Critical Look at Fracture Diagnostic through a Lens of a Geomechanicist: Oman Experience

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Motivation

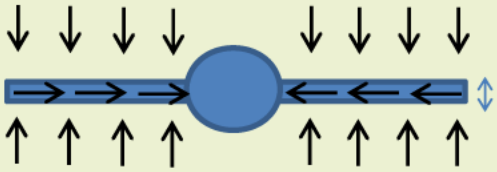
- Big percentage of oil and gas wells in Oman are being hydraulically fractured (HF)
- Geomechanical settings are one of the critical controls in the success of HF
- Predictive capability of GM models is most powerful when integrating deterministic and probabilistic treatment

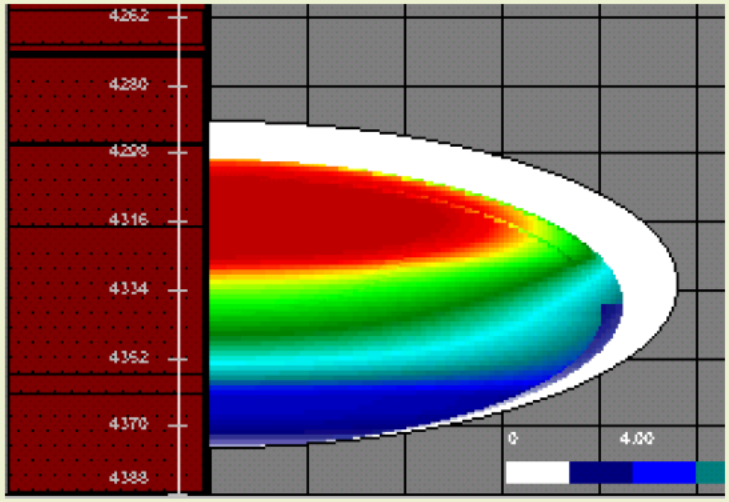
Presentation Objectives

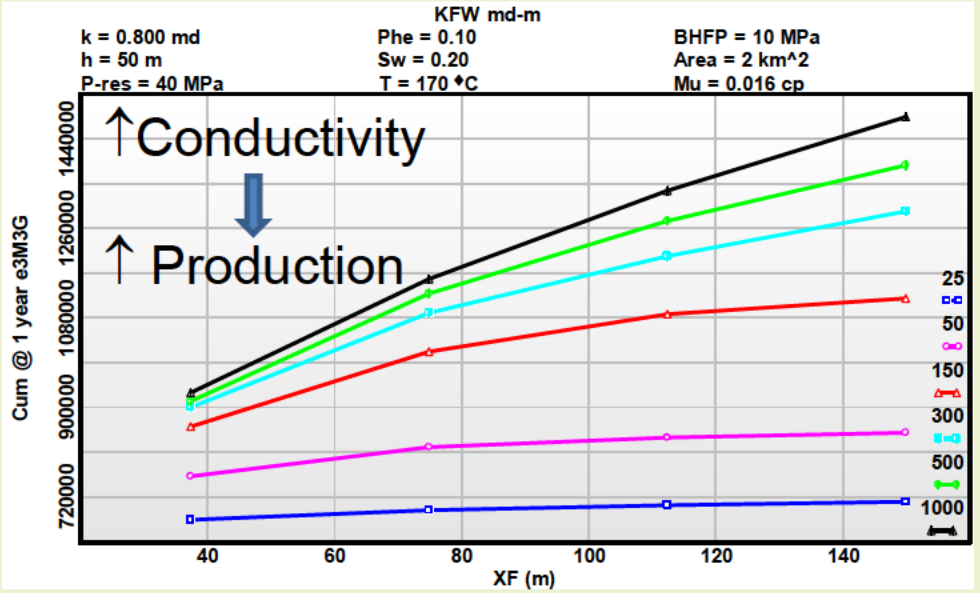
- Highlight some challenges with interpretation of hydrofracture monitoring data

- Articulate industry needs for analytical technology development

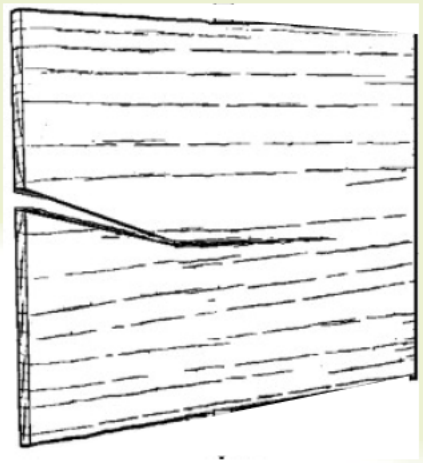
Why Geomechanics?

