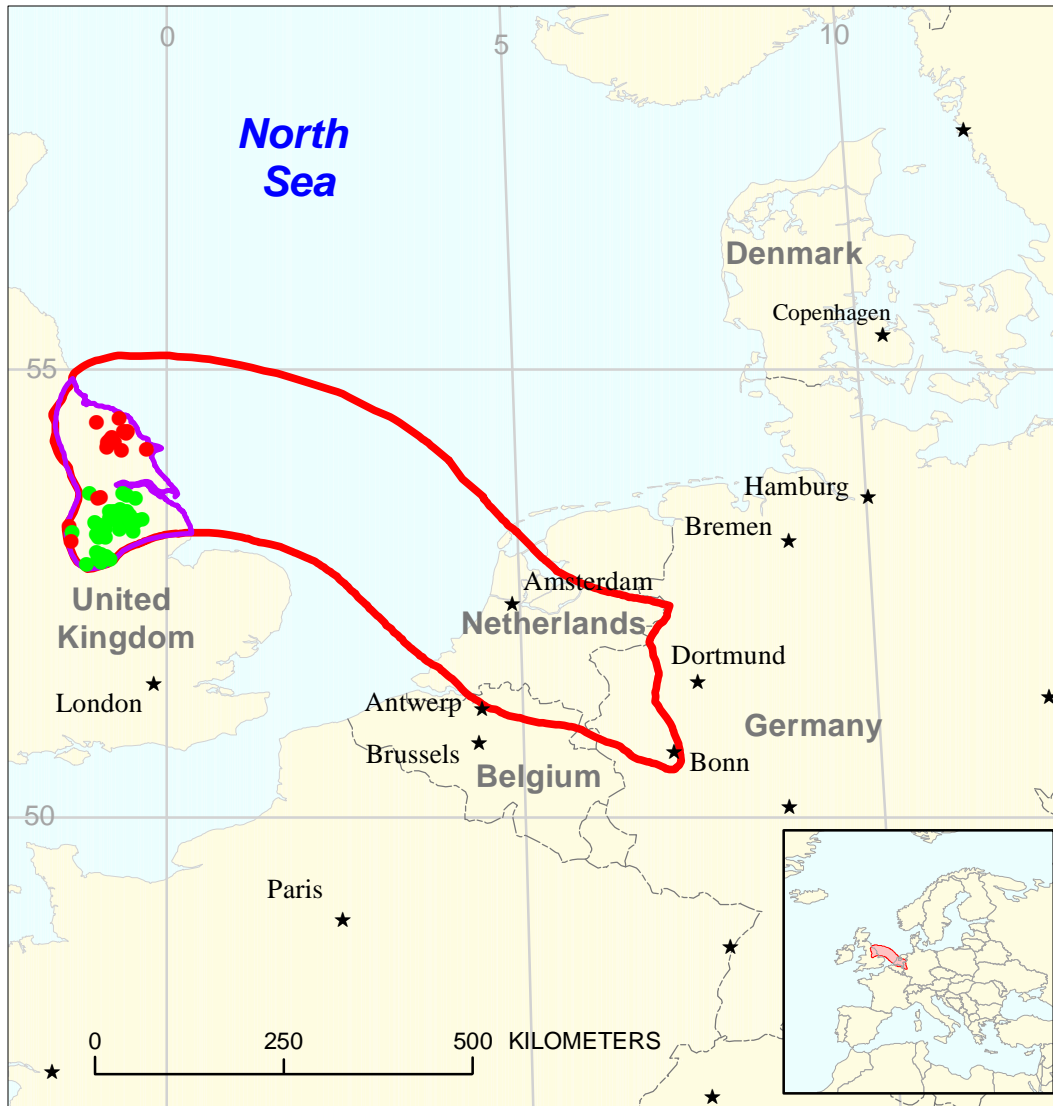


Southern Permian Basin-U.K. Onshore Assessment Unit 40360101



□ Southern Permian Basin-U.K. Onshore Assessment Unit 40360101

□ Anglo-Dutch Basin Geologic Province 4036

USGS PROVINCE: Anglo-Dutch Basin (4036)

GEOLOGIST: D.L. Gautier

TOTAL PETROLEUM SYSTEM: Carboniferous-Rotliegend (403601)

ASSESSMENT UNIT: Southern Permian Basin-UK Onshore (40360101)

DESCRIPTION: The total petroleum system and corresponding assessment unit coincide with the extent of thermally mature Carboniferous source rocks and related gas and oil accumulations in the onshore area of the southern Permian basin in the East Midlands of England.

