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Will future coal mines emit more gas?

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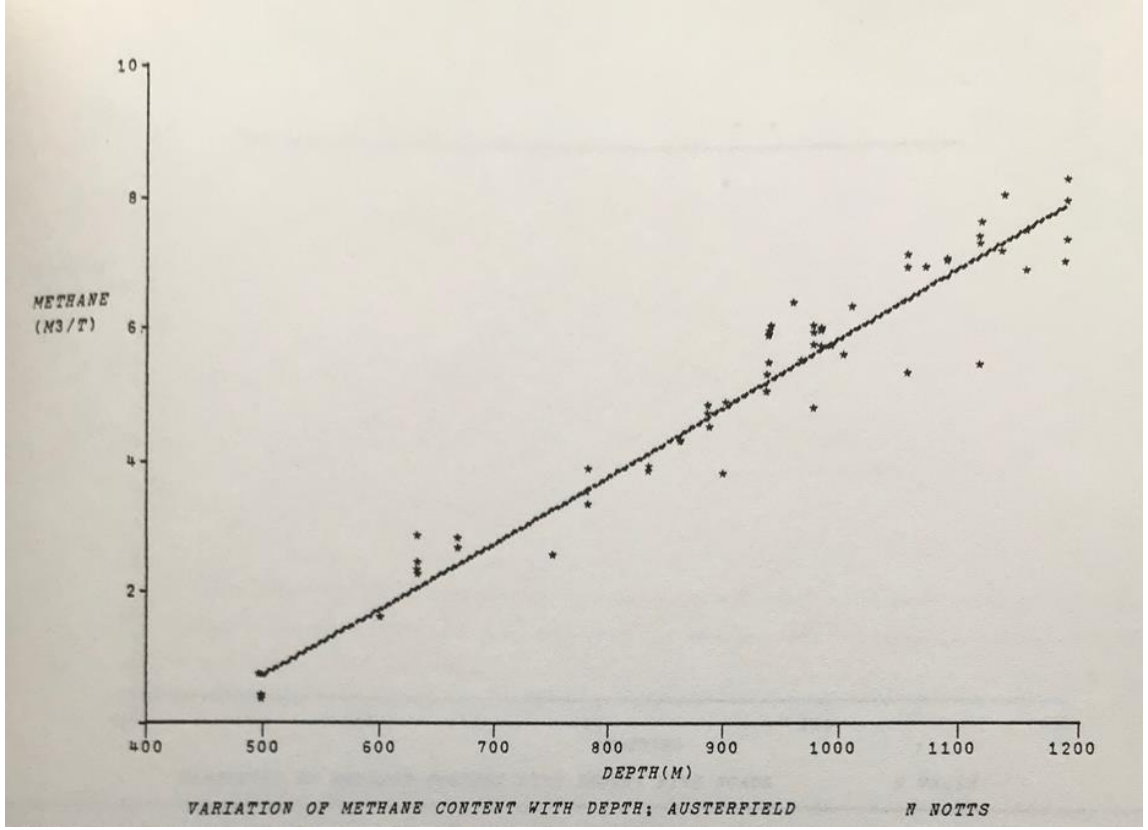
Coal mines, on average, will become deeper so does that mean they will be more gassy?

