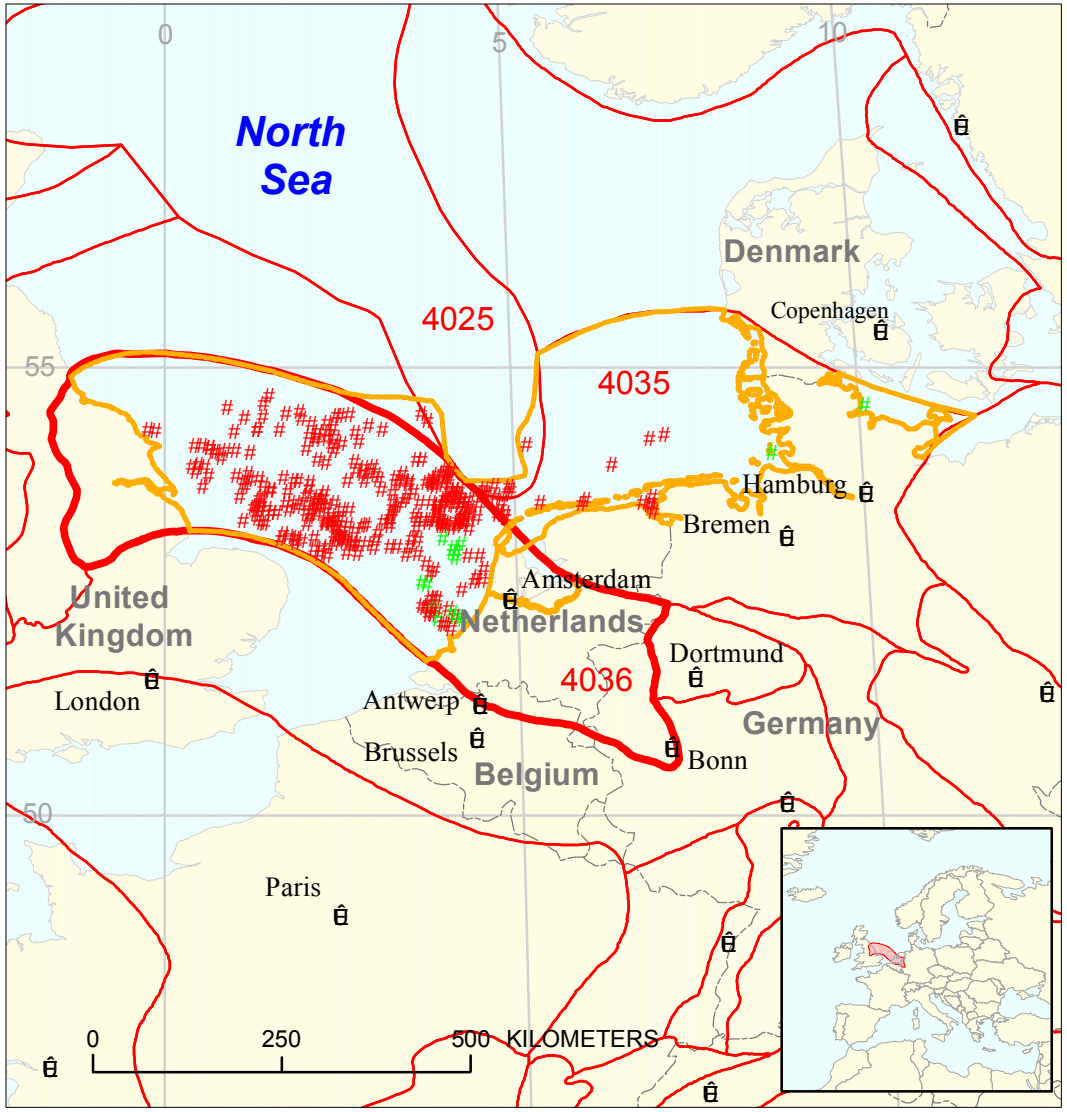
Southern Permian Basin-Offshore
Assessment Unit 40360103



Sourthern Permian Basin-Offshore 40360103

Anglo-Dutch Basin Geologic Province 4036

Other geologic province boundary

USGS PROVINCE: Anglo-Dutch Basin (4036) **GEOLOGIST:** D.L. Gautier

TOTAL PETROLEUM SYSTEM: Carboniferous-Rotliegend (403601)

ASSESSMENT UNIT: Southern Permian Basin-Offshore (40360103)

DESCRIPTION: The total petroleum system and corresponding assessment unit coincide with the extent of thermally mature Westphalian (coal measure) source rocks and related gas and liquid accumulations in the offshore area of the southern North Sea between England and the European continent. The total petroleum system is bounded on the south by the London Brabant Platform and on the North by the mid North Sea high.

