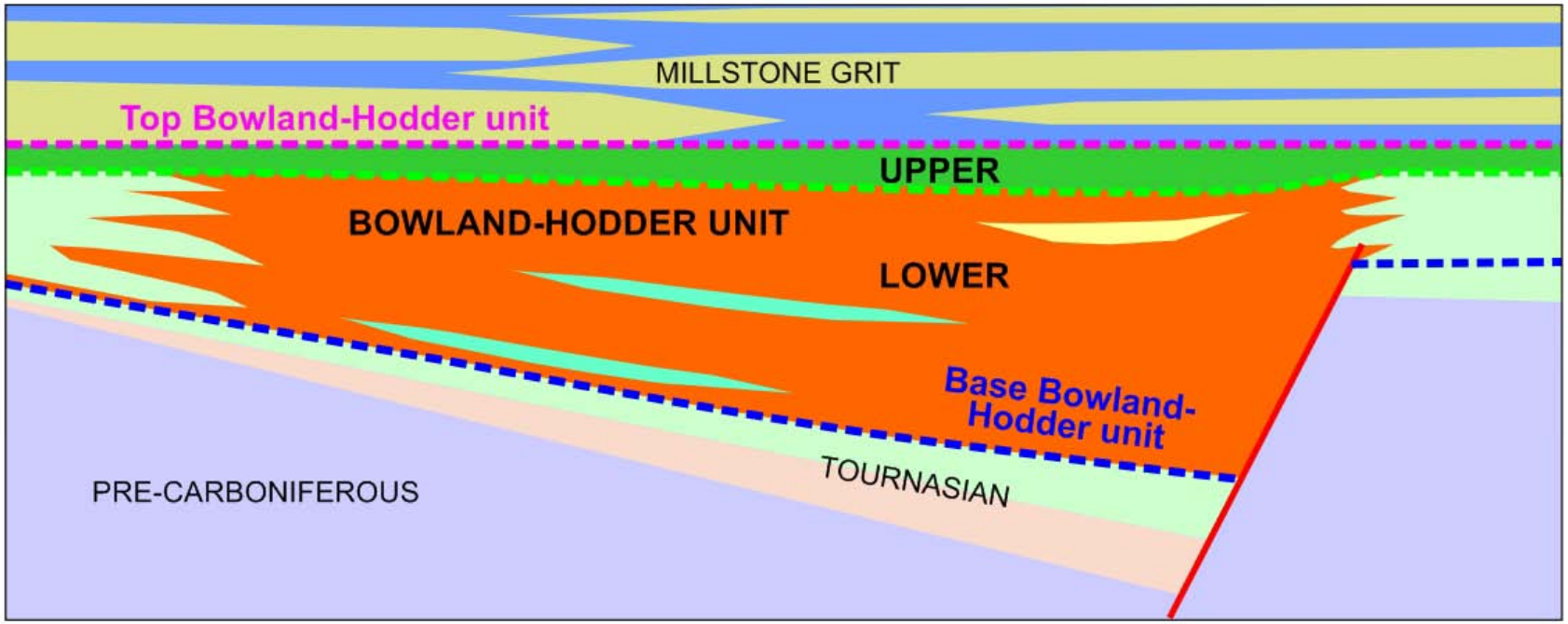

'Millstone Grit' lithofacies with hemipelagics

Platform/ramp carbonate lithofacies

Hemipelagic lithofacies (with mass-flow limestones and sandstones)

Continental and peritidal lithofacies

Base of upper unit

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Shale percentage (lower unit)