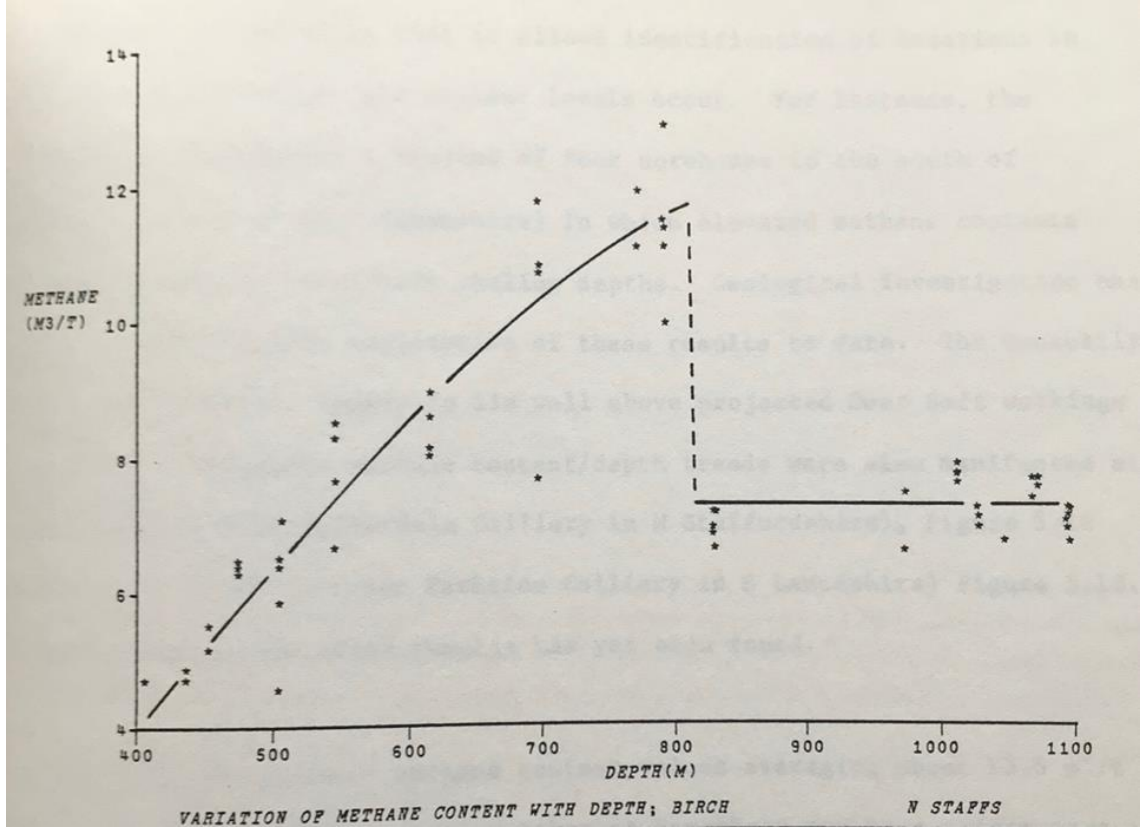
Will other cost-related factors lead to less production from gassy mines?

