

CBM and Shale Gas - An Energy Option for Germany?

Dipl.-Geol. Ralph Schlueter (DMT GmbH & Co. KG, Essen)

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How it all started ...

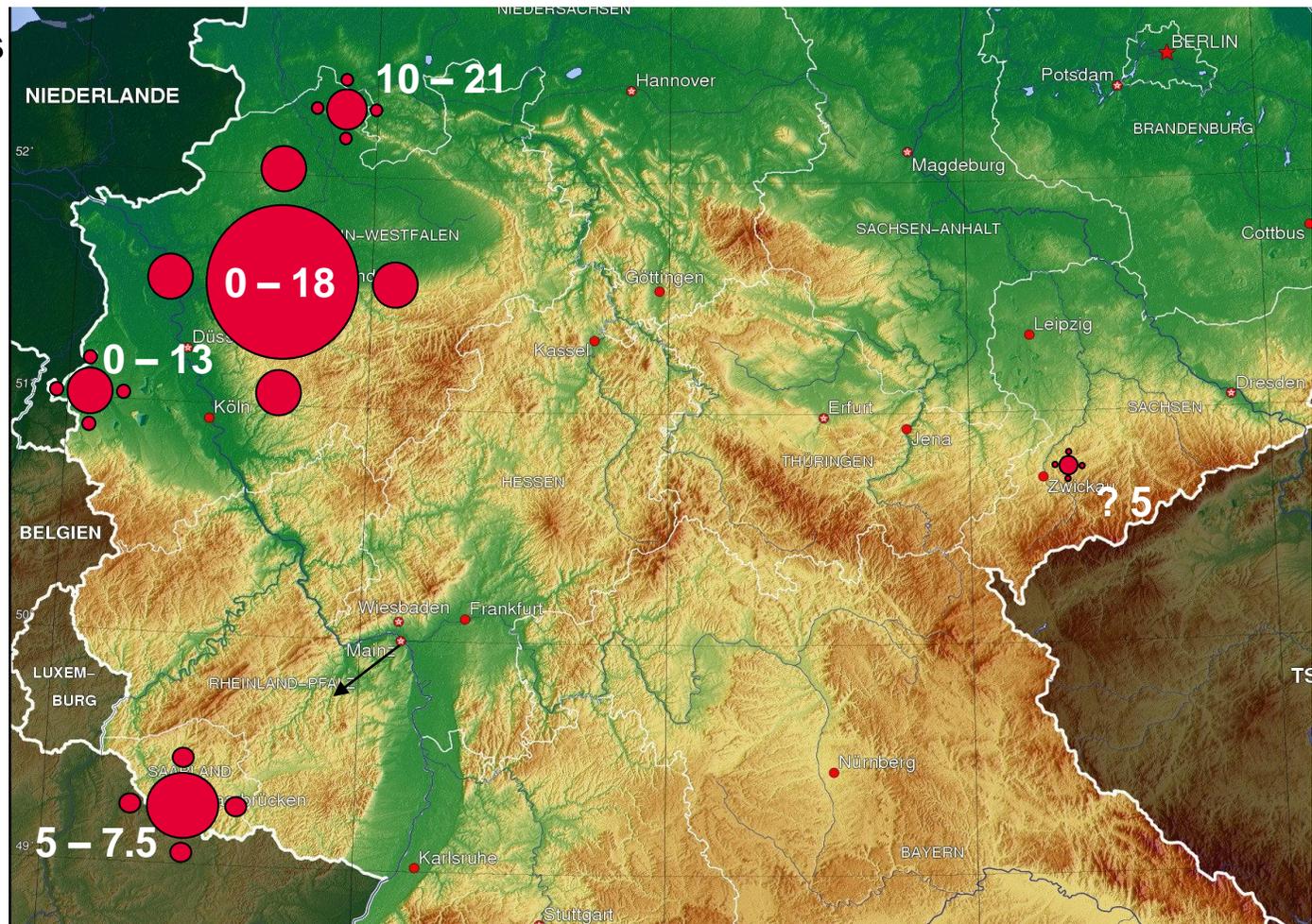


from Ruhrlanmuseum Essen

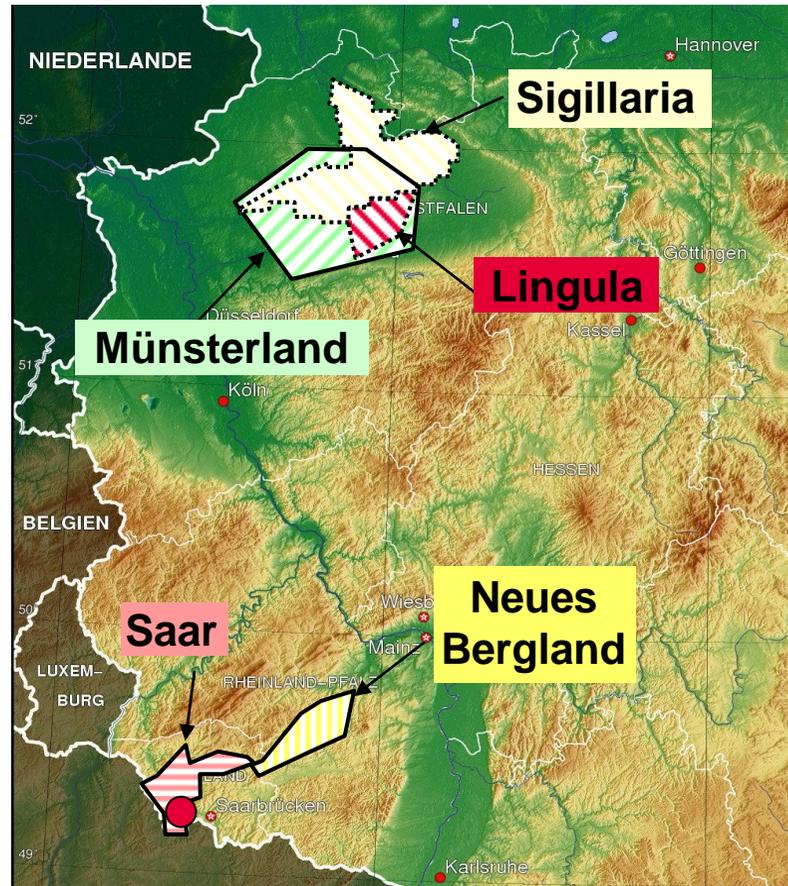
CBM Potentials in Germany

