

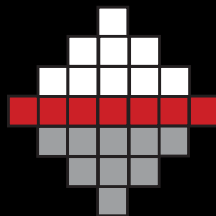


Exploration Challenges for Coalbed Methane in Indonesia

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OUTLINE OF PRESENTATION

- **Scope/Purpose of Talk** (*what I will & will not talk on*)
- **Current Technical Status** (*how far are we along*)
- **Geological Review** (*what's out there*)
- **Testing Caveats** (*how to assess what's out there*)
- **Some Engineering Challenges** (*impediments to getting what's out there*)
- **Regulatory & Cultural Challenges** (*mother & family*)
- **Solutions** (*what can we do about what's out there*)

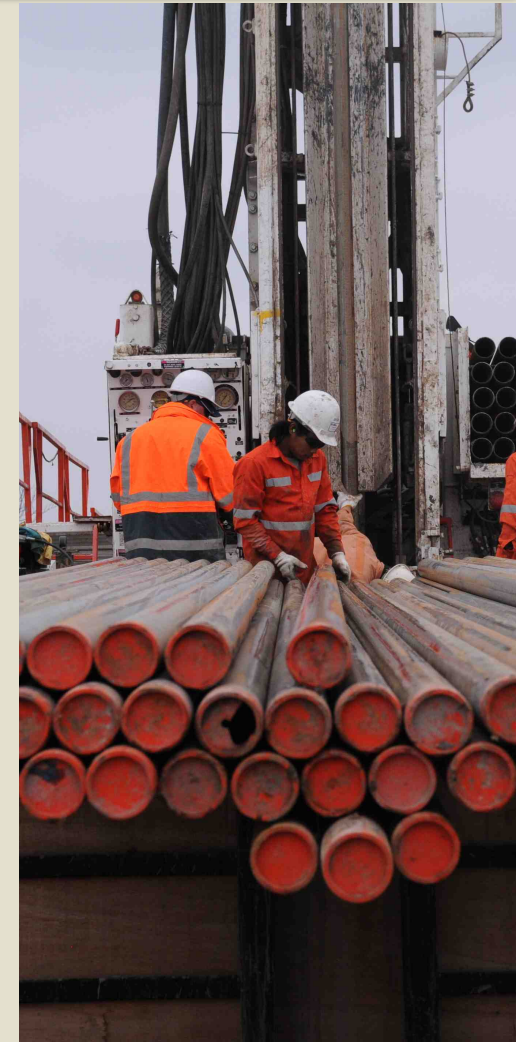
Scope/Purpose of Talk

- **Status Report of CBM in Indonesia, from a TECHNICAL perspective only**
- **Touching on only a few representative issues**
- **Its more of a narrative, based on its author's experience**
- **Thus it is not a talk which will:**
 - **Cover all the issues**
 - **Pass on a cook book recipe to develop CBM**



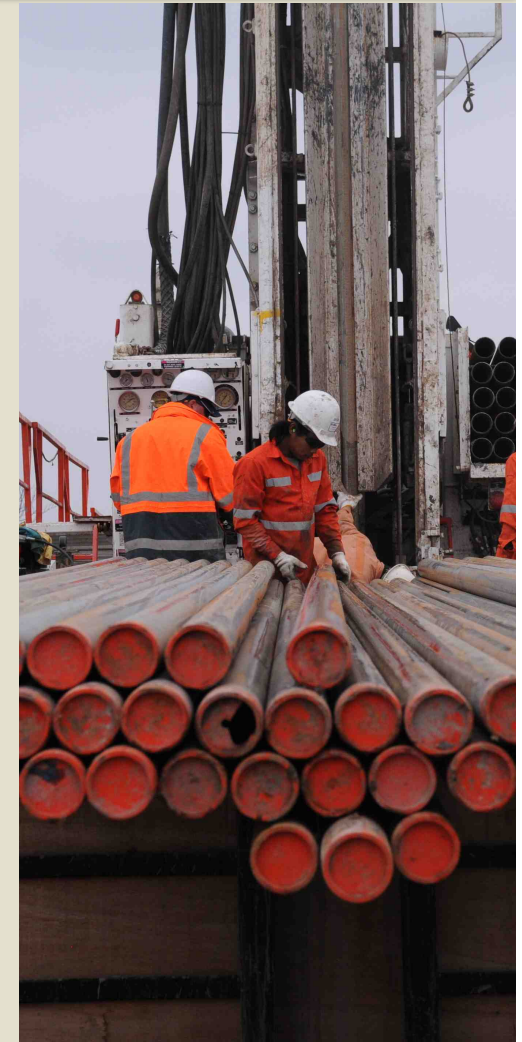
Current Technical Status

- About 50+ CBM PSCs have been issued since 2008 (Kalimantan & Sumatra)
- Work programs vary, but only a very few have met them on time
- 2-3 dozen core holes have been drilled (though more have been under the radar)
- A ‘Baker’s Dozen’ [13] ± dewatering (~pilots or “production”) wells have been attempted
- ‘Little to No’ commercial gas production as of today



Current Technical Status

- Numerous desktop **G&G studies** conducted on just about every CBM PSC (variable quality)
- Reliable **gas volume, gas saturation & gas quality** measures on a few, but increasing number of areas (South Sumatra, Barito, Kutai Basins)
- A very small number of **permeability tests** (some reliable, some not)