Contents

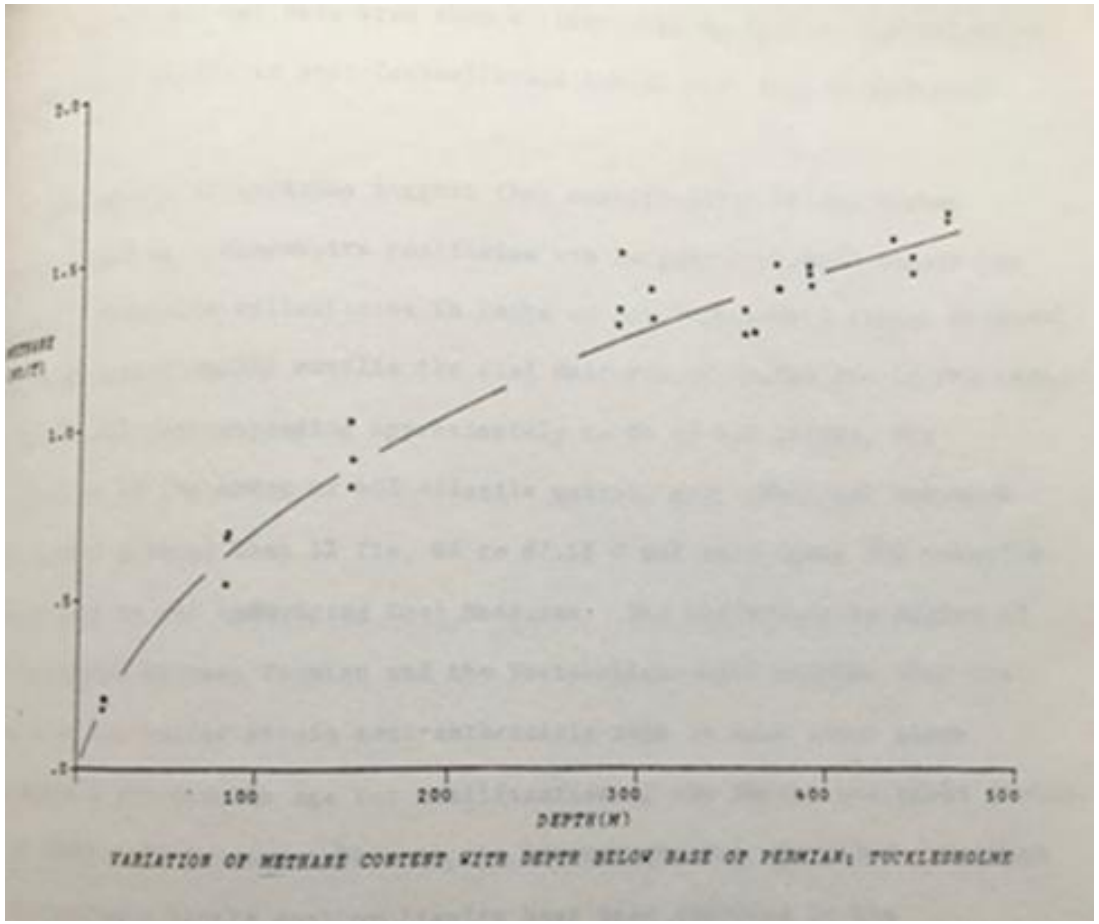
1. Gas content vs depth of mining