SOURCE ROCKS: Coals and carbonaceous shales, mainly of Westphalian and Stephanian (Upper Carboniferous) age, were deposited in the foreland north of the Variscan orogenic belt. The organic matter in the coal measures consists mainly of Type III terrigenous kerogen, although Type II kerogen is also present. 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.

MATURATION: Source rocks became mature for oil and other liquids as early as Triassic time in some areas and for natural gas by early Jurassic time. Principal gas generation occurred in late Jurassic and Late Cretaceous time. In some areas gas generation has probably continued to the present.

MIGRATION: Initial gas migration probably accompanied earliest generation, and has continued to the present. Migration pathways are mainly along porous and permeable sandstones, as well as fractures in fine-grained sedimentary rocks.

RESERVOIR ROCKS: Best reservoir rocks in the southern North Sea are in the Rotliegend, particularly in eolian sandstone facies of several types. The entire Rotliegend contains reservoir intervals, but eolian dunes generally provide the highest quality reservoirs. Other Rotliegend reservoir facies include sheet flood and fluvial sandstones and relatively coarse grained fluvial channel deposits. Reservoir quality in the Rotliegend is strongly influenced by both depositional facies and by diagenetic processes, particularly precipitation of authigenic illite. In addition to the Rotliegendes, reservoir quality rocks are included in the Carboniferous fluvial channels, and in the Zechstein and Lower Cretaceous sequences.

TRAPS AND SEALS: Excellent regional seals are provided by evaporite and carbonate rocks of the Zechstein. Local lithologic variations provide stratigraphically heterogeneous distributions of gas accumulations.

REFERENCES:

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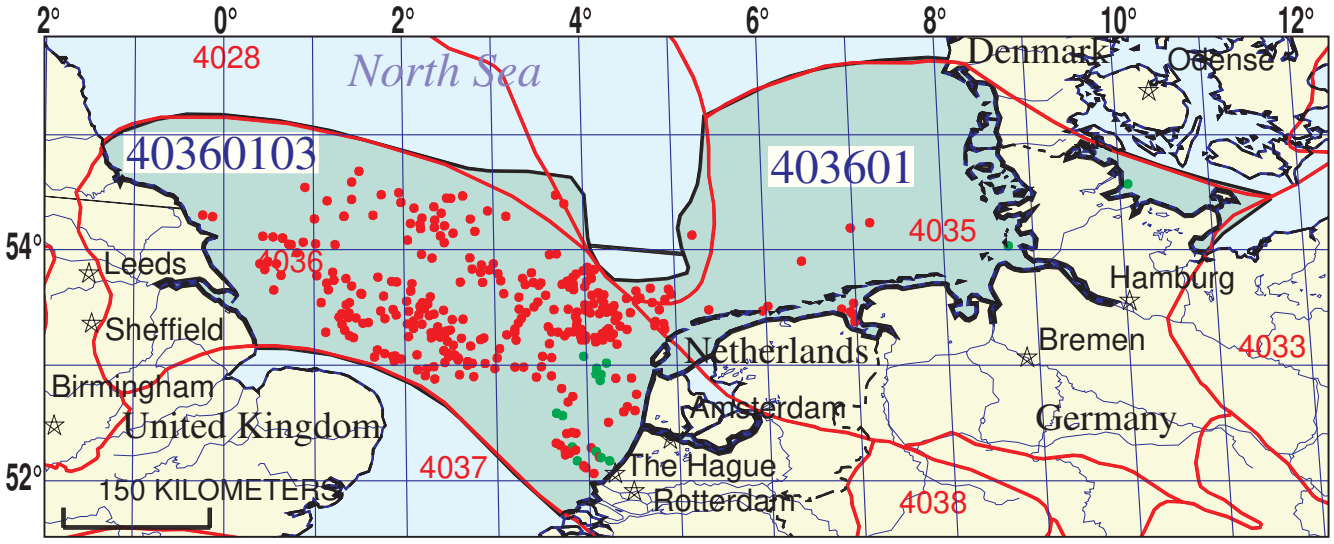
Glennie, K.W., and Provan, D.M.J., 1990, Lower Permian Rotliegend reservoir of the Southern North sea province, *in* J. Brooks, ed, Classic Petroleum Provinces: London, Geological Society, p. 399-416.