Size of the symbols representing CBM potential

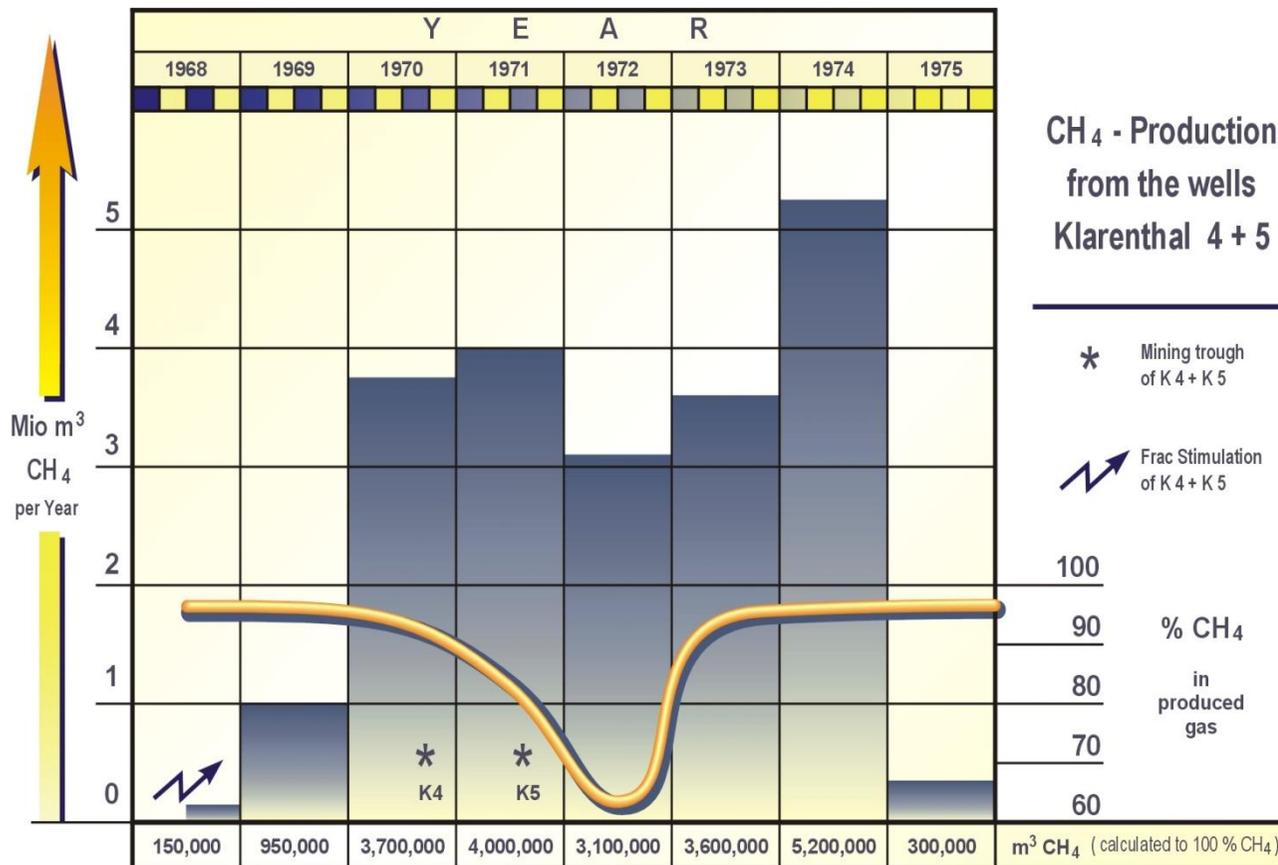
Figures indicate gas content [in m³/t of coal]



Earlier Attempts of Methane Drainage from Surface and CBM/Tight Gas Production



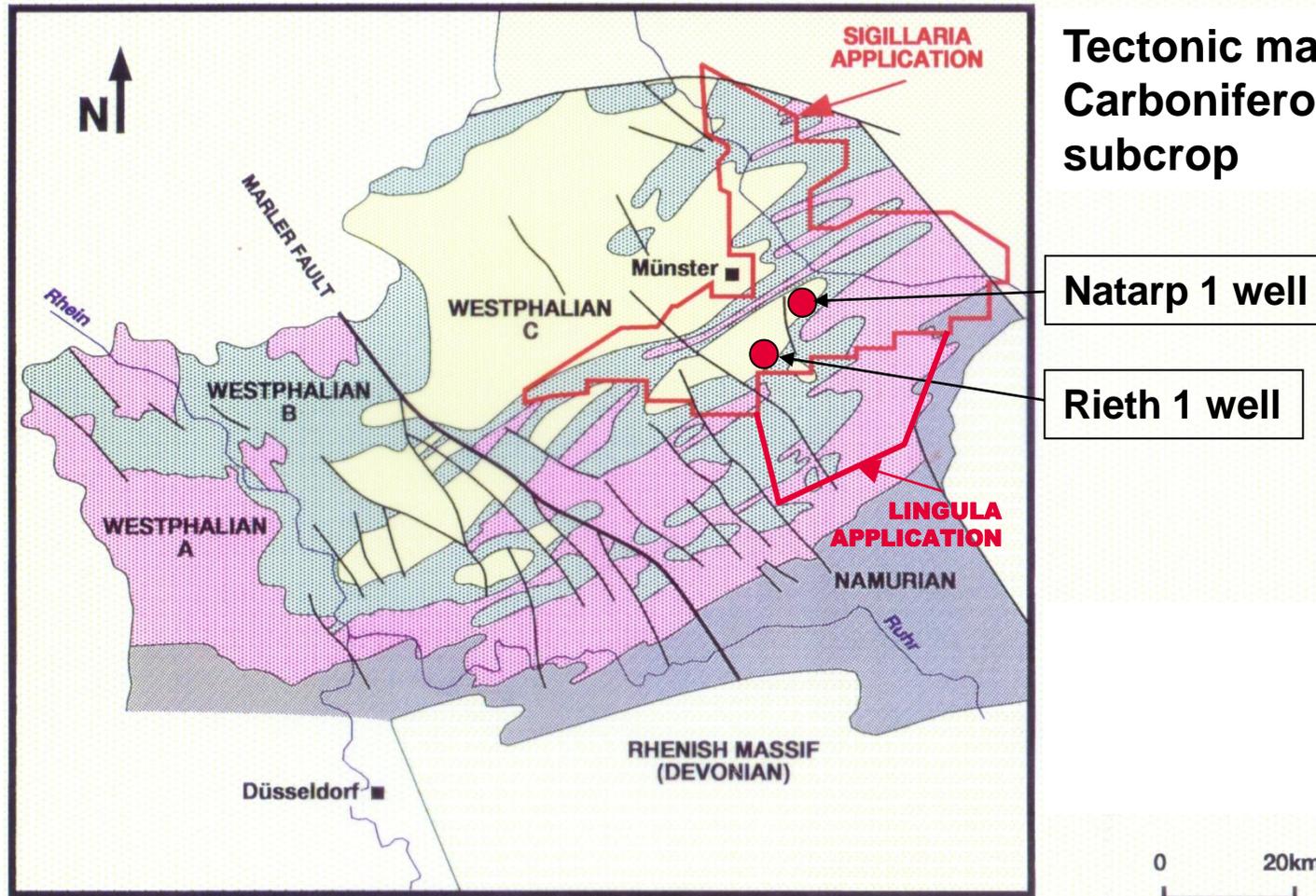
Early Attempts of Pre-Mining Drainage from the Surface (Saar)