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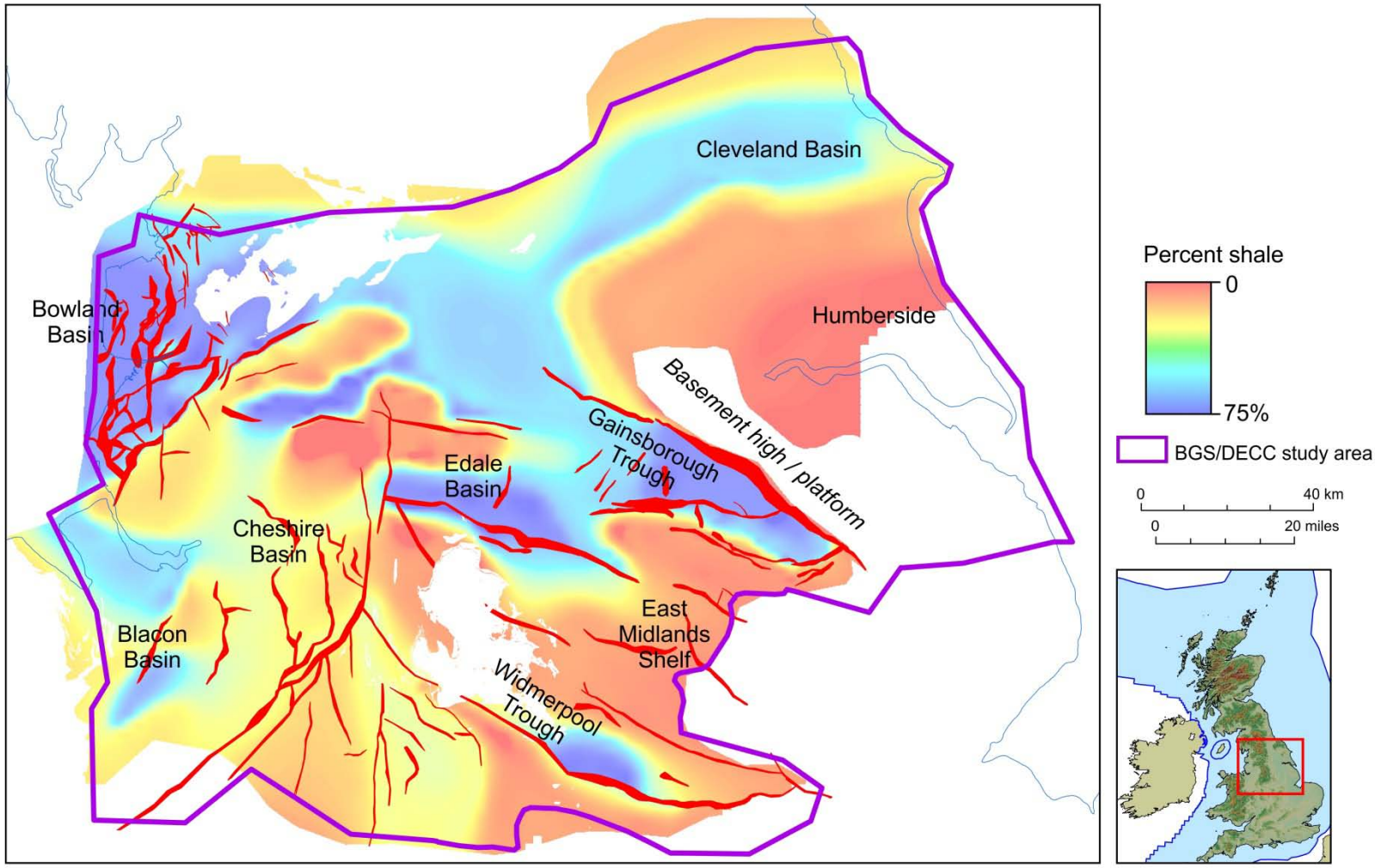