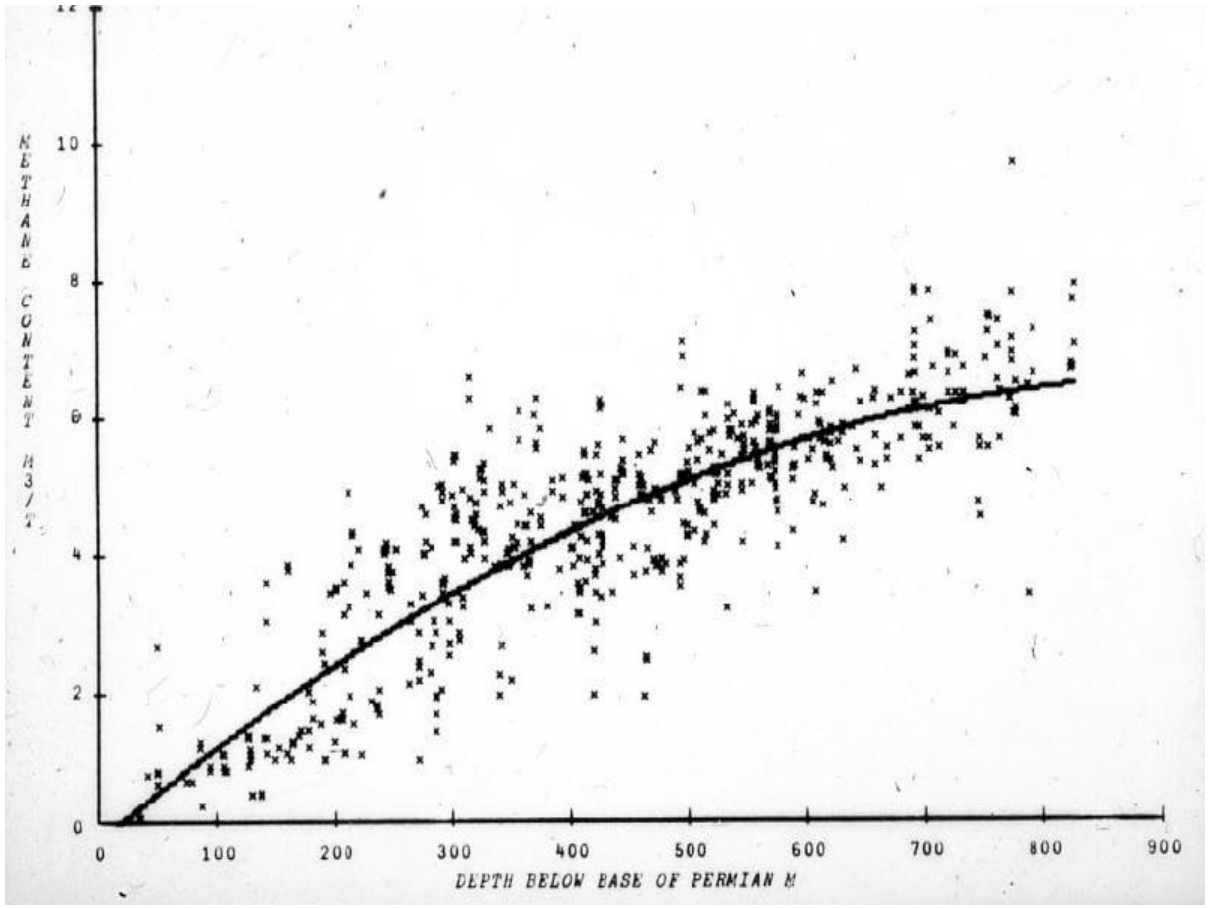
Methane content (af) increases with vertical depth – but not always