Cornford, C., 1986, Source rocks and hydrocarbons of the North Sea, in Glennie, K.W., ed., Introduction to the Petroleum Geology of the North Sea, London, Blackwell, p. 197-236.



Southern Permian Basin-Offshore Assessment Unit - 40360103

EXPLANATION

- Hydrography
- Shoreline
- 4036 Geologic province code and boundary
- Country boundary
- Gas field centerpoint
- Oil field centerpoint
- 40360103 Assessment unit code and boundary

Projection: Robinson. Central meridian: 0

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

Date:……..	6/26/98		
Assessment Geologist:……..	D.L. Gautier		
Region:……..	Europe	Number:	4
Province:……	Anglo-Dutch Basin	Number:	4036
Priority or Boutique……	Priority		
Total Petroleum System:……	Carboniferous-Rotliegend	Number:	403601
Assessment Unit:……	Southern Permian Basin-Offshore	Number:	40360103
* Notes from Assessor			

CHARACTERISTICS OF ASSESSMENT UNIT

Oil (<20,000 cfg/bo overall) **or** Gas (≥20,000 cfg/bo overall):… Gas

What is the minimum field size?……. 4 mmboe grown (≥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: 15 Gas: 300
Established (>13 fields) X Frontier (1-13 fields) _____ Hypothetical (no fields) _____

Median size (grown) of discovered oil fields (mmboe):
1st 3rd 25 2nd 3rd 30 3rd 3rd 6
Median size (grown) of discovered gas fields (bcfg):
1st 3rd 153 2nd 3rd 75 3rd 3rd 74
*Growth of known fields (median)~=18000 bcf

Assessment-Unit Probabilities:

Attribute	Probability of occurrence (0-1.0)
1. **CHARGE:** Adequate petroleum charge for an undiscovered field ≥ minimum size……	1.0
2. **ROCKS:** Adequate reservoirs, traps, and seals for an undiscovered field ≥ minimum size……	1.0
3. **TIMING OF GEOLOGIC EVENTS:** Favorable timing for an undiscovered field ≥ minimum size	1.0
Assessment-Unit GEOLOGIC Probability (Product of 1, 2, and 3):……..……...….	1.0
4. **ACCESSIBILITY:** Adequate location to allow exploration for an undiscovered field ≥ minimum size……..……..……..……	1.0

UNDISCOVERED FIELDS

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

Oil fields:……min. no. (>0)	1	median no.	10	max no.	30
Gas fields:……min. no. (>0)	30	median no.	201	max no.	600

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	4	median size	5	max. size	25
Gas in gas fields (bcfg):…… min. size	24	median size	36	max. size	1200

Assessment Unit (name, no.)
Southern Permian Basin-Offshore, 40360103

AVERAGE RATIOS FOR UNDISCOVERED FIELDS, TO ASSESS COPRODUCTS
(uncertainty of fixed but unknown values)

Oil Fields:	minimum	median	maximum
Gas/oil ratio (cfg/bo)……	180	360	540
NGL/gas ratio (bngl/mmcfg)……	34	67	100

Gas fields:	minimum	median	maximum
Liquids/gas ratio (bngl/mmcfg)……	1.5	3	4.5
Oil/gas ratio (bo/mmcfg)……			

SELECTED ANCILLARY DATA FOR UNDISCOVERED FIELDS
(variations in the properties of undiscovered fields)

Oil Fields:	minimum	median	maximum
API gravity (degrees)……			
Sulfur content of oil (%)……			
Drilling Depth (m) ……			
Depth (m) of water (if applicable)……			

Gas Fields:	minimum	median	maximum
Inert gas content (%)……	0.2	2	40
CO_2 content (%)……	1.2	0.5	1
Hydrogen-sulfide content (%)……			
Drilling Depth (m)……	1000	3000	15000
Depth (m) of water (if applicable)……	7	50	200

Assessment Unit (name, no.)
Southern Permian Basin-Offshore, 40360103

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

1. United Kingdom represents 50 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		65	
Portion of volume % that is offshore (0-100%)……		100	

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		60	
Portion of volume % that is offshore (0-100%)……		100	