Onset of gas generation

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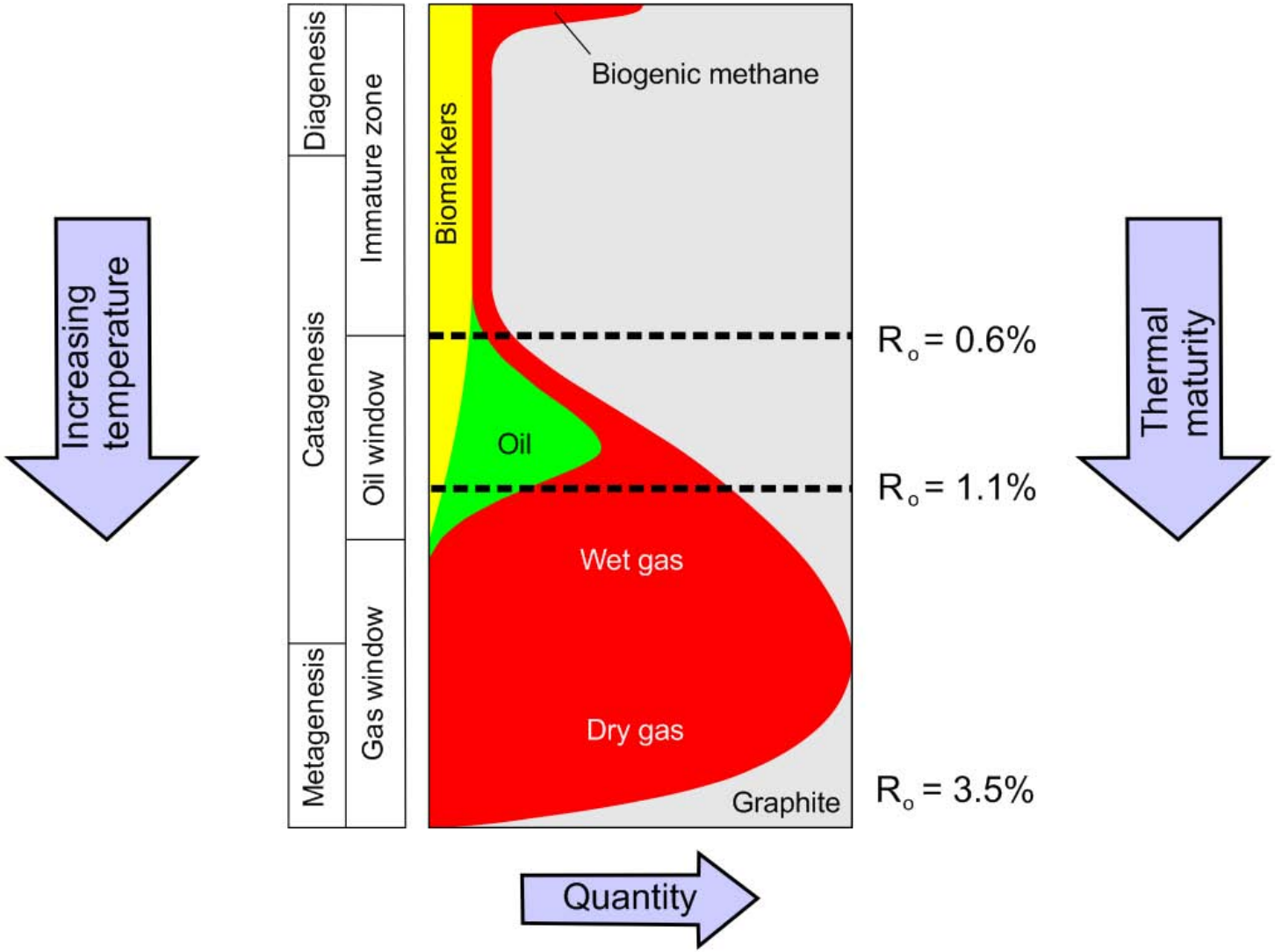