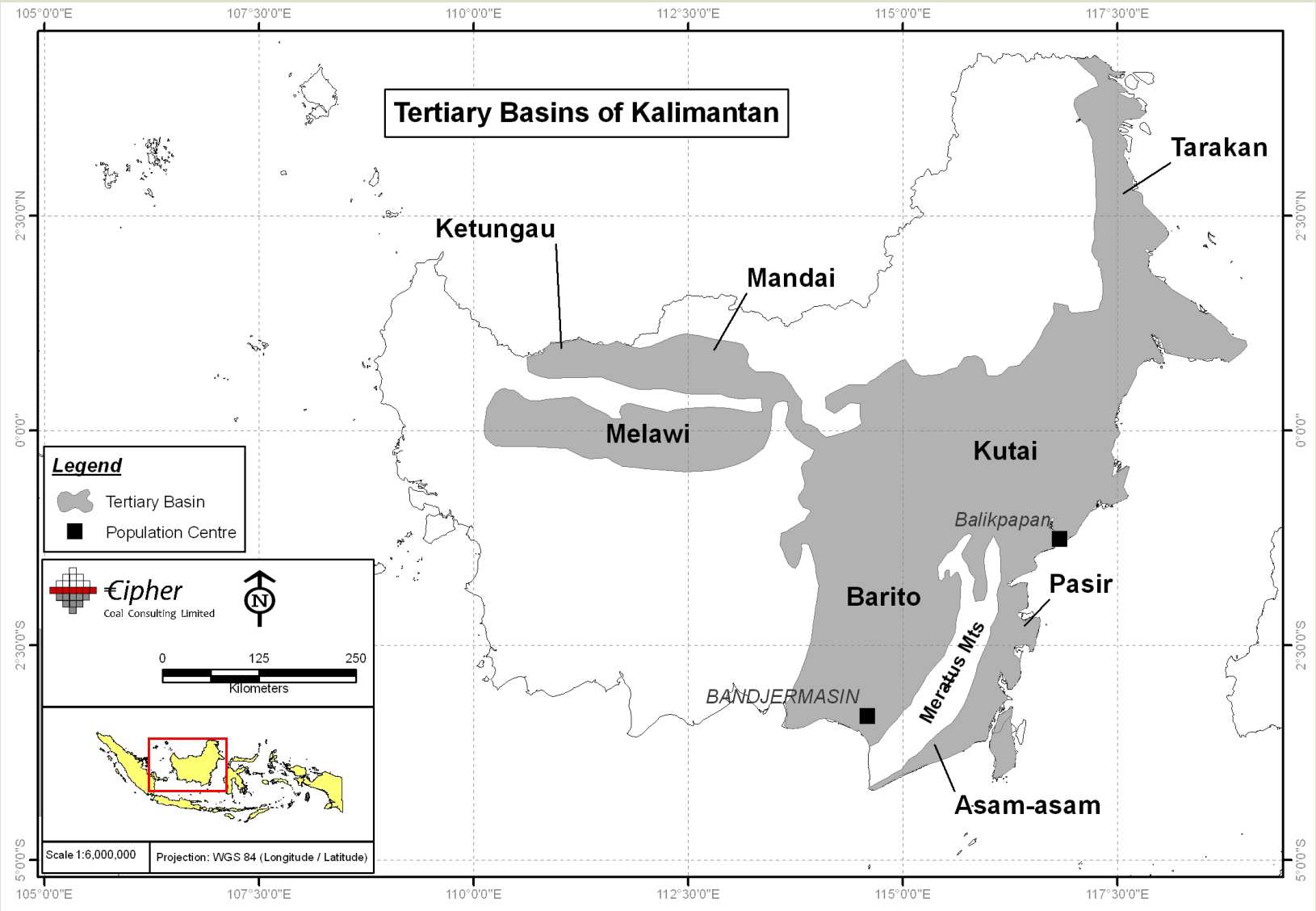
Geological Review - Geographic



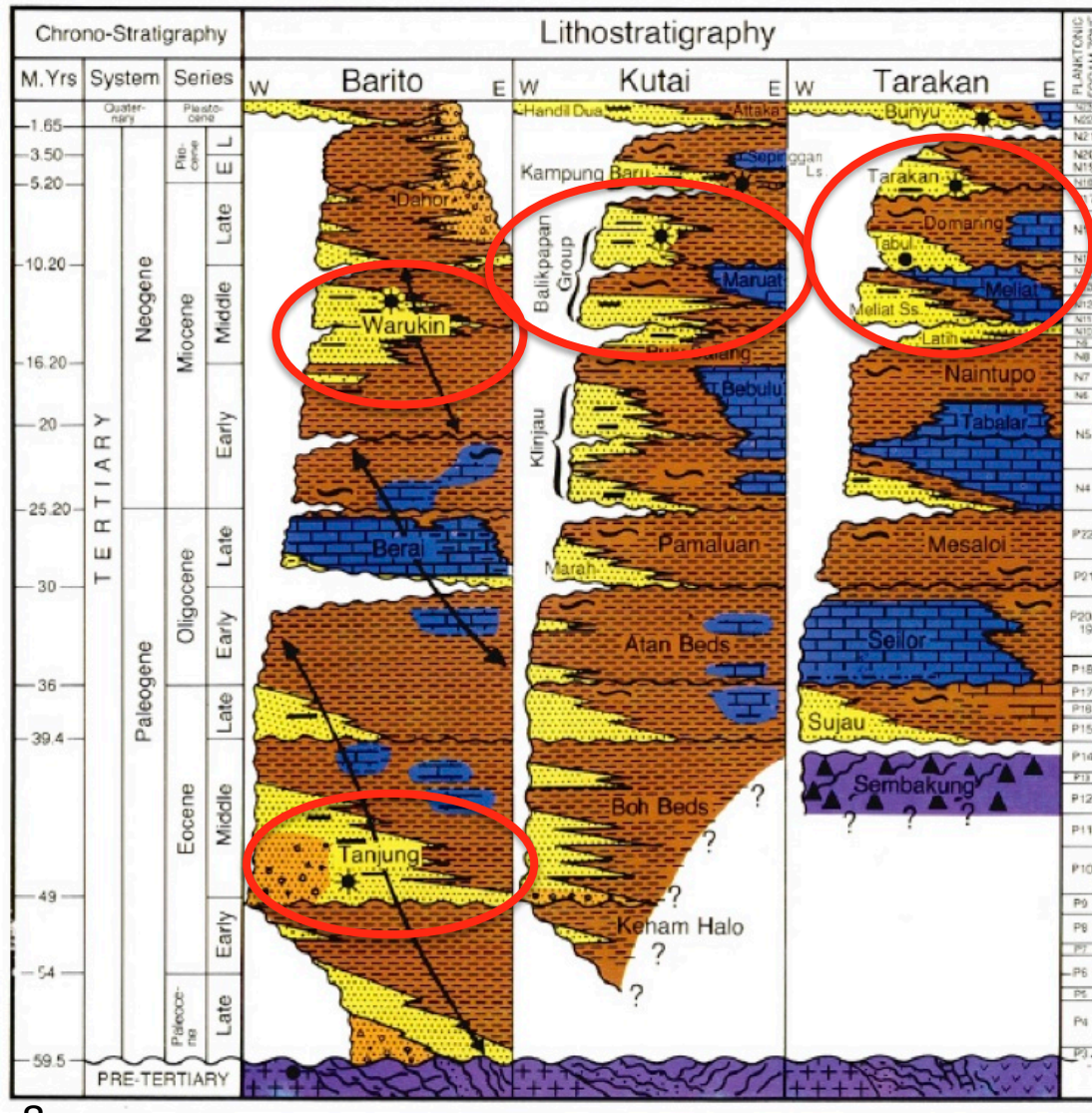
Coal in Indonesia is widespread and occurs in most of the archipelago's islands. However the majority of the CBM targets occur only in four basins:

- 1. South Sumatra Basin**
- 2. Barito Basin**
- 3. Kutai Basin**