Results of Gob-Wells „Klarenthal 4 & 5“

Amount of methane produced: 21 Mio m³

The Sigillaria-Project (Ruhr)



Tectonic map of Carboniferous subcrop

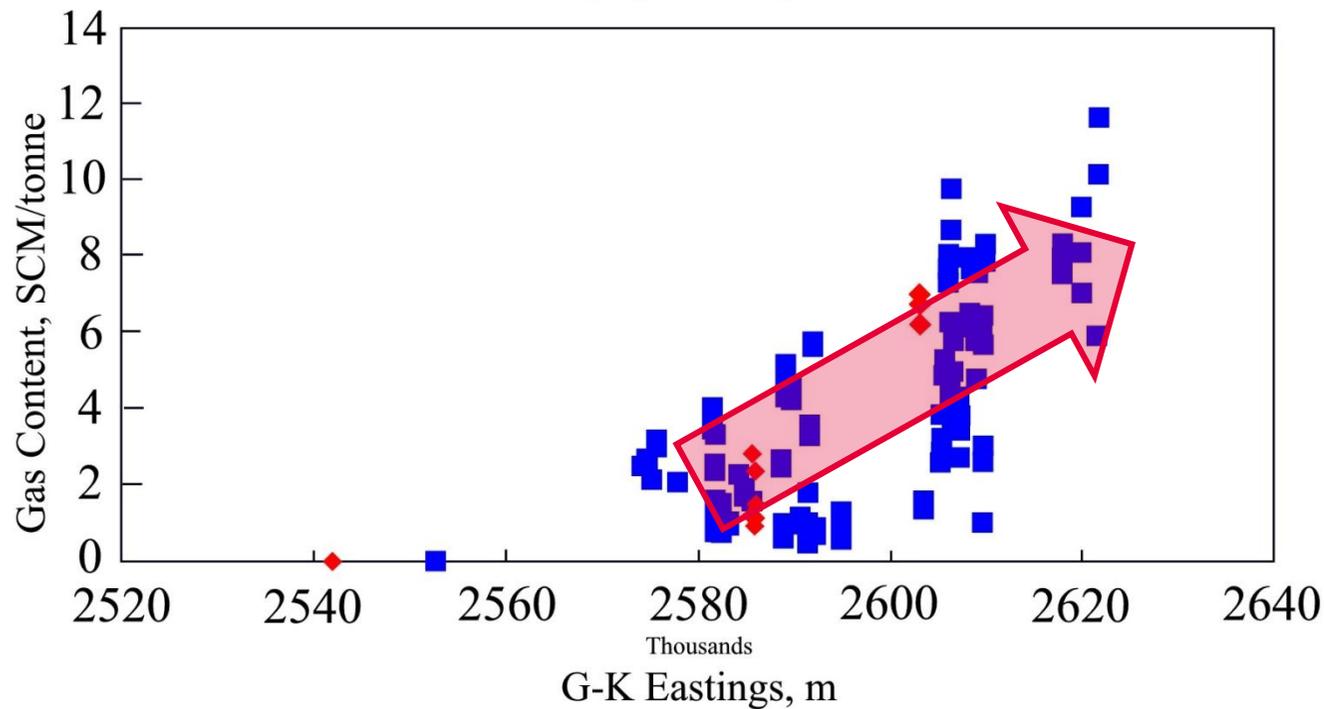
Natarp 1 well

Rieth 1 well

modified after Sperber, Gaschnitz, Juch & Kunz, 1996

The Sigillaria-Project (Ruhr)

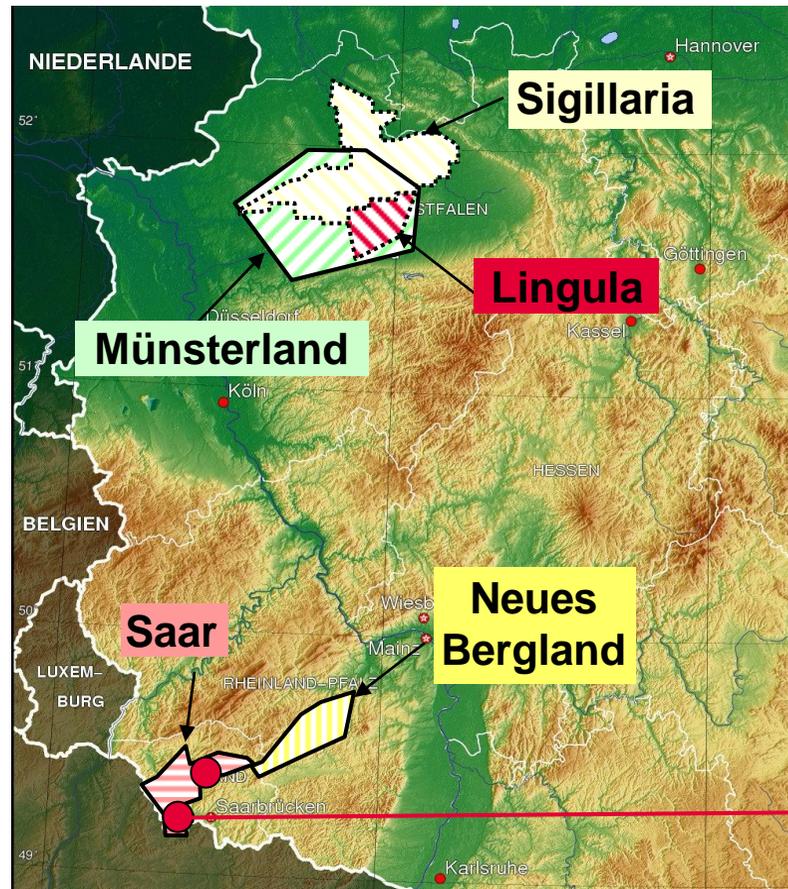
Gas Content versus Gauss-Krüger Eastings
Stratigraphic Height 1278



■ Greater than 200m from top Carbon. ◆ within 200m of top Carbon.