Maturity data

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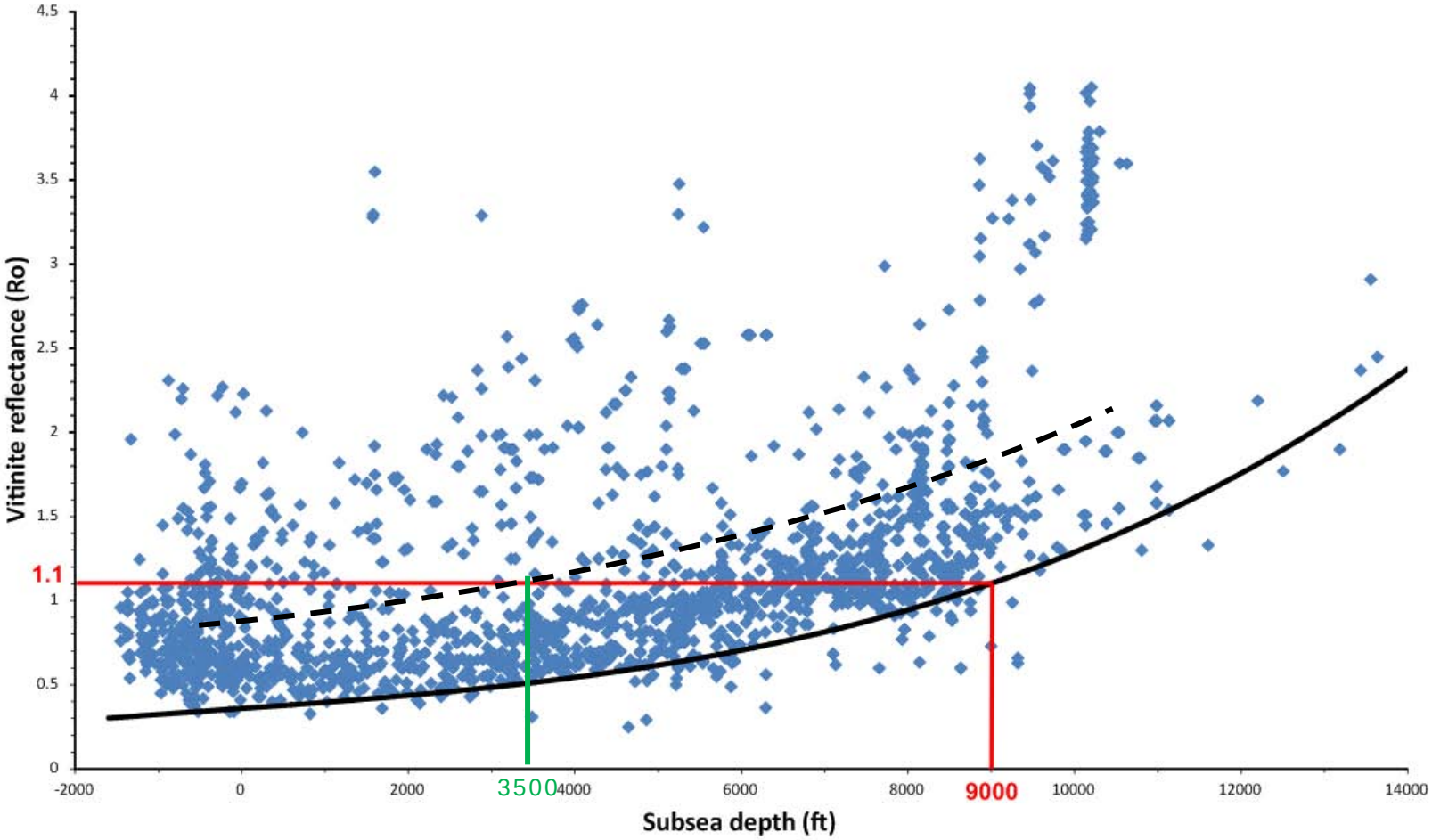