SOURCE ROCKS: Source rocks include calcareous marine shales of Dinantian age, and deltaic shales, carbonaceous shales, and coals, mainly of Namurian and Westphalian (Carboniferous) age. Organic matter in these diverse source rocks ranges from small volumes of hydrogen-rich Type II kerogen related to marine deposition, to carbonaceous shales and coals of the deltaic sequences, which were deposited in the foreland north of the Variscan orogenic belt. The coals and carbonaceous shales constitute two distinct source rock components, with the coals containing approximately 60 percent TOC and Type III kerogen, whereas the carbonaceous shale have approximately 1 percent TOC and mixed Type II and Type III kerogen. Marine shales range from less than 1 to several percent TOC, mostly in Type II kerogen. Oil accumulations are directly related to the presence of pro-delta marine shales with Type II kerogen.

MATURATION: Source rocks became mature for oil and other liquids as early as the late Carboniferous in some areas. Distribution of fields in this well explored province depends critically on the burial depth of good quality Type II organic matter.

MIGRATION: Correlation of depth to thermal maturity of organic matter suggests relatively short distances of migration for preserved accumulations. Migration pathways are mainly along porous and permeable sandstones, as well as along fractures in fine-grained sedimentary rocks.

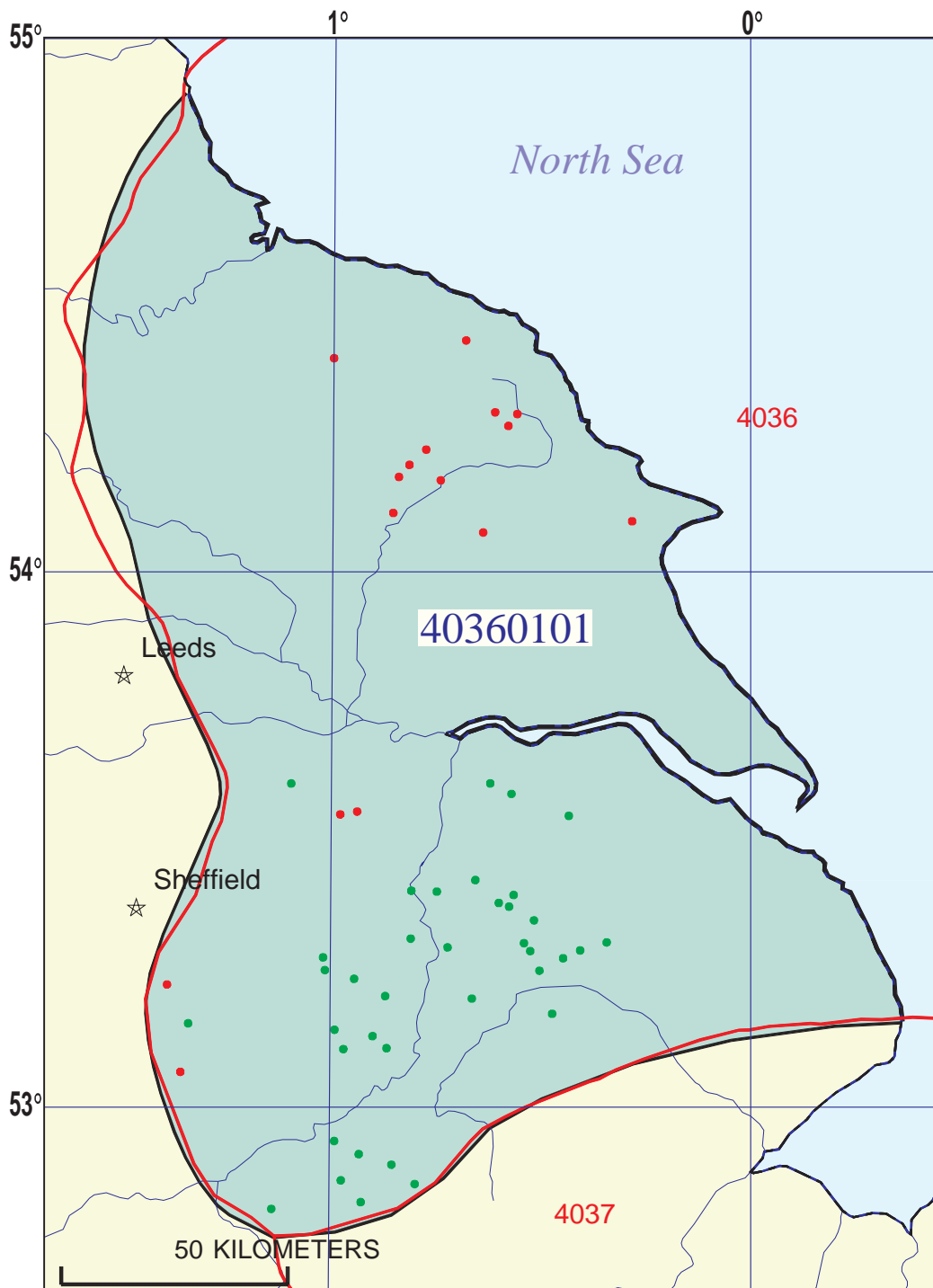
RESERVOIR ROCKS: Most reservoir rocks are of Carboniferous age. Reservoir rocks include the Old Red Sandstone, Waulsortian mounds and other carbonates of Dinantian age, deltaic sandstones, fluvial sandstones associated with the Coal Measures, and Permian red beds.