Tickell & Thomas, 1996

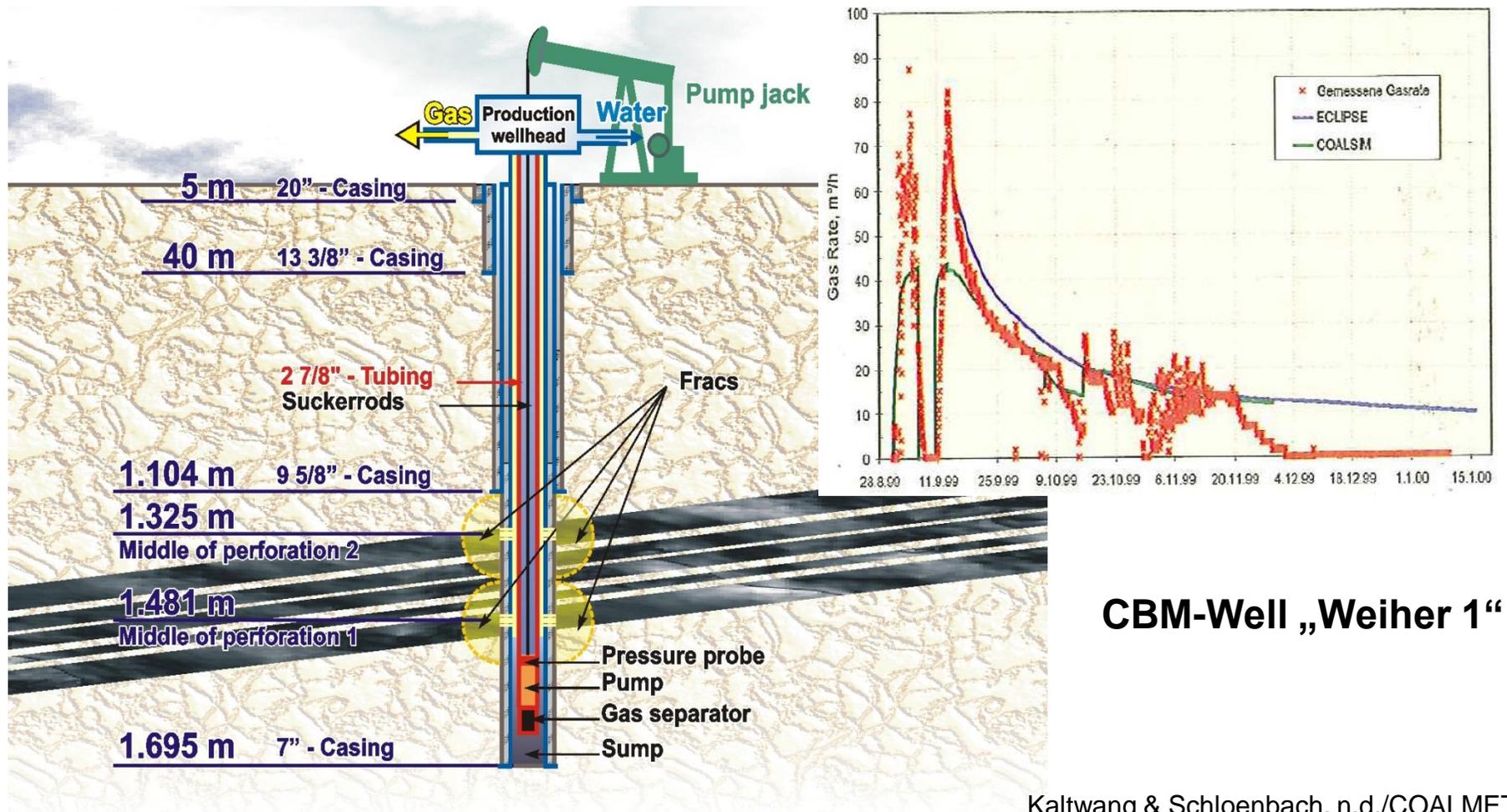
CBM-Projects in the Saar-Region before 2000



CBM production from Aspenhübel (August 1998)

Photo: T. Thielemann

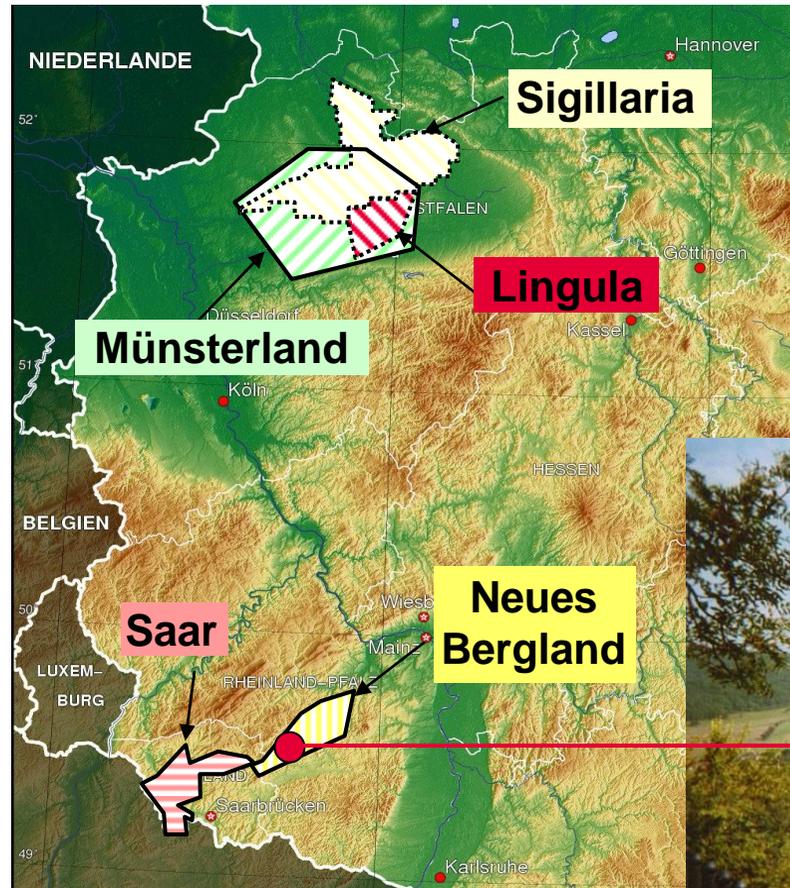
CBM-Projects in the Saar-Region before 2000