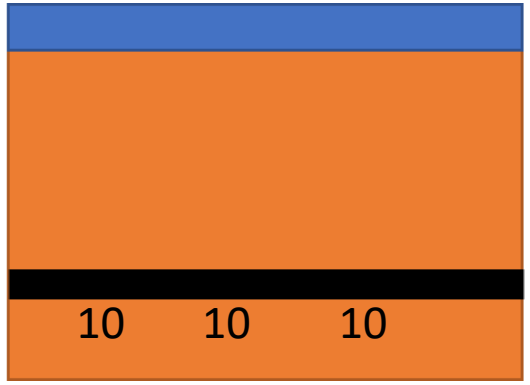


Methane content is not necessarily related to depth from the present surface

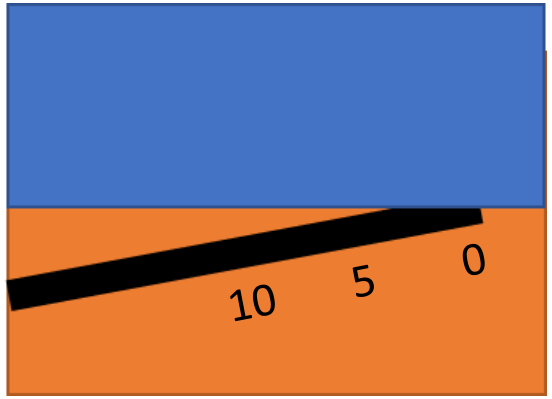




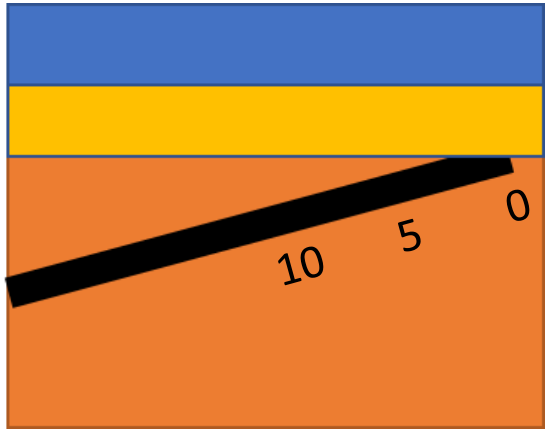
Gas content depends on the geological history of the coal seams