TRAPS AND SEALS: Local lithologic variations provide a variety of complex seals. Common seals include calcareous marine shales resting above deltaic sandstones, and lithologic variations within the sandstone/shale sequences of the Carboniferous delta.

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- Ziegler, P.A., 1978, North-western Europe–tectonics and basin development: *Geologie en Mijnbouw*, v. 57, p. 589-626.



Southern Permian Basin-U.K. Onshore Assessment Unit - 40360101

EXPLANATION

- Hydrography
- Shoreline
- 4036 Geologic province code and boundary
- Country boundary
- Gas field centerpoint
- Oil field centerpoint
- 40360101 — Assessment unit code and boundary

Projection: Robinson. Central meridian: 0

**SEVENTH APPROXIMATION
NEW MILLENNIUM WORLD PETROLEUM ASSESSMENT
DATA FORM FOR CONVENTIONAL ASSESSMENT UNITS**

Date:.....	<u>6/26/98</u>		
Assessment Geologist:.....	<u>D.L. Gautier</u>		
Region:.....	<u>Europe</u>	Number:	<u>4</u>
Province:.....	<u>Anglo-Dutch Basin</u>	Number:	<u>4036</u>
Priority or Boutique:.....	<u>Priority</u>		
Total Petroleum System:.....	<u>Carboniferous-Rotliegend</u>	Number:	<u>403601</u>
Assessment Unit:.....	<u>Southern Permian Basin-U.K. Onshore</u>	Number:	<u>40360101</u>
* Notes from Assessor			

CHARACTERISTICS OF ASSESSMENT UNIT

Oil (<20,000 cfg/bo overall) or Gas (\geq 20,000 cfg/bo overall):... Oil

What is the minimum field size?..... 1 mmboe grown (\geq 1mmboe)
(the smallest field that has potential to be added to reserves in the next 30 years)

Number of discovered fields exceeding minimum size:.....	Oil:	<u>13</u>	Gas:	<u>6</u>
Established (>13 fields) <u>X</u>	Frontier (1-13 fields)		Hypothetical (no fields)	