CBM-Well „Weiher 1“

Kaltwang & Schloenbach, n.d./COALMET

An Approach in the Saar-Nahe-Basin



Glantal 1 well
 drilled in 2005/2006 by
 Pannonian Int. Ltd.



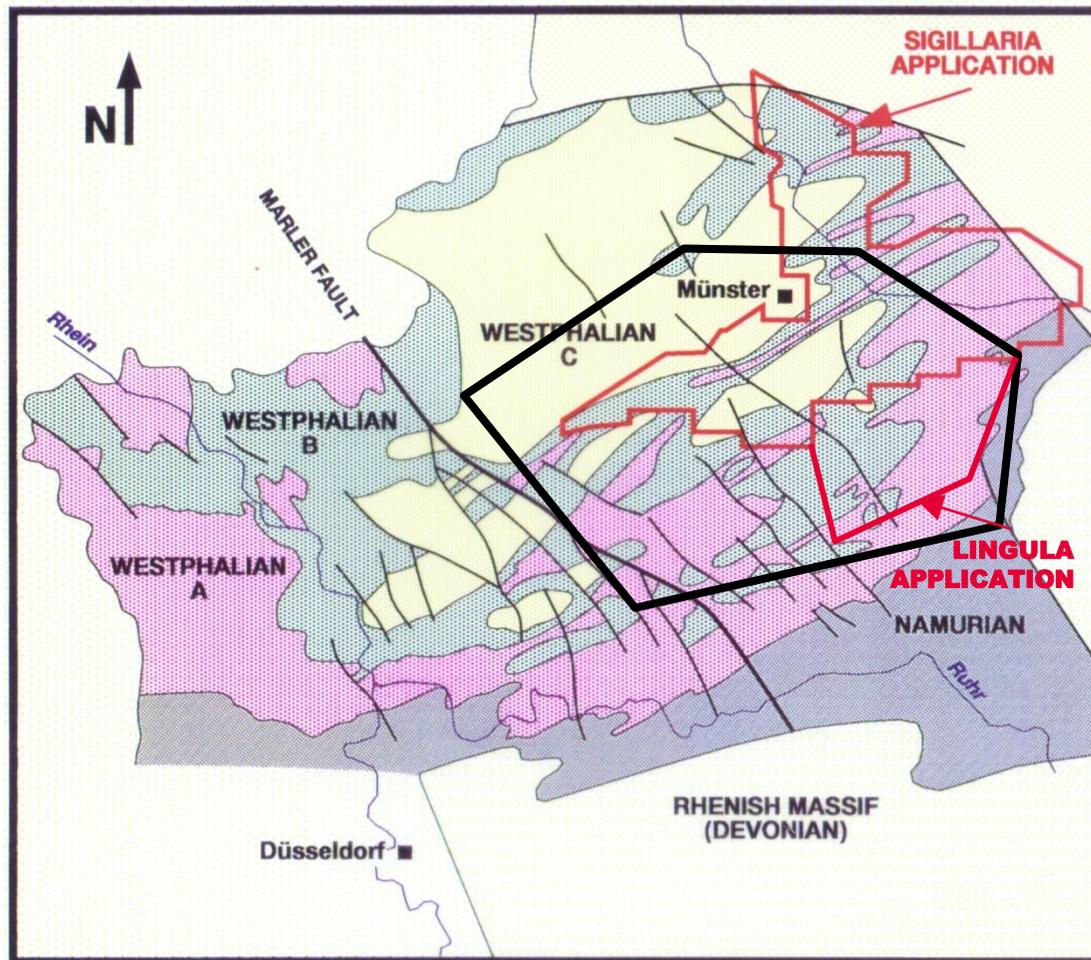
Photo: www.empyreanenergy.com

An Approach in the Saar-Nahe-Basin

Interval	Depth [m]	Details
Interval 1	1445 - 1455	A light blow at the surface and 212 litres of fluid were recovered in the drill string.
Interval 2	1355 – 1379	Similar results with no detection of gas and only recovery of formation water.
Interval 3	1228 – 1249	This was the zone that showed the best permeability and over a 4 hour flow period produced only 348 litres of connate water and no significant gas .
Interval 4	1205 - 1220	This interval yielded only a small quantity of flammable gas to surface with no discernible formation water. The permeability appeared to be poor.

Source: www.empyreanenergy.com

Early 2000s Developments (Ruhr)



“Münsterland”
scientific license:
Hydrocarbons including other
extracted gases (3.460km²)