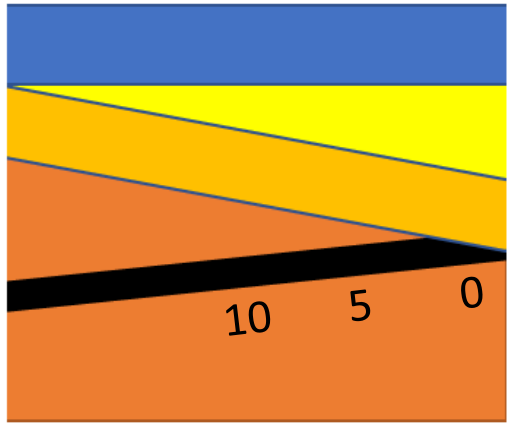
Deep burial and coalification



Folding and erosion of coal measures



Re-burial of the unconformity



Tilting and present erosion

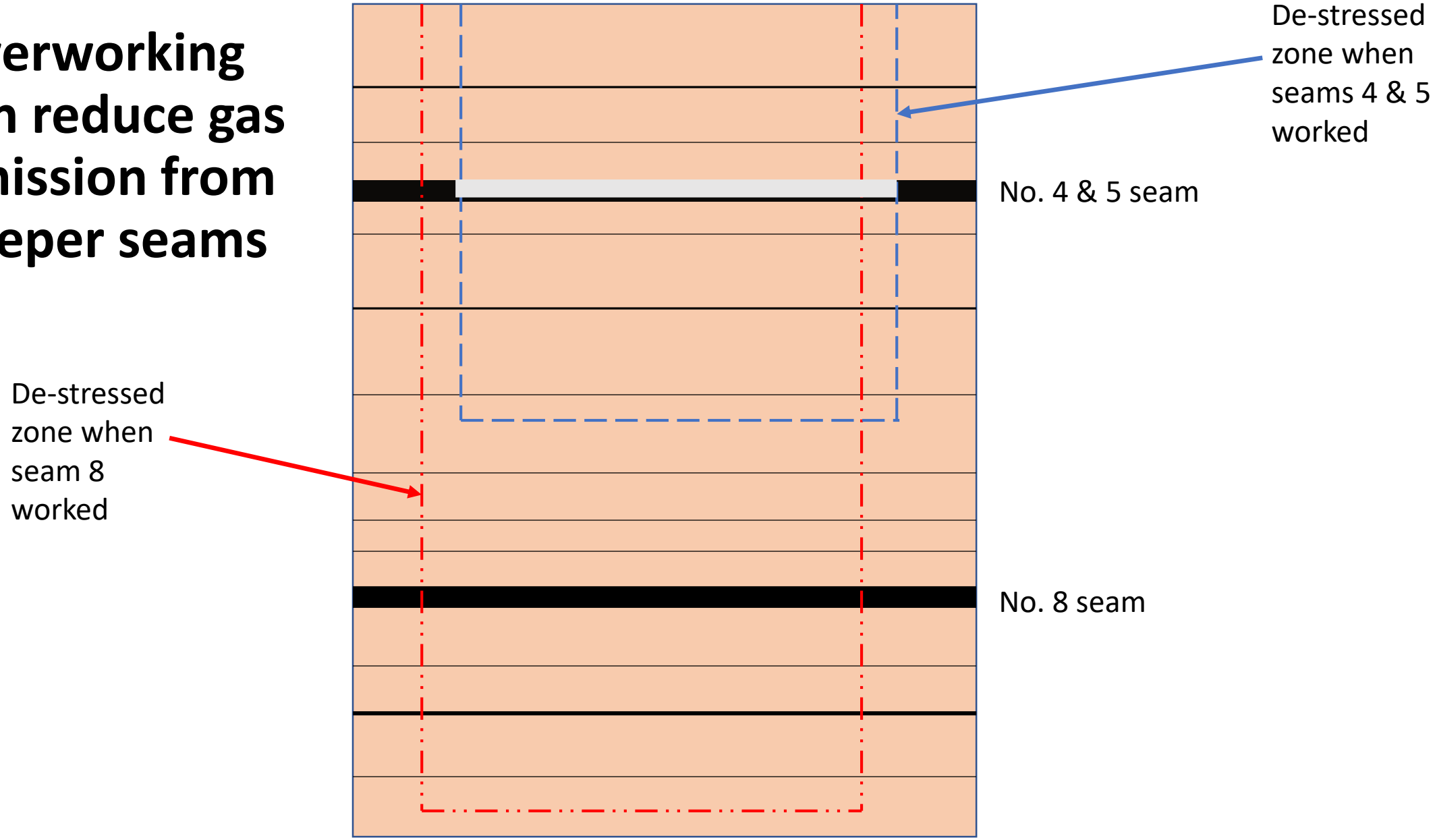
Note: Methane content shown in m3/t

2. Gas emission vs depth

Gas emission rate depends on various factors

- Gas content, number, thickness and distance of seams from the worked seam
- Extraneous gas sources
- Longwall dimensions and extraction height
- District age
- Longwall retreat rate – emissions from roof and floor seams are proportional to mining retreat rate
- Strata strength

Overworking can reduce gas emission from deeper seams