2. Netherlands represents 20 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		26	
Portion of volume % that is offshore (0-100%)……		100	

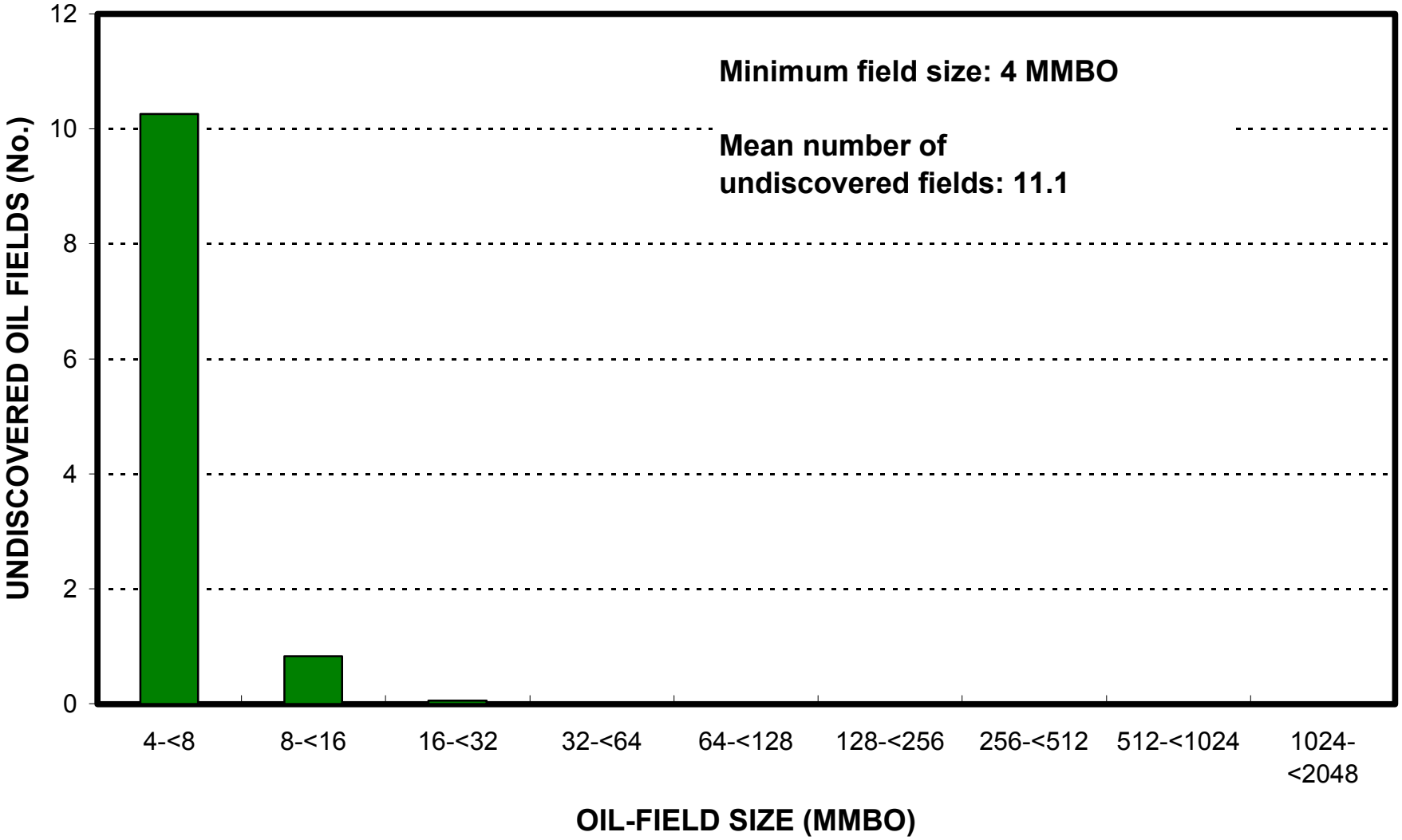
Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		30	
Portion of volume % that is offshore (0-100%)……		100	

3. Germany represents 30 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		9	
Portion of volume % that is offshore (0-100%)……		100	

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		10	
Portion of volume % that is offshore (0-100%)……		100	

Southern Permian Basin-Offshore, AU 40360103
Undiscovered Field-Size Distribution



Southern Permian Basin-Offshore, AU 40360103
Undiscovered Field-Size Distribution