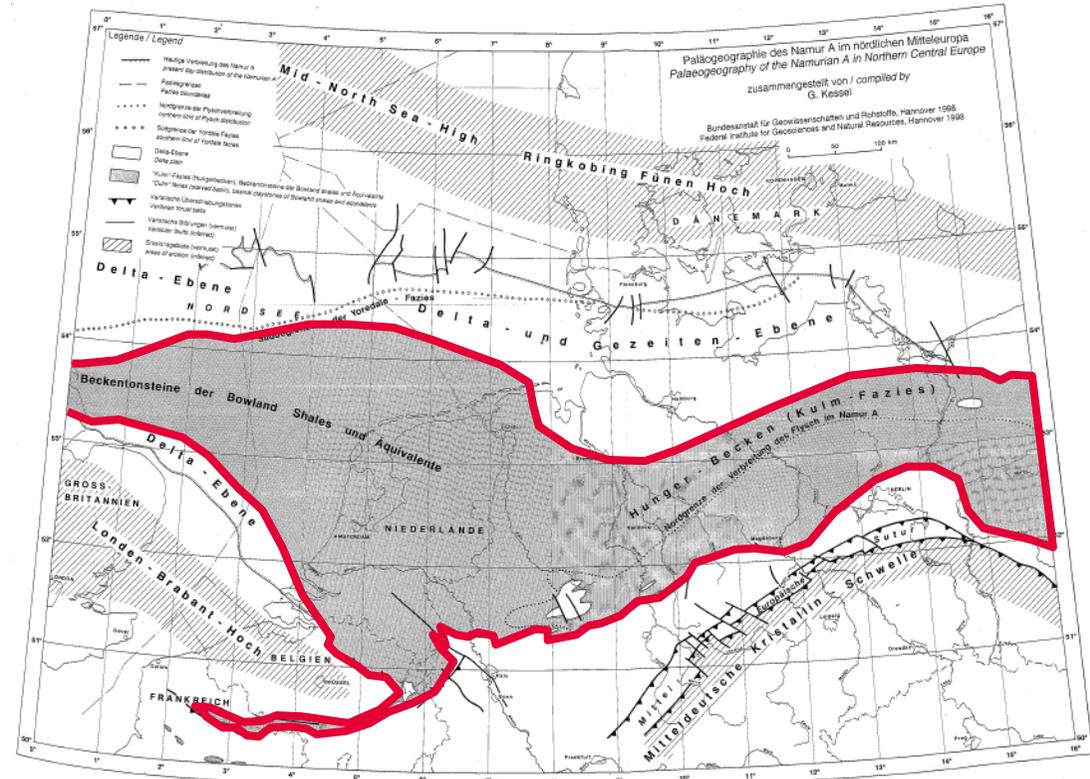
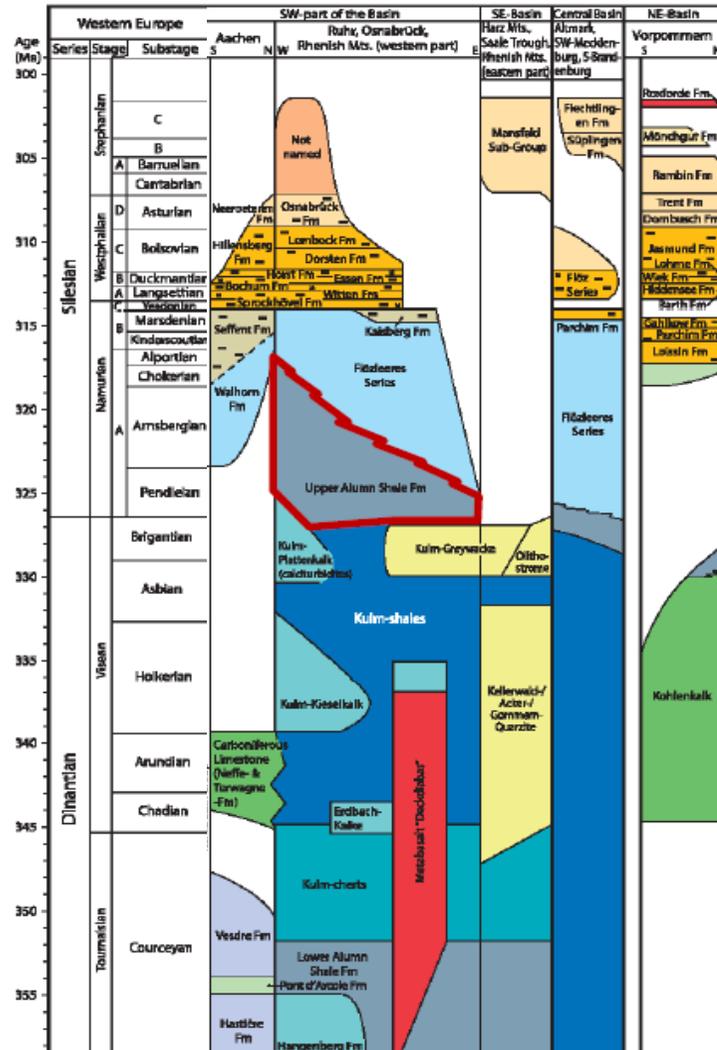
modified after Sperber, Gaschnitz, Juch & Kunz, 1996 Preuße, 2008

Shale Gas in Germany – Potentials

- Cambro-Ordovician Alum Shales (Sweden, Bornholm, Denmark, Baltic Sea)
- Silurian Graptolite Shale (Middle and East Europe)
- Middle and Upper Devonian black shales (Northern Germany)
- **Renohercynian Alum Shales (Uppermost Lower Carboniferous (Dinantian) to basal Upper Carboniferous (Namurian) in West and Middle Europe (Ireland, UK, North Sea, the Netherlands, Northern Germany, Poland)**
- **Lower Jurassic (Toarcien) Posidonia Shales in the Northern German Basin**

Schulz & Horsfield (2009)