Limiting factors on gas emission are coal production, gas capture and ventilation NOT depth

Relative depth (m)	Worked seam	Worked out seams above or below	Relative emission m3/t	Max coal production Mtpa ($40m^3/s$ air, 50% capture)	Methane flow rate m3/min
29	No. 4	None	23	0.70	32
107	No. 8	None	52.5	0.31	32
107	No. 8	Seams Nos 4 & 5 worked	32.5	0.50	32

Assumes 50 week year, 1% maximum permitted methane concentration in airways

Gas emission constraints on coal production

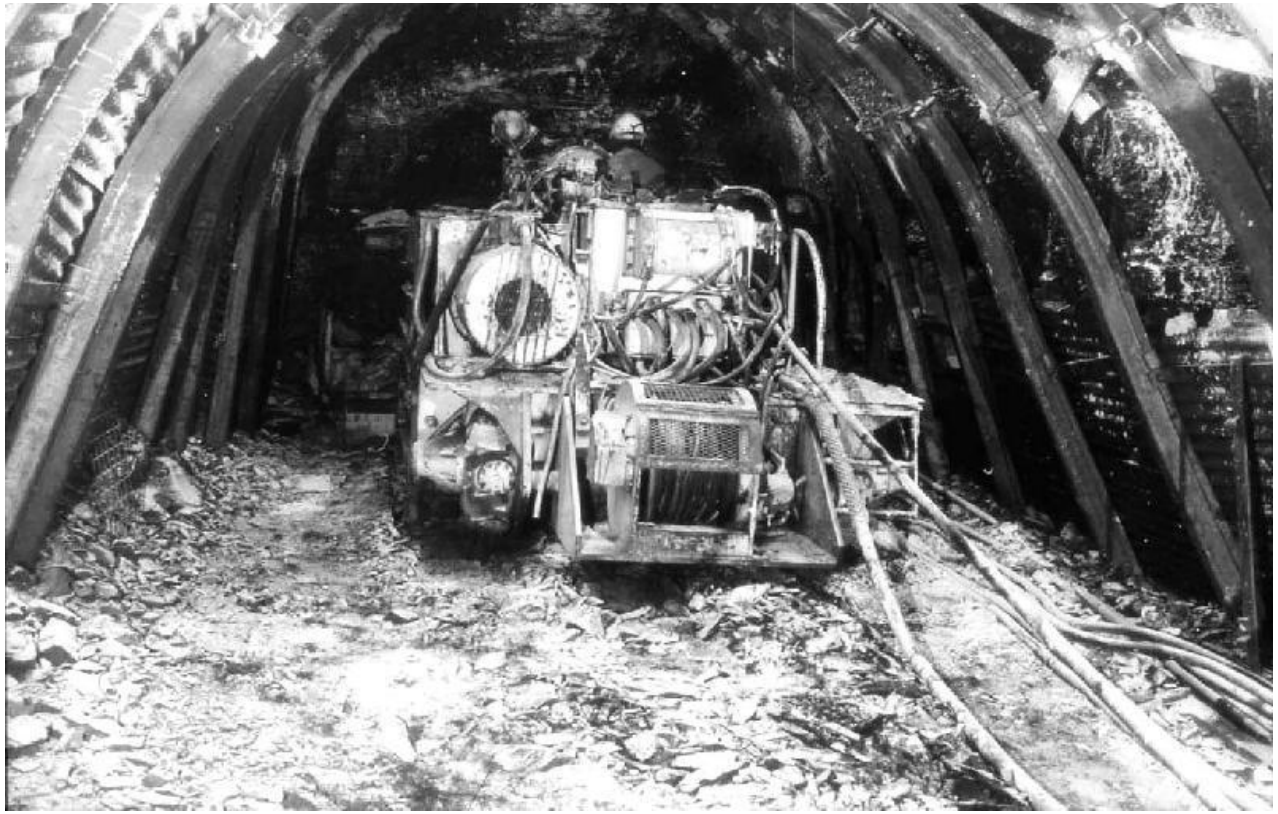
- Gas emission limits coal production rate at a given ventilation flow and drainage efficiency