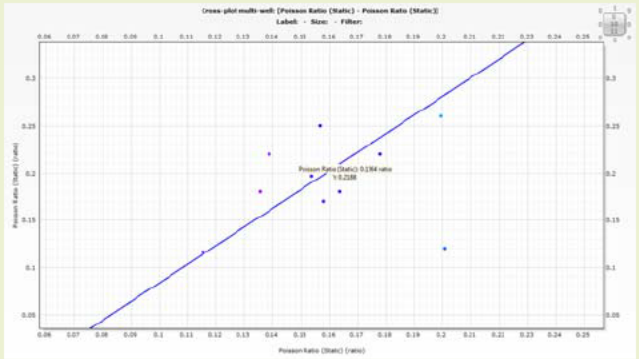


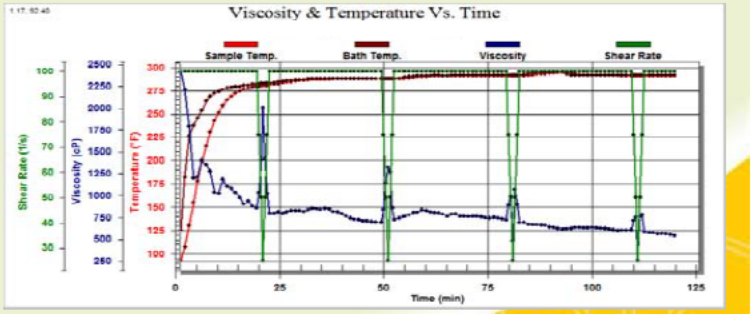




Uncertainties







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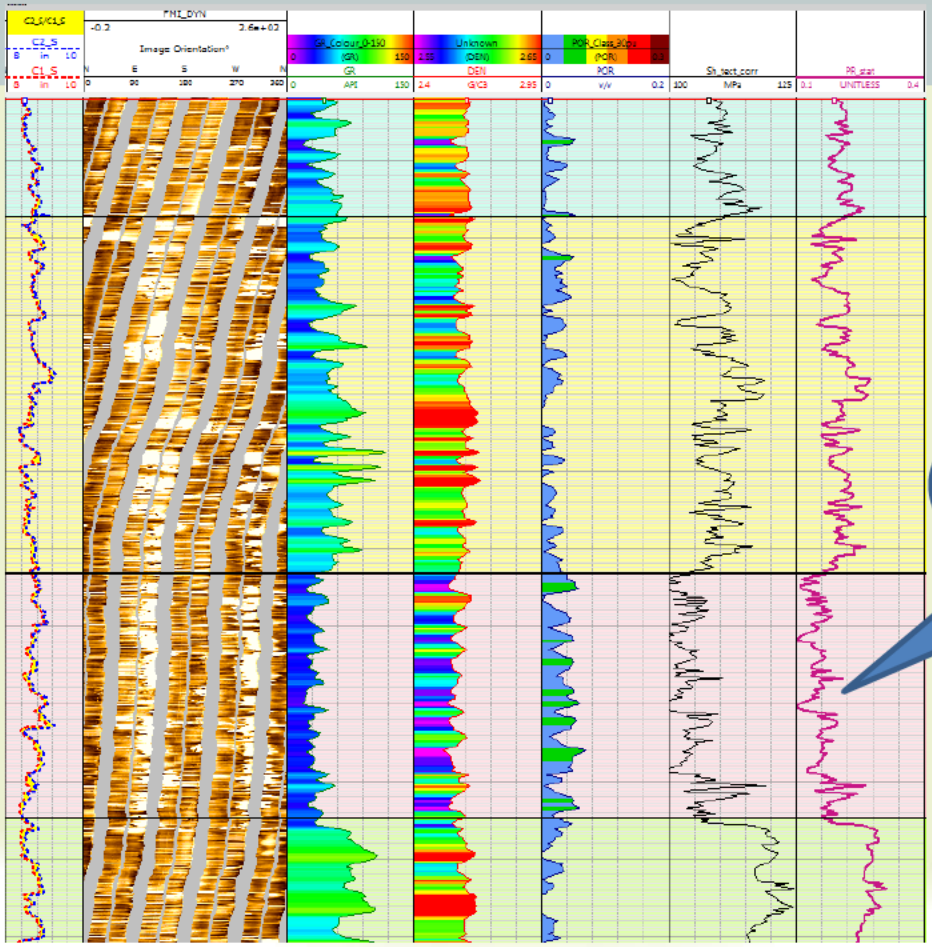
Example 1