Median size (grown) of discovered oil fields (mmboe):			
	1st 3rd <u>6</u>	2nd 3rd <u>2.2</u>	3rd 3rd
Median size (grown) of discovered gas fields (bcfg):			
	1st 3rd <u>11</u>	2nd 3rd <u>7</u>	3rd 3rd

Assessment-Unit Probabilities:

<u>Attribute</u>	<u>Probability of occurrence (0-1.0)</u>
1. CHARGE: Adequate petroleum charge for an undiscovered field \geq minimum size.....	<u>1.0</u>
2. ROCKS: Adequate reservoirs, traps, and seals for an undiscovered field \geq minimum size.....	<u>1.0</u>
3. TIMING OF GEOLOGIC EVENTS: Favorable timing for an undiscovered field \geq minimum size	<u>1.0</u>

Assessment-Unit GEOLOGIC Probability (Product of 1, 2, and 3):..... 1.0

4. ACCESSIBILITY: Adequate location to allow exploration for an undiscovered field \geq minimum size.....	<u>1.0</u>
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UNDISCOVERED FIELDS

Number of Undiscovered Fields: How many undiscovered fields exist that are \geq minimum size?:
(uncertainty of fixed but unknown values)

Oil fields:.....min. no. (>0)	<u>1</u>	median no.	<u>3</u>	max no.	<u>7</u>
Gas fields:.....min. no. (>0)	<u>1</u>	median no.	<u>2</u>	max no.	<u>4</u>

Size of Undiscovered Fields: What are the anticipated sizes (**grown**) of the above fields?:
(variations in the sizes of undiscovered fields)

Oil in oil fields (mmbo).....min. size	<u>1</u>	median size	<u>2</u>	max. size	<u>8</u>
Gas in gas fields (bcfg):.....min. size	<u>6</u>	median size	<u>10</u>	max. size	<u>30</u>

AVERAGE RATIOS FOR UNDISCOVERED FIELDS, TO ASSESS COPRODUCTS

(uncertainty of fixed but unknown values)

<u>Oil Fields:</u>	minimum	median	maximum
Gas/oil ratio (cfg/bo).....	600	1200	1800
NGL/gas ratio (bnl/mmcf).....	30	60	90
<u>Gas fields:</u>	minimum	median	maximum
Liquids/gas ratio (bnl/mmcf).....	22	44	66
Oil/gas ratio (bo/mmcf).....			

SELECTED ANCILLARY DATA FOR UNDISCOVERED FIELDS

(variations in the properties of undiscovered fields)

<u>Oil Fields:</u>	minimum	median	maximum
API gravity (degrees).....	20	35	50
Sulfur content of oil (%).....			
Drilling Depth (m)			
Depth (m) of water (if applicable).....			
<u>Gas Fields:</u>	minimum	median	maximum
Inert gas content (%).....			
CO ₂ content (%).....			
Hydrogen-sulfide content (%).....			
Drilling Depth (m).....			
Depth (m) of water (if applicable).....			