- 4. Tarakan Basin**
- 5. Assam Assam/Pasir Basin**

Geological Review - Kalimantan



Geological Review – Stratigraphic [Kalimantan]



CBM Targets Occur only in:

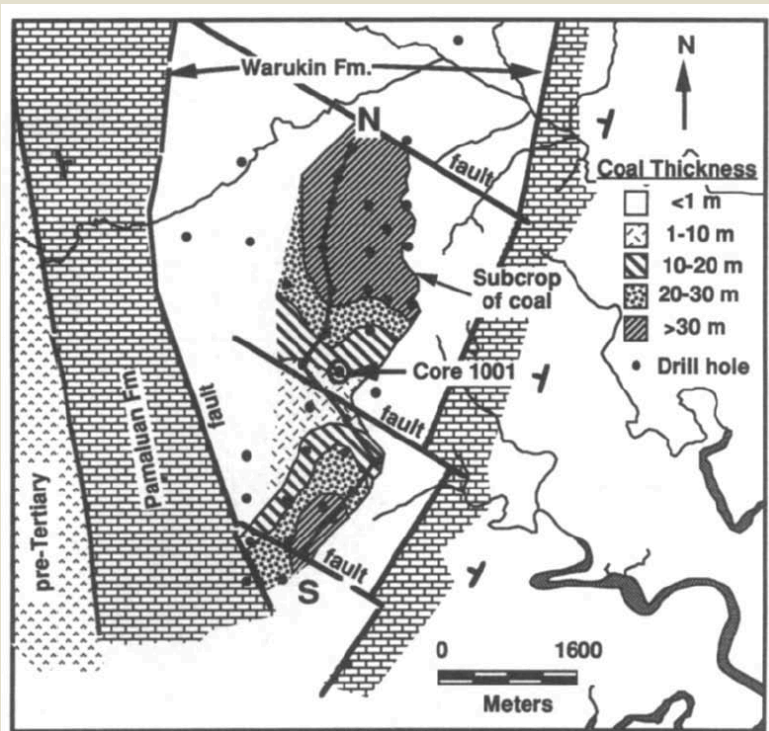
MIOCENE

- Warukin Formation
- Balikpapan Formation
[Kampungbaru Fm↑]
[Pulubalang Fm↓]
- Tarakan Formation