Geomechanical model input

Layer	TVD Depth to Top of Zone (m)	Type	Stress Difference (MPa)	Stress Gradient from Surface (MPa/m)	Stress at Top of Zone (MPa)	Stress Gradient (MPa/m)	Stress at Bottom of Zone (MPa)	Modulus (e4MPa)	Poisson's Ratio	K-Ic	Fluid Loss Coefficient (ft/root (min))	Spurt Loss (m3/m2)	Proppant Embedment (Kg/m^2)
1	883.9	OB	0.0	0.037	32.8	0.000	32.8	2.757860	0.26	2000.0	0.000000	0.00000	0.00000
2	1493.5	OB	-8.7	0.016	24.1	0.000	24.1	2.757860	0.26	2000.0	0.000000	0.00000	0.00000
3	1539.3	BK0-1	8.7	0.021	32.8	0.000	0.0	2.757860	0.23	2000.0	0.000000	0.00000	0.00000



~60m

5 BD attempts with estimated $P_c > S_v$

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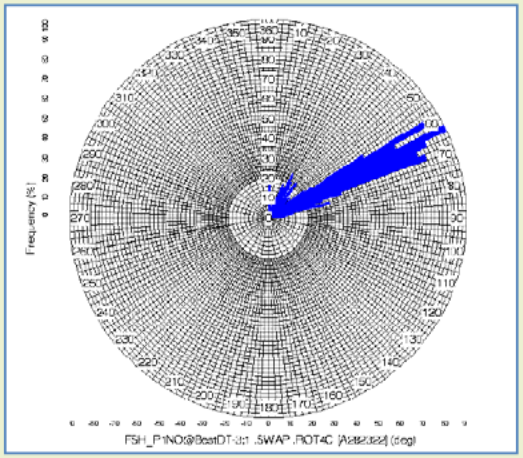
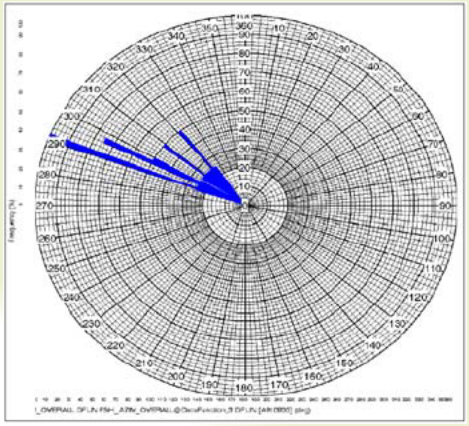
Example 2