- Thinner seams require faster retreat rates to achieve a particular coal production - so with thinner seams limiting coal production is lower

How to reduce gas emission constraints on coal production

Technology	Issues	Benefit
Pre drain gas to the surface from CBM wells	Deeper seams, lower permeability and hence longer degassing lead time	High purity gas that can be sold to grid or compressed or liquified for transport to customer. Significant gas removed before mining
Shorter longwalls or room and pillar (non caving extraction)	Geology dependent – only applies if coal seams occur within around 60m below and 150m above the worked longwall.	Reduced destressing height above short longwalls smaller emission zone above and below the goaf
Enhanced gas drainage and increased ventilation quantities	In low permeability coals heavily reliant on post drainage systems for gas control. Due to air leakages, large increases in surface fan power are not always translated into significant airflows on the longwalls	Intensive pre drainage – surface and underground – plus effective post drainage can produce large volumes of gas for utilisation
Selectively mine thick seams	Coal reserves with the desired geological configuration are not always available. If there are few coals in the 150m above the longwall then no benefit – no gas sources in the roof	Planned coal production achieved with slower retreat rate with thick seams so lower rate of strata disturbance and hence lower gas emissions from adjacent seams

3. Mining cost as a depth related factor



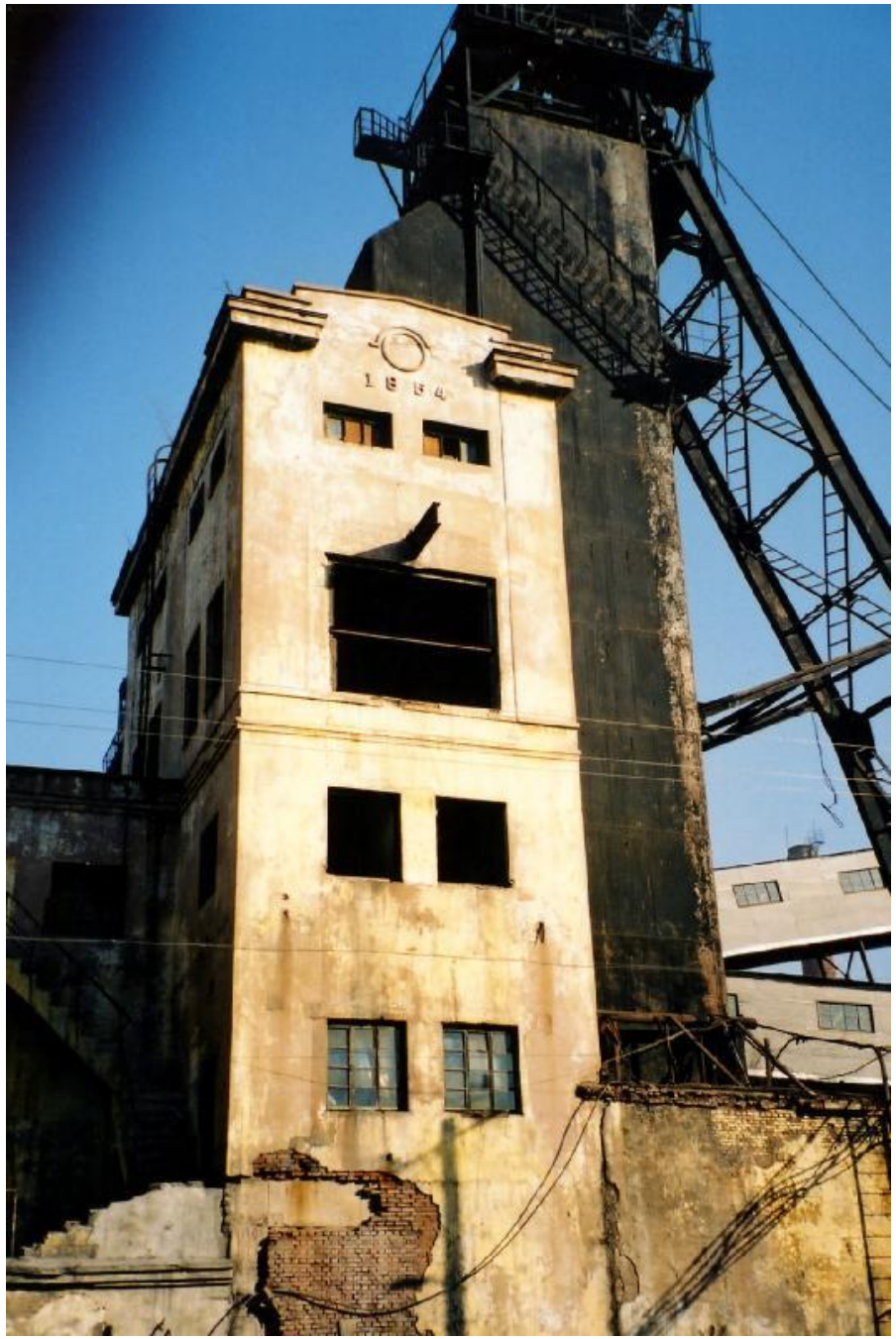
Mining cost increases with geological complexity

- Geological complexity and resource availability – easiest coals have already been worked in many coalfield areas

Mining costs increase with depth and age of working

- Increased mining difficulty - wider support pillars, more roof support
- Gas content tends to increase with **vertical** depth in many instances
- More stoppages due to elevated gas concentrations
- Increasing strata temperature – heat strain, cooling equipment
- Mine infrastructure is extended, working time per shift shortens and hence productivity will decline
- Each 10m increase in depth can increase production cost by as much as 1%-2% (based on unpublished sources May 2008)

4. Conclusions



Future coal mines may emit less gas because:

- Mines with lower operating costs are generally more profitable
- Mine owners will seek to reduce mine operating costs e.g., capture and use of more CMM
- Coal production costs increase with depth so deeper mines are less competitive and may close; similarly with increase in geological complexity
- Alternative energy sources become more attractive – closing high cost, gassy coal mines and switching to other fuels eg., natural gas

But the actual picture is likely to be more complex in some countries due to market distortions and other factors

Future coal mining will be concentrated in coalfields where:

- Low cost labour
- Low cost mechanisation
- Subsidies - low cost finance, gas capture and power generation incentives
- Full environmental cost not incurred
- Proximity to market
- Transport infrastructure exists and transport prices are reasonable

Final answers

- Coal mines, on average, will become deeper so does that mean they will be more gassy? POSSIBLY NOT

- Will other cost-related factors lead to less production from gassy mines? PROBABLY YES

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