Maturity interpretation:depth to gas window

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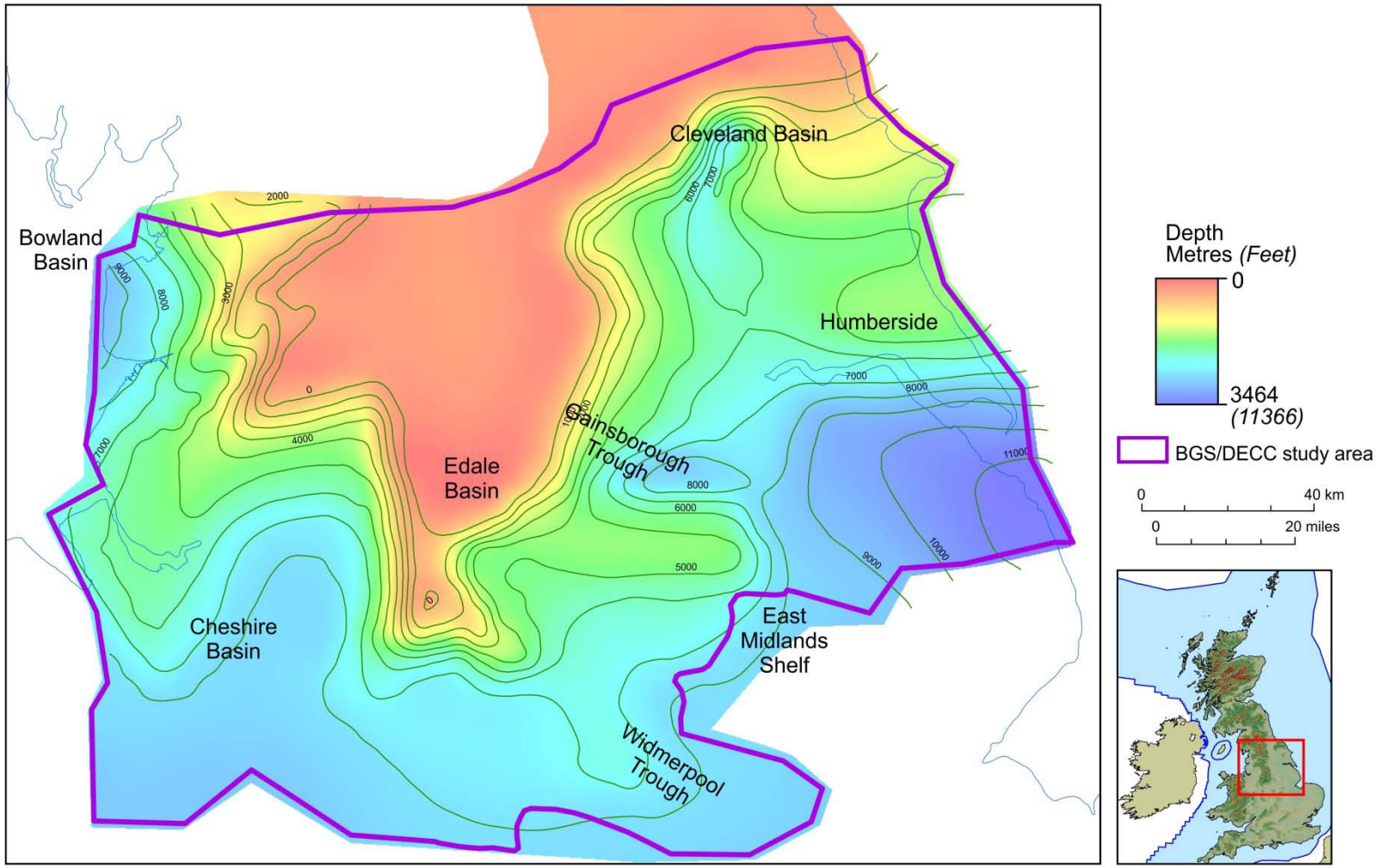