Shear Anizotropy

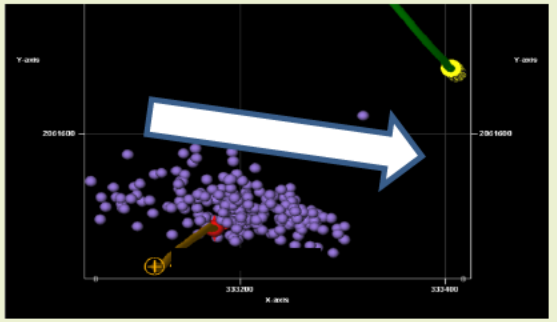
Well 1



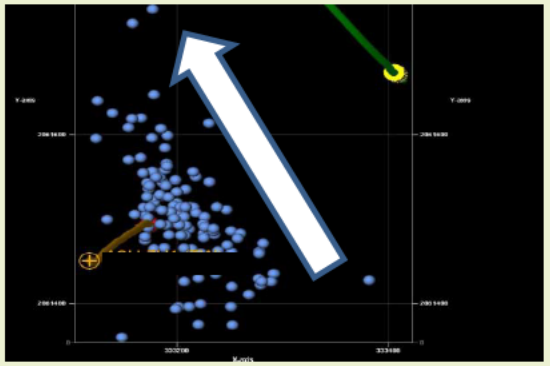
Well 2



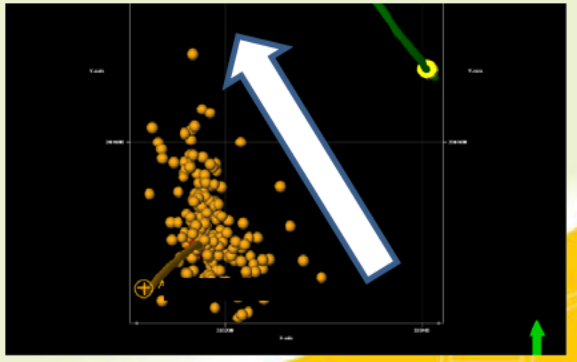
Microseismic Well 2



Stage 1

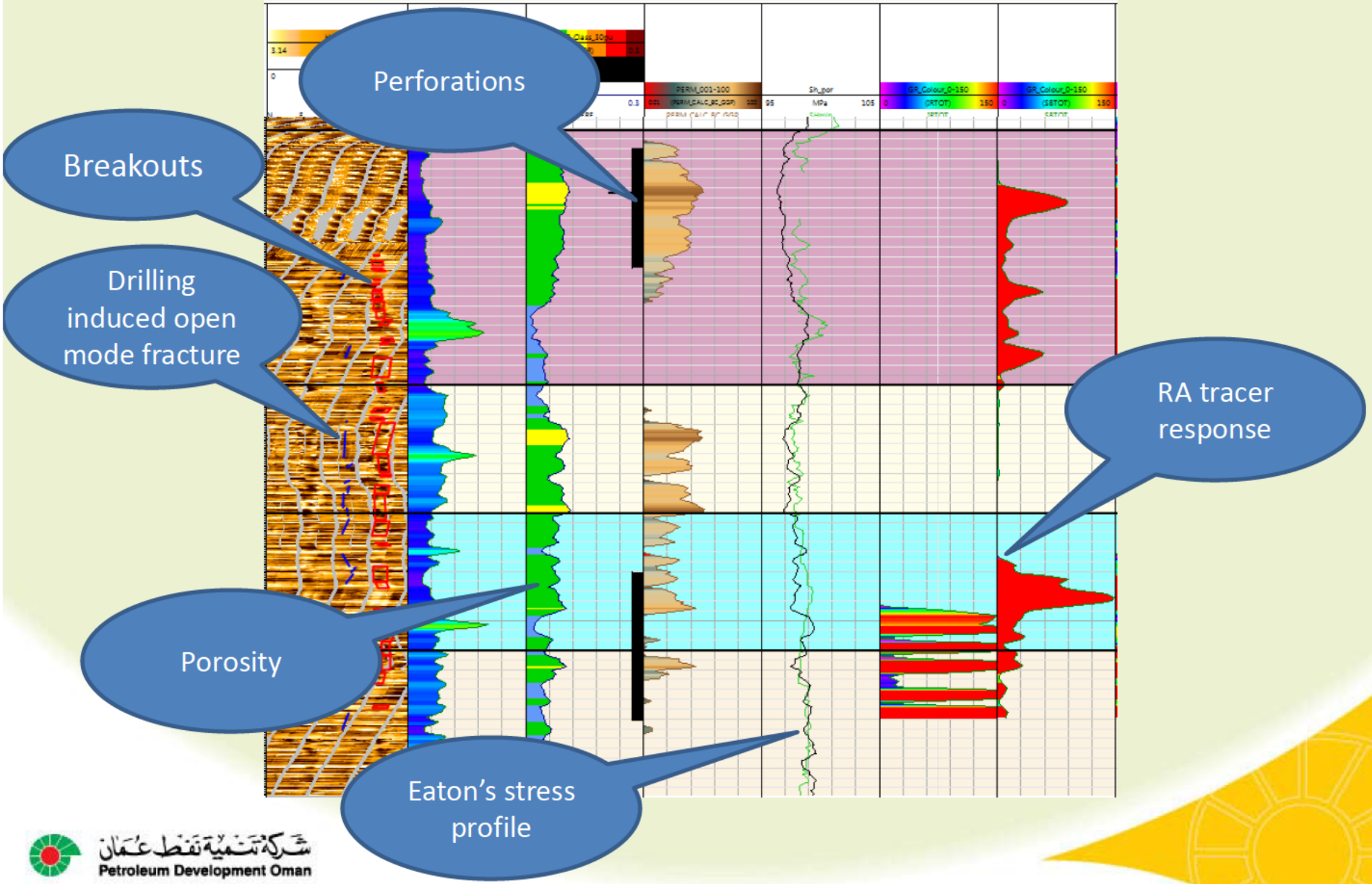


Stage 2



Stage 3

Example 3



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