THE ENIGMA OF THE PINANG DOME (KALIMANTANAN TIMUR):
A REVIEW OF ITS ORIGIN,
SIGNIFICANCE AND INFLUENCE ON
COAL RANK AND COALBED METHANE
PROPERTIES

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OUTLINE OF PRESENTATION

- Key Questions
- Location
- Stratigraphy & Geology
- Data Types & Limitation
- Geothermal Gradient
- Vitrinite Reflectance/Rank Data – Vertical & Lateral
- Gravity
- Summary, Conclusion & Implications
Does the rank of coal increase towards the Pinang Dome?

What is the cause of any rank increase?
Location
Kampungbaru Formation:
Siltstones, sandstones, thin coal beds & claystones

Balikpapan Formation:
Coal (thin to med thick), siltstones, claystones & sandstones

Pulubalang Formation:
Siltstones, claystones, thin and occasional coal beds & sandstones

Bebulu Formation:
Limestones, sandstones, marls & claystones

Pamaluan Formation:
Marls, siltstones, claystones
Coal seams in the Balikpapan Formation
Types of Data

**Existing oil & gas wells:** vitrinite reflectance measurements, down-hole temperature (Fukasawa et al., 1987; Herudiyanto, 2006)

**Detailed mine drill holes:** vitrinite reflectance (Nas, 1994)

**Coalbed methane drill holes:** vitrinite reflectance, coal quality, down-hole temperature (Moore et al., 2012)

**Geophysical surveys:** Bouguer gravity anomaly (numerous references)
Data Limitations

I need more data!

- More data is out there – but very hard to obtain
- Some data is available, but not allowed to use
- Contradictory/imprecise locations for some data
- Not enough documentation on data collection and analysis methods
Data Distribution

Data from Herudiyanto, 2006; Nas, 1994; Fukasawa et al., 1987; Moore et al., 2012

Conventional oil & gas drill hole

CBM drill hole

Mine drill hole
Geothermal Gradient

REGIONAL:
- 27° - 36°C/km (Kenyon et al., 1976)
- 30° - 39°C/km (Thamrin, 1985)

WELLS:
- SD-1 – 17° C/km

~50°C/km
Conventional O&G wells

Bottom of the Balikpapan Fm:
S-3: 2100 m
Pinang -1: 1372 m
S-1: 1250 m

Rate of Vr increase down hole:
S-3: 0.19%/1000 m (0.74% lower)
Pinang -1: 0.24%/1000 m (0.83% lower)
S-1: 0.20%/1000 m
Mine Data: Vitrinite Reflectance Sangatta Coal Seam

(from Nas, 1994)
More Recent Data: Vitrinite Reflectance

Calorific Value (cal/g, dry ash free)

% Vitrinite Reflectance (mean max)

0.08%/1000 m
0.12%/1000 m
0.34%/1000 m
Bouguer Gravity Anomaly

- There is a Bouguer Gravity Anomaly high associated with the Pinang Dome.
- The high values are not perfectly centered over the Pinang Dome.
- The highest values are to the west and southwest of the dome.
- The high values indicate the presence of more dense rocks at some depth.
Summary

1. The...are.
2. Several...down to the...the.
3. Two...‘normal’...have than about...and/or...formally.
4. Vr...Dome...has...around...
5. High...SW...sug...near...some.
6. High...ass...some
Conclusions

• Does rank increase towards the Pinang Dome?

Yes, though it appears not uniformly

• What is the cause of any rank increase?

The rank increase could only be an apparent increase and related to relative stratigraphic position

But, the presence of a high geothermal gradient, high Bouguer Gravity Anomaly values and rank increases in coal seams, suggests a heat source at depth.

A caveat: heat flow in the area is obviously complex, and it would be erroneous to assume a uniform increase in organic maturation from all directions towards the center of the Pinang Dome.
Implications

• Only the western and southwestern areas around the Pinang Dome may have coal ranks in the bituminous rank range (and thus have high graded value)

• Methane generated from the coal in the higher rank areas will be thermogenic, and thus the reservoir may be fully gas saturated. However, CO₂ may be an issue as a ‘contaminant’.