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Workflow

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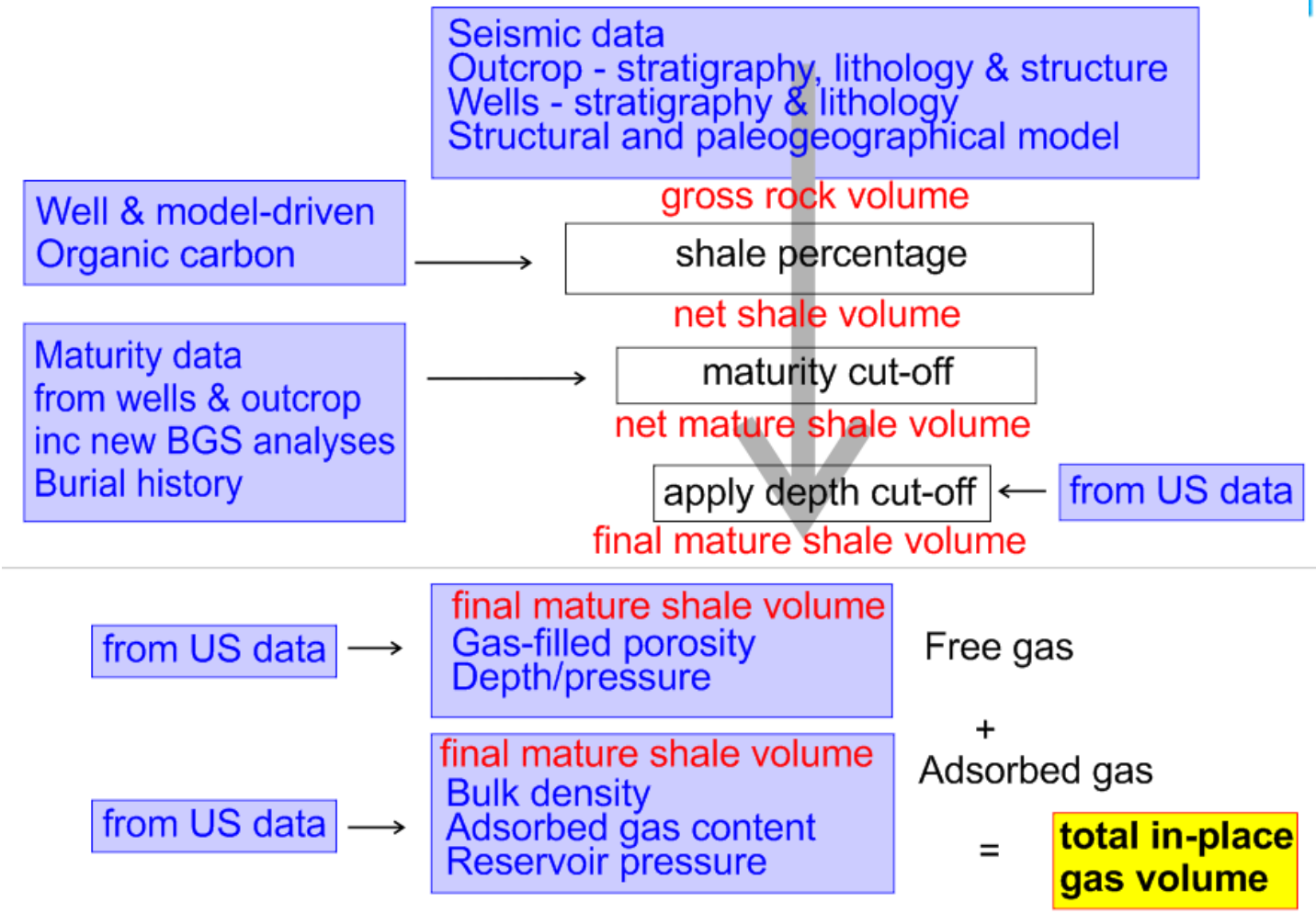

Factors determining the viability of natural gas developments (IEA 2011)