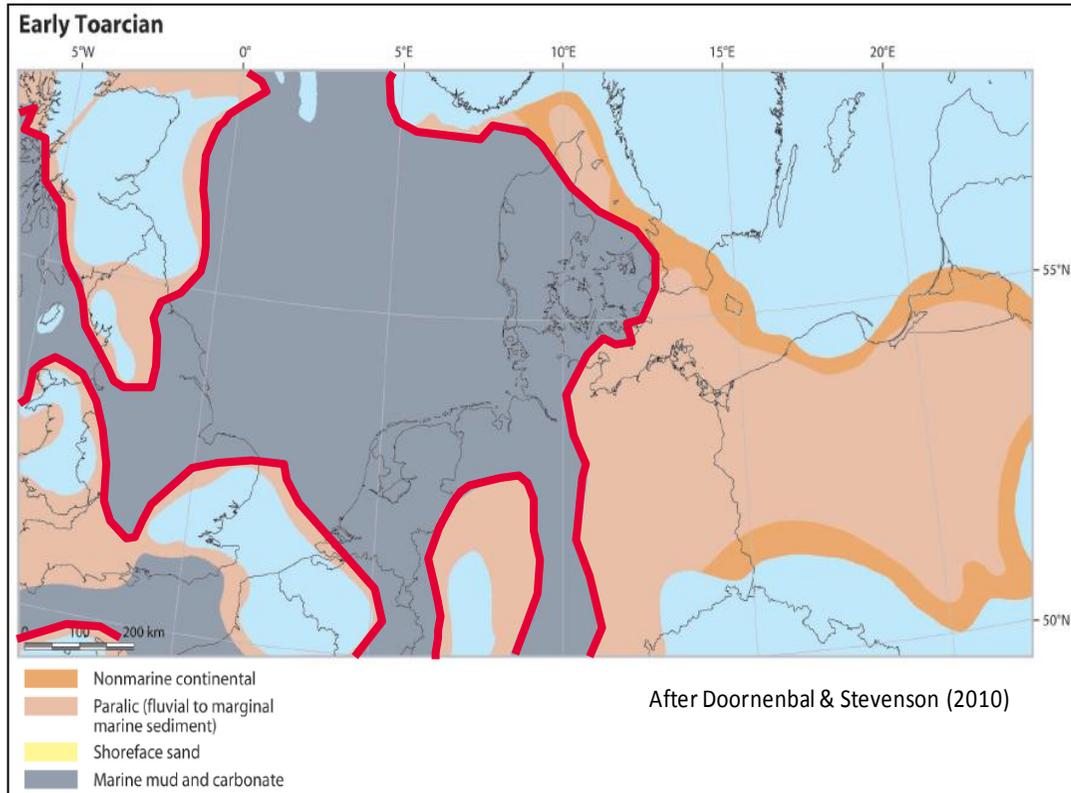
Shale Gas in Germany – Rhenohercynian Shales



after Kombrink (2008)

Gerling et al. (1999)

Shale Gas in Germany – Posidonia Shales



after Van Aldrichem, Boogaert & Kouwe (1993-1997),
Herngreen et al. (2003)

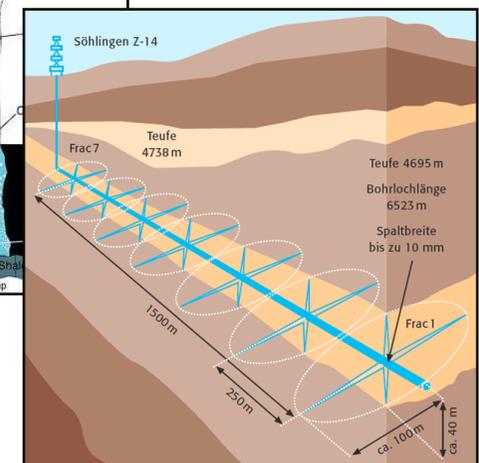
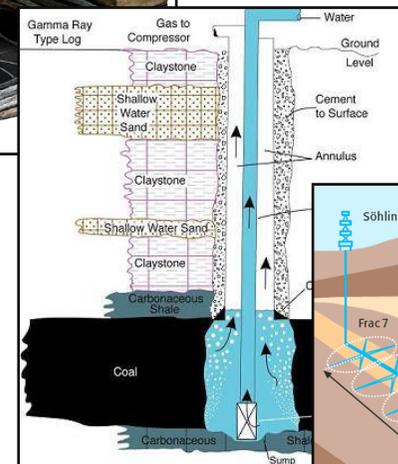
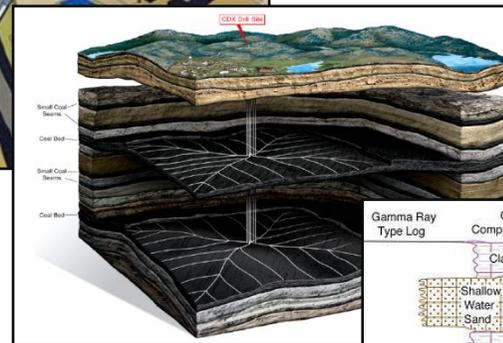
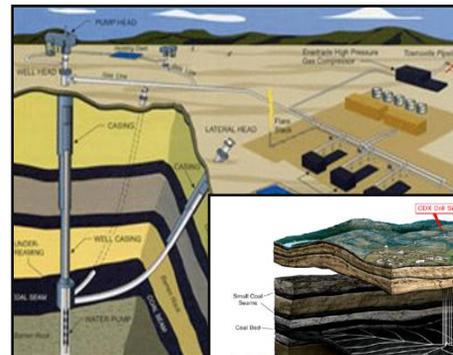
Epoch	Age	Germany Lower Saxony Basin (western part)	
Early Cretaceous	Albian	Flammenmergel	Malm
		Minimuston	
	Apbian	Ossinggrünsand, Rothenberg-Sandstein	
	Berrenian	Neokom-Schieferton (Hilsion Fm.)	
	Hauterivian	Güdelhäuser Sandstein	
	Valanginian	Bendheimer Sandstein	
Late Jurassic	Ryazanian	Bückeberg Fm. ("Wackeln")	Malm
	Portlandian	Serpulit Mb., Münder Fm., Birnböckhäuser Platten, Gigasschichten	
	Kimmeridgian s.l.	Kimmeridgekalke & Mergel	
	Oxfordian	Wiehengeb., Korallenquarzit, Heersumer Schichten	
Middle Jurassic	Celovian	Ornatenton, Macrocephalanton	Dogger
	Bathonian	Porta-Sandstein (Macroceph., sst)	
	Bajocian	Aspidolides-Sandstein, Württembergplaus-Sandstein	
	Aalenian	"Combrash"	
Early Jurassic	Toarcian	Posidonienschiefer	Lias
	Pliensbachian		
	Sinemurian		
	Hettangian		
Late Triassic	Rhaetian	Rhätkeuper	Keuper

Shale Gas in Germany – Potentials

Threshold (after TNO 2009)	Renohercynian Shales	Posidonia Shales
Maturity between 1.1 and 4.0 % Vr	+ -	-
Organic Content (TOC) > 2%	+ +	+ +
Shale Thickness > 20 m	+	-
Organic Matter Type II	+ +	+ +