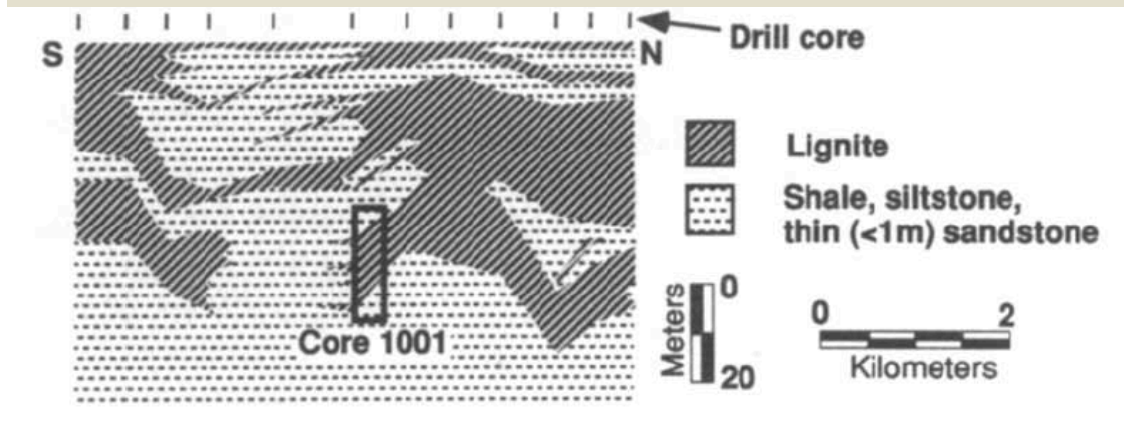
EOCENE

- Tanjung Formation

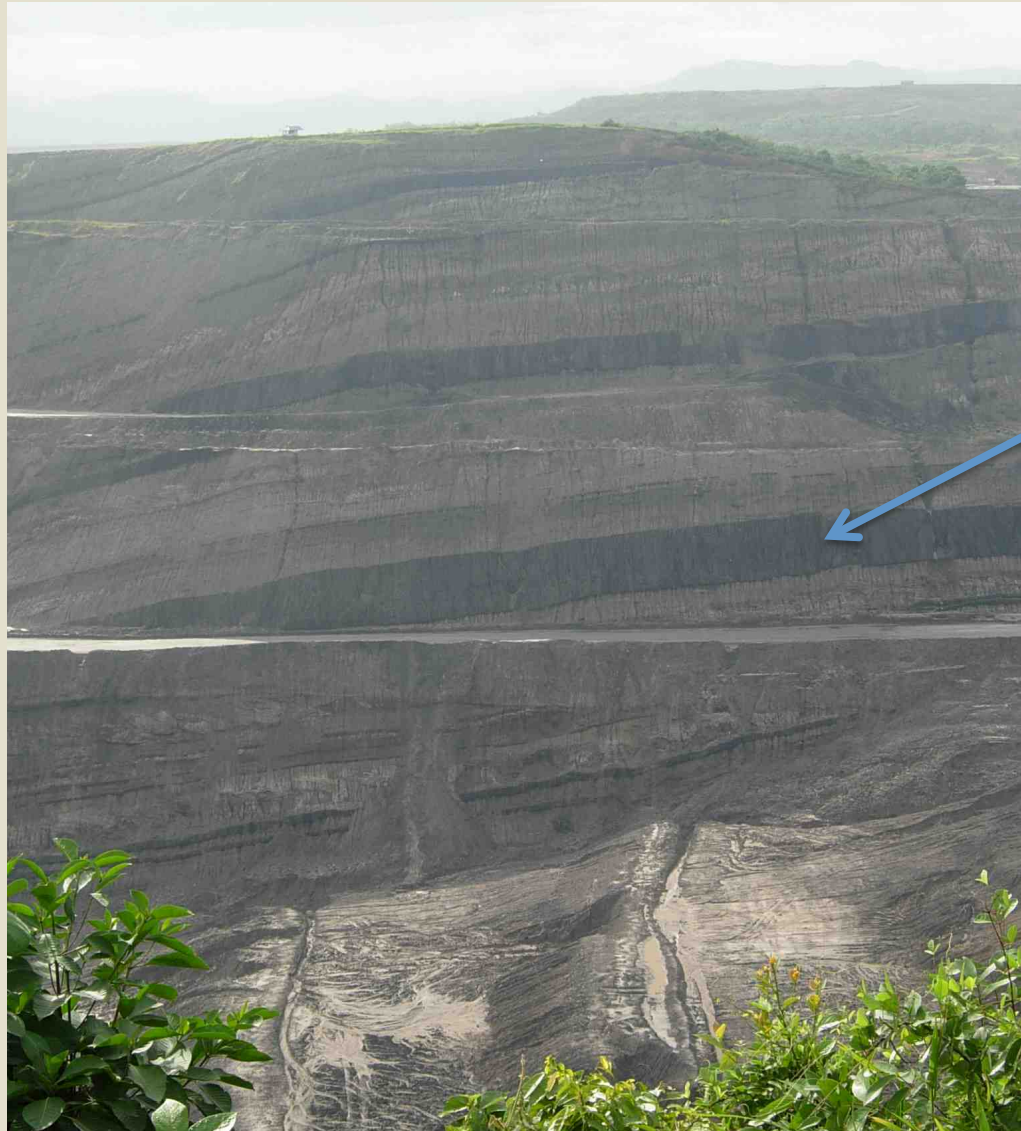
Geological Review: Warukin Formation