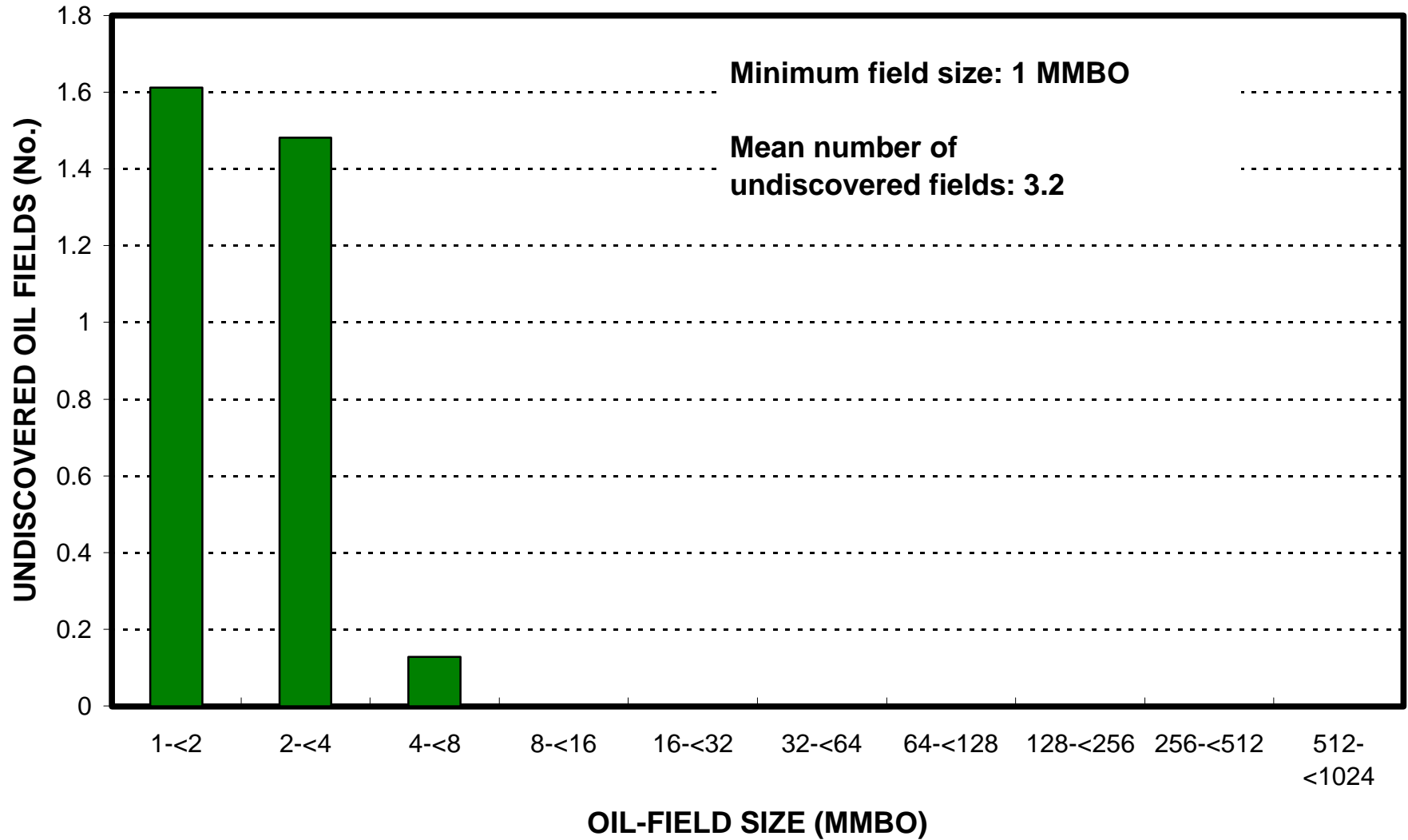
**ALLOCATION OF UNDISCOVERED RESOURCES IN THE ASSESSMENT UNIT
 TO COUNTRIES OR OTHER LAND PARCELS** (uncertainty of fixed but unknown values)

1. United Kingdom represents 100 areal % of the total assessment unit

<u>Oil in Oil Fields:</u>	minimum	median	maximum
Richness factor (unitless multiplier):.....	_____	_____	_____
Volume % in parcel (areal % x richness factor):...	_____	100	_____
Portion of volume % that is offshore (0-100%).....	_____	0	_____
 <u>Gas in Gas Fields:</u>	 minimum	 median	 maximum
Richness factor (unitless multiplier):.....	_____	_____	_____
Volume % in parcel (areal % x richness factor):...	_____	100	_____
Portion of volume % that is offshore (0-100%).....	_____	0	_____

Southern Permian Basin-U.K. Onshore, AU 40360101

Undiscovered Field-Size Distribution



Southern Permian Basin-Europe Onshore, AU 40360102

Undiscovered Field-Size Distribution