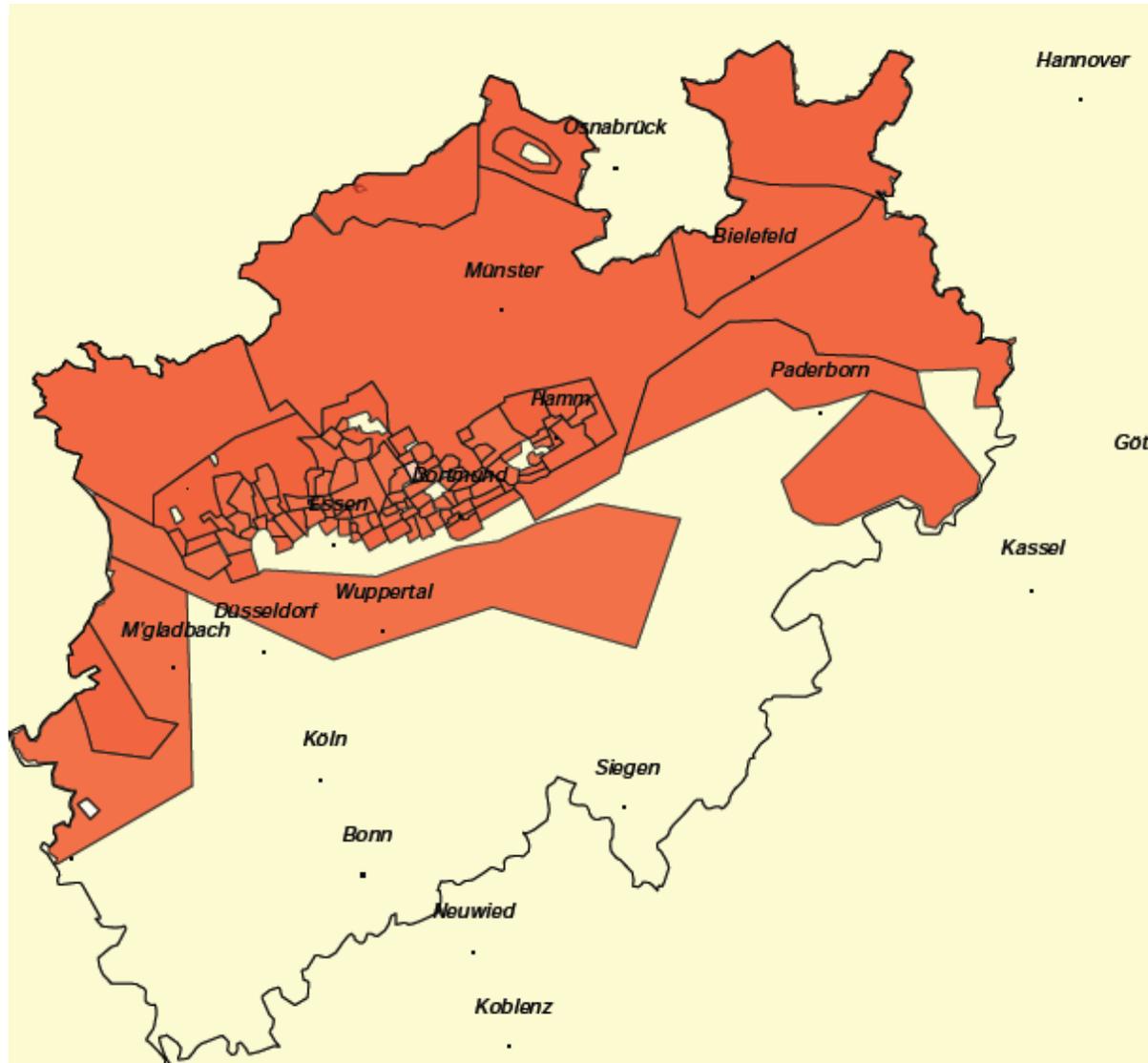
Recent Technical Developments

- Horizontal Drilling
- Multilateral Drilling
- Cavitation
- Multi-Frac-Drilling



Modified after Preuße, 2008, illustrations: www.mitchelldrilling.com/
www.cdxgas.com/ / www.wsgs.uwyo.edu/ / www.wingas.de

Securing Hydrocarbon Licenses in NRW



Unconventional Gas Wells – A Media History (I)

- **25. Januar 2008 (Wittlager Kreisblatt): To get to the Heart of Gas**
... in the region, Oppenwehe is known for Asparagus. This may change. Experts suspect more: They are talking about Gas. ...
- **2008 (WIR in Oppenwehe):**
In an interesting talk ExxonMobil ... presented the project "OPPENWEHE 1". ... [ExxonMobil] as well as mayor Stauss cautioned against euphoria.
- **2008 (Website Oppenwehe):**
A small group of interested citizens of Oppenwehe recently visited ExxonMobil's "Oppenwehe 1" well. ... Thanks to [the representative of ExxonMobil] and the drilling forman, who answered every question. Both stressed that they intend to be good and friendly neighbours.
- **22.09.2010 (Neue Westfälische Zeitung): Gas Search is Like a Long Journey**
The people were curious to know the results of the ExxonMobil well. The answer was given ... by [an ExxonMobil representative] to the members of Stemwede's Committee for Housing and Urban Development

Unconventional Gas Wells – A Media History (II)

- **17.08.2010 (Spiegel Online): Hazardous Gas Production – Fire from the Water-Tap**
... The industry is hoping for a billions worth bonanza – but now the documentary „*Gasland*“ shows how hazardous the methods are.
- **End of 2010: Forming of *Interessengemeinschaften „Gegen Gasbohren“* [*Communities of Interests „Against Gas Drilling“*]**
- **13.01. 2011 (Neue Westfälische Zeitung): Exxon Puts Project on Ice**
Until yesterday, no special operating plan was submitted to the mining authorities.
- **23.03.2011 (WDR): Why Do We Want This Gas?**
... Experts and citizens were invited by the [Mining Authorities] and discussed the disputed technology „fracking“ and possible impacts on environment and health.

CBM and Shale Gas in Germany – Summary and Outlook

- **Germany has potential in-place CBM resources of almost 3 trillion m³, of which only a minor fraction is recoverable by current technology. Shale Gas potential is yet unknown but is currently assessed BGR.**
- **No active productive project is currently under way. Various CBM pilot projects have been carried out for decades in several regions and confirmed that the main problem was the low permeability.**
- **There is a high and renewed interest in Germany's CBM and Shale Gas deposits by various companies expressed by claiming new licenses and envisaged drilling and seismic programs.**
- **New technologies will have to be applied in order to increase permeability and to enhance the gas flow.**
- **There is a lot of local resistance following environmental problems in the US. Public acceptance has to be regained.**

■ **Thank you for your attention!**