from Demchuk & Moore, 1993



Geological Review: Warukin Formation

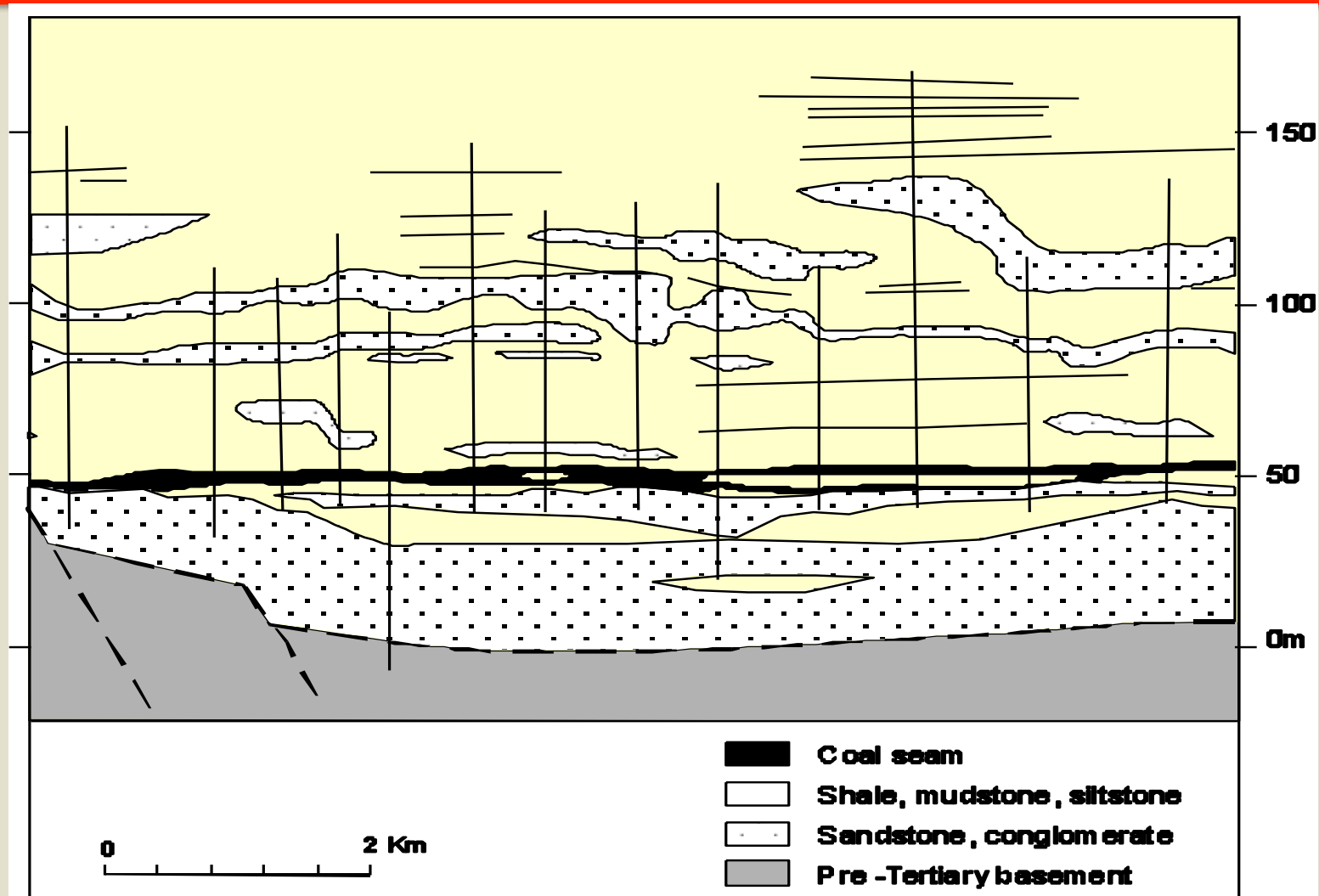


20 m +

Geological Review: Balikpapan Formation