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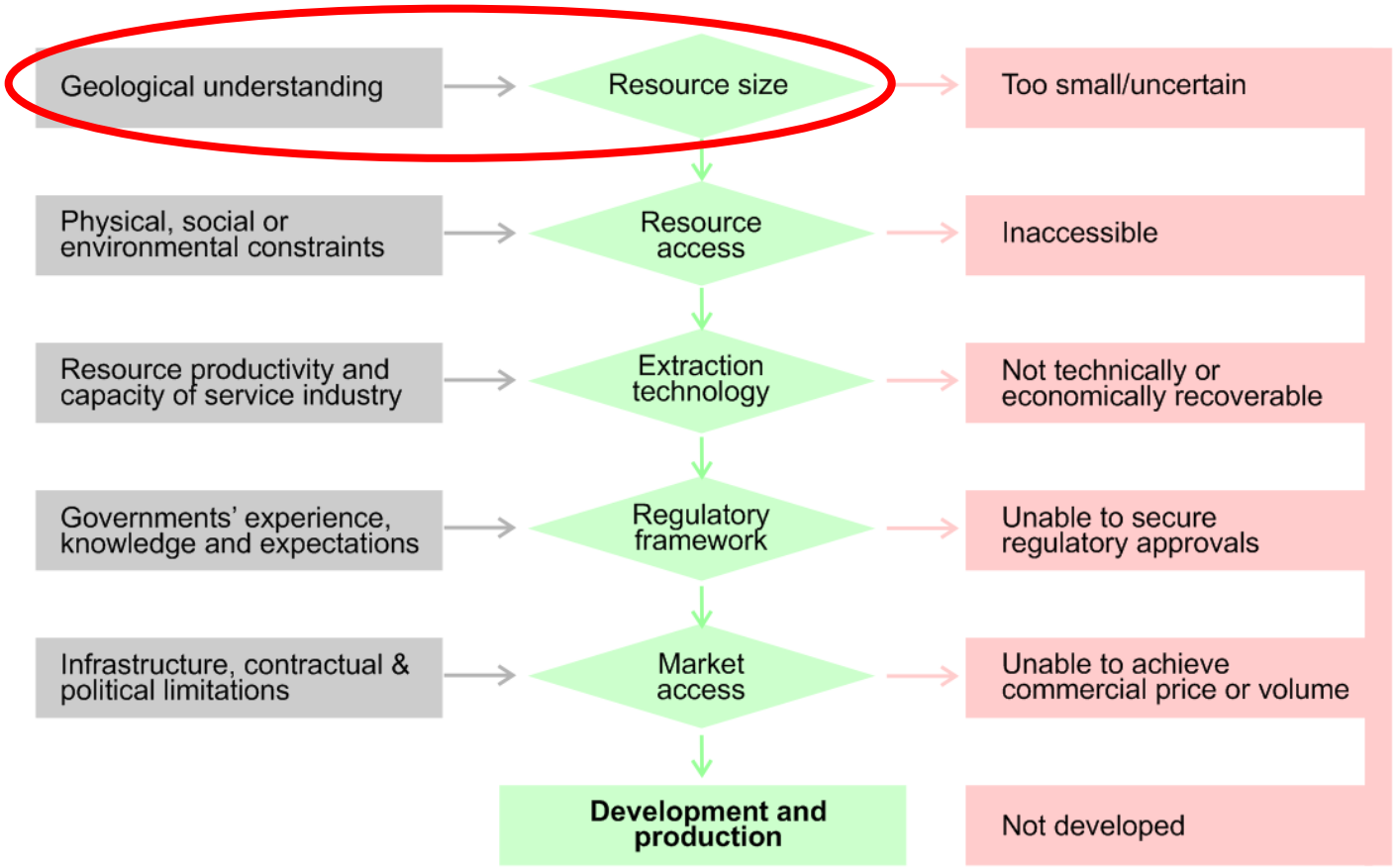

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In-place gas figure

…. will be announced by DECC later this summer

See press release or visit

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

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