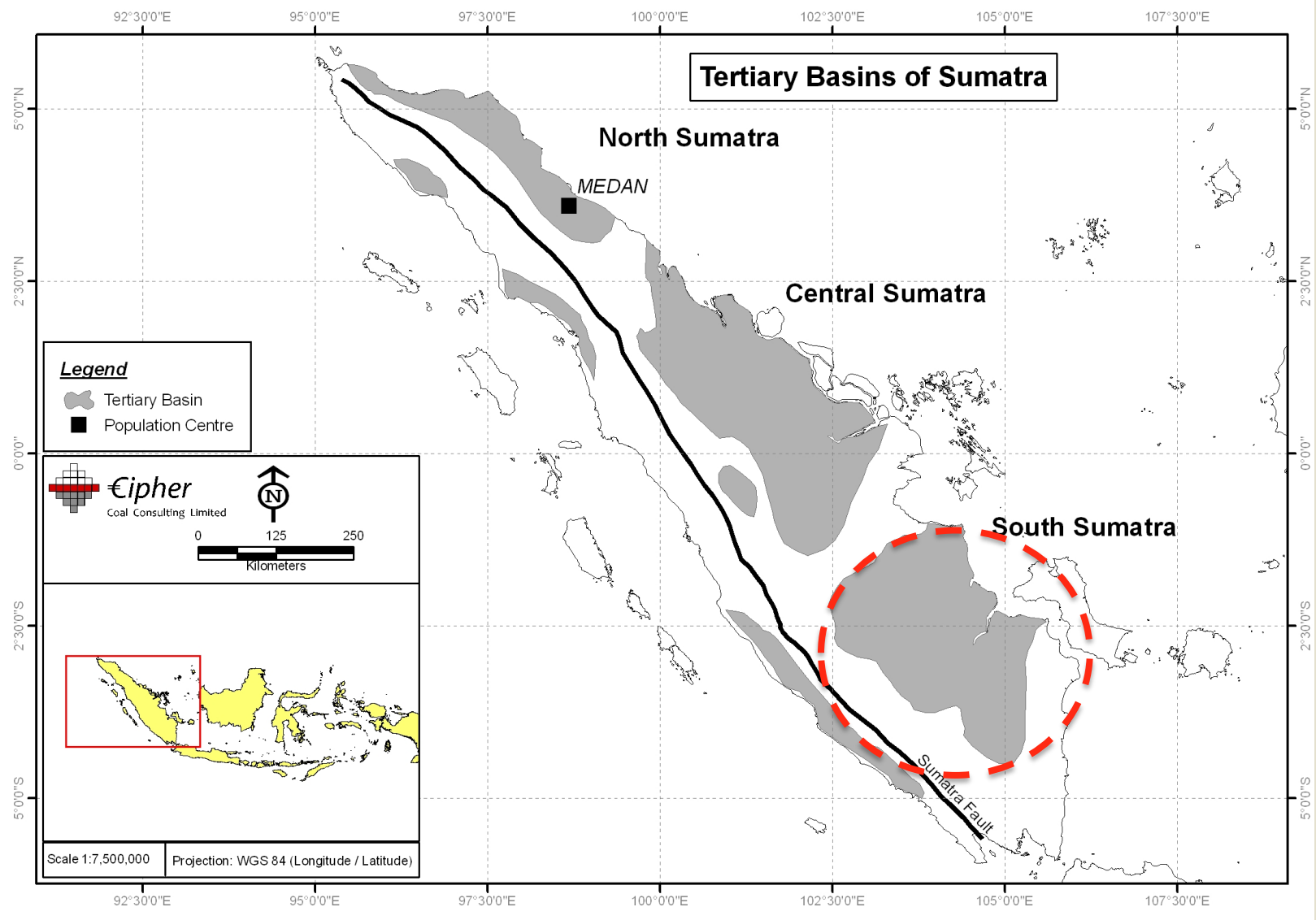


Geological Review: Tanjung Formation

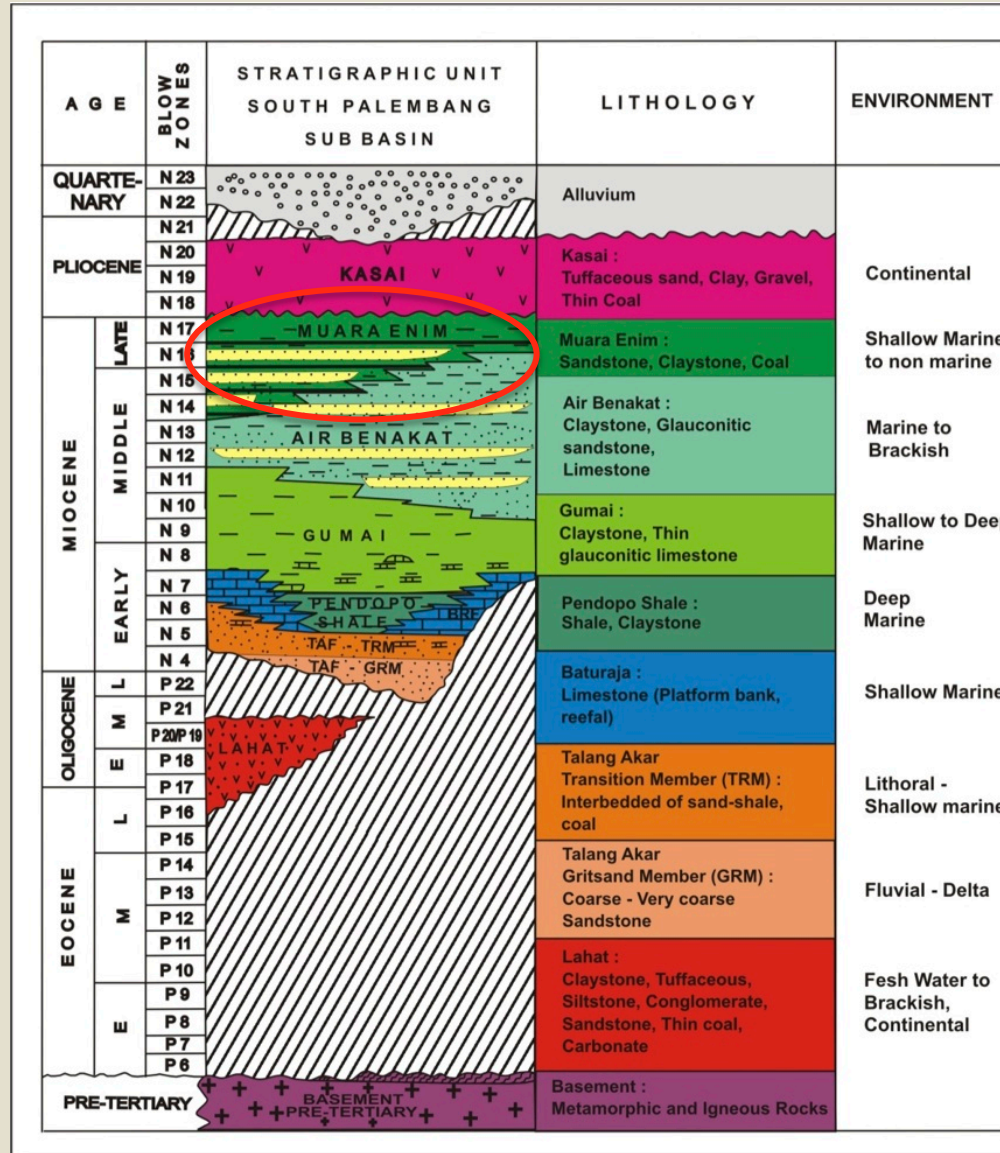


(from Pangabeau, 1991)

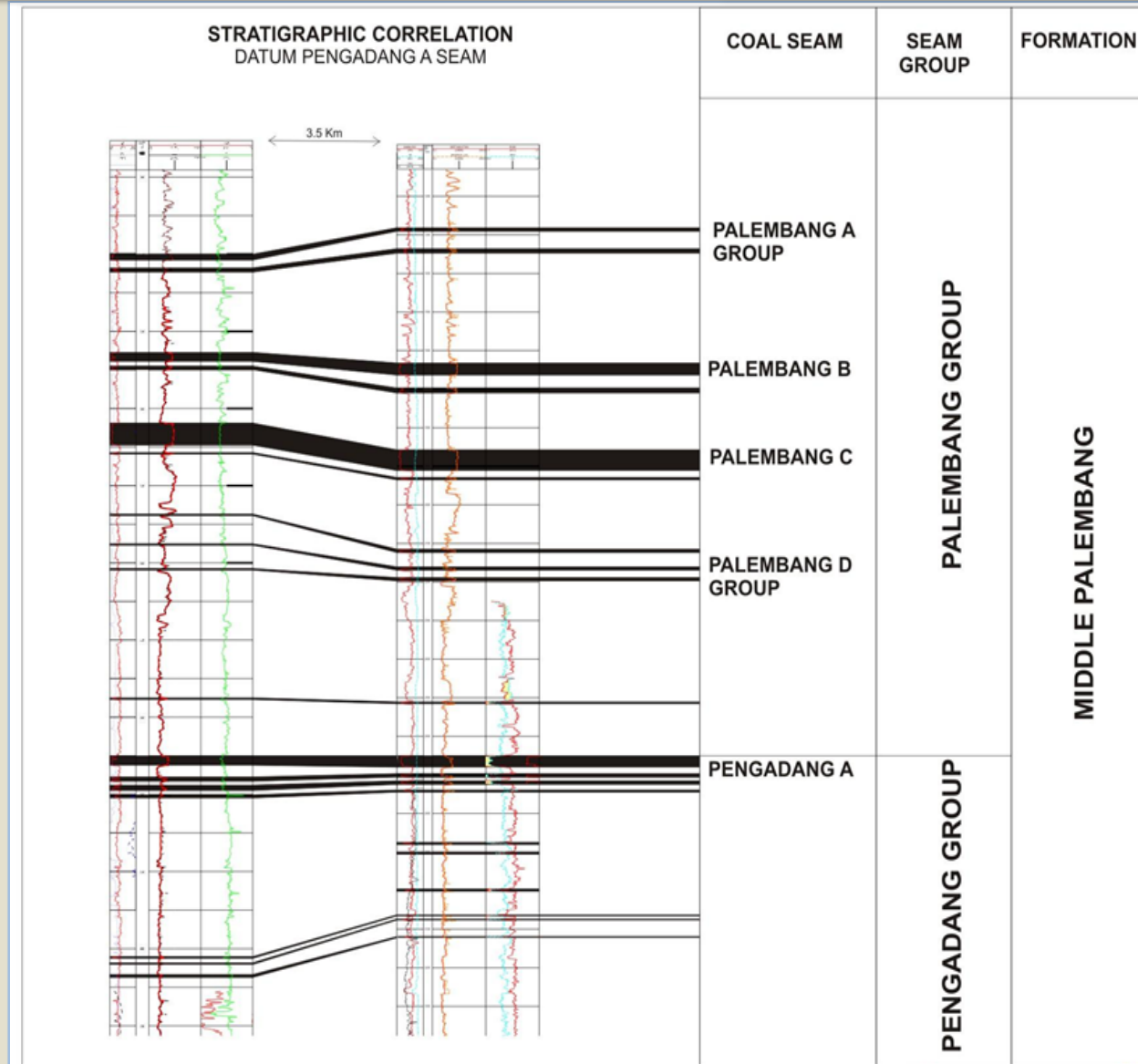
Geological Review - Sumatra



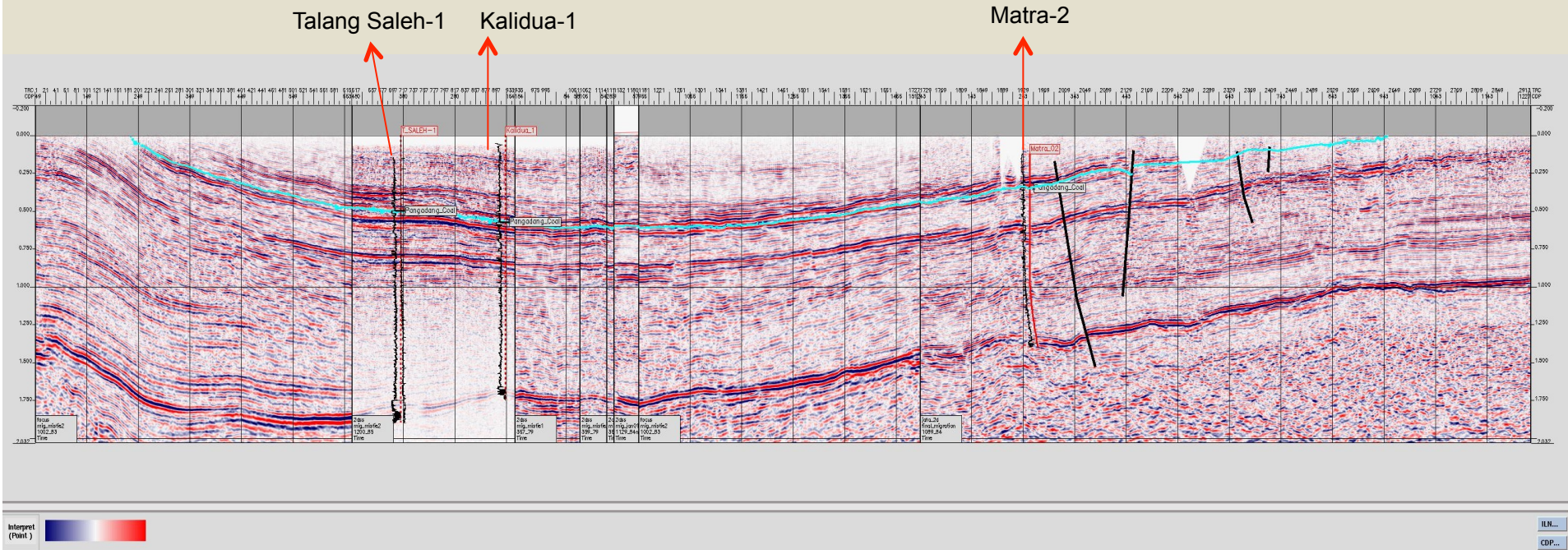
Geological Review – Stratigraphic [Sumatra]



Geological Review – Stratigraphic [Sumatra]



Geological Review – Stratigraphic [Sumatra]



Geological Review - Summary

Basin	Formation	Seam Thickness	Lateral Continuity	Rank
South Sumatra	Muara Enim	Moderate - Thick	High	Lignite - Subbituminous (Bit)
Kutai	Balikpapan	Thin	Low	Lignite - Subbit/Bit
Barito	Warukin	Thick - v. Thick	Moderate	Lignite - Subbit
Assam Assam/Pasir	Warukin	Thick - v. Thick	Low - Moderate	Lignite - Subbit
Assam Assam/Pasir	Tanjung	Moderate	High	Subbit - Bit.

Testing Caveats for Exploration

Overall

- What makes a good core hole, doesn't necessarily make a good permeability or production test well
- These are green field areas: in 100% of cases, trying to get core & a production test out of the same well has failed

Gas Content/Gas Saturation/Gas Quality

- Wire-line coring must be used, without this realistic gas volume, saturation and quality can't be estimated
- Don't be shy, take a lot of samples. There is a lot of variation in gas properties

Permeability

- Understand the nature of the tests, be skeptical of results
- Long-term tests are better & more reliable than short



Some Engineering Challenges

Balikpapan Formation

- *Completion over multiple seam horizons over 100s of m*
- *Permeability [fracking of thin seams]*
- *What to do with conventional oil and gas?*

Warukin Formation

- *De-watering and water disposal*
- *Low reservoir pressures in low rank reservoirs*

Tanjung Formation

- *Possible low permeability*
- *What to do with conventional oil and gas?*

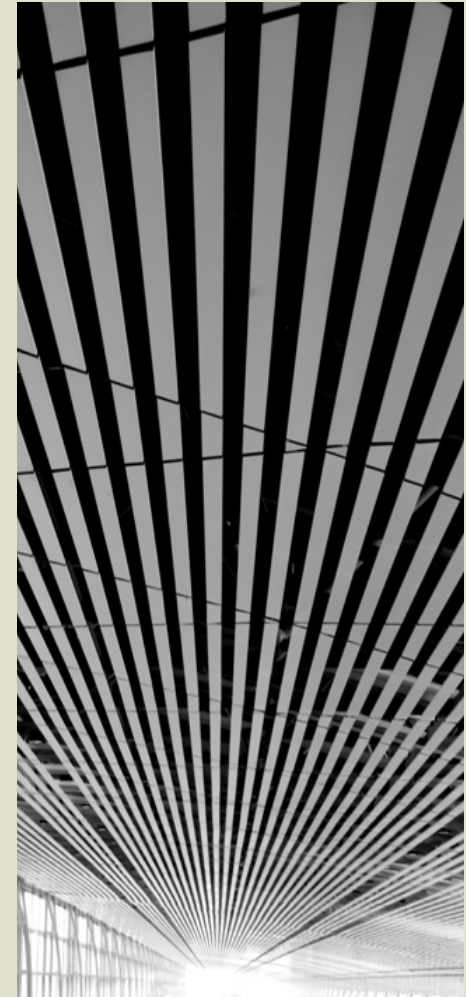
Muara Enim Formation

- *Co-mingling of seams (of different ranks)*
- *De-watering and water disposal*



Regulatory & Cultural Challenges

- **Currently, CBM exploration is regulated like conventional O&G**
- **CBM in Indonesia is at a similar stage of where exploration for oil was in the 1920s, but regulations are treating it like a mature industry**
- **Though ‘every basin/coal is different’, overseas experience has to find a way to be integrated into local knowledge**
- **As in any country, there is resistance to outside leadership in a domestic industry**



Solutions



- Don't try to do too many things in a single well – if you do it will be bound to fail
- Gather data. It is the least expensive of all the tasks
- Engineering solutions are out there, but there is no 'silver bullet' - plan, trial and be patient
- The regulatory regime needs to be more flexible, rewarding the quick, the efficient and the innovative
- More openness in sharing successes and failures within the industry
- Recognise that for CBM to be a sustainable industry in Indonesia, it ultimately has to be lead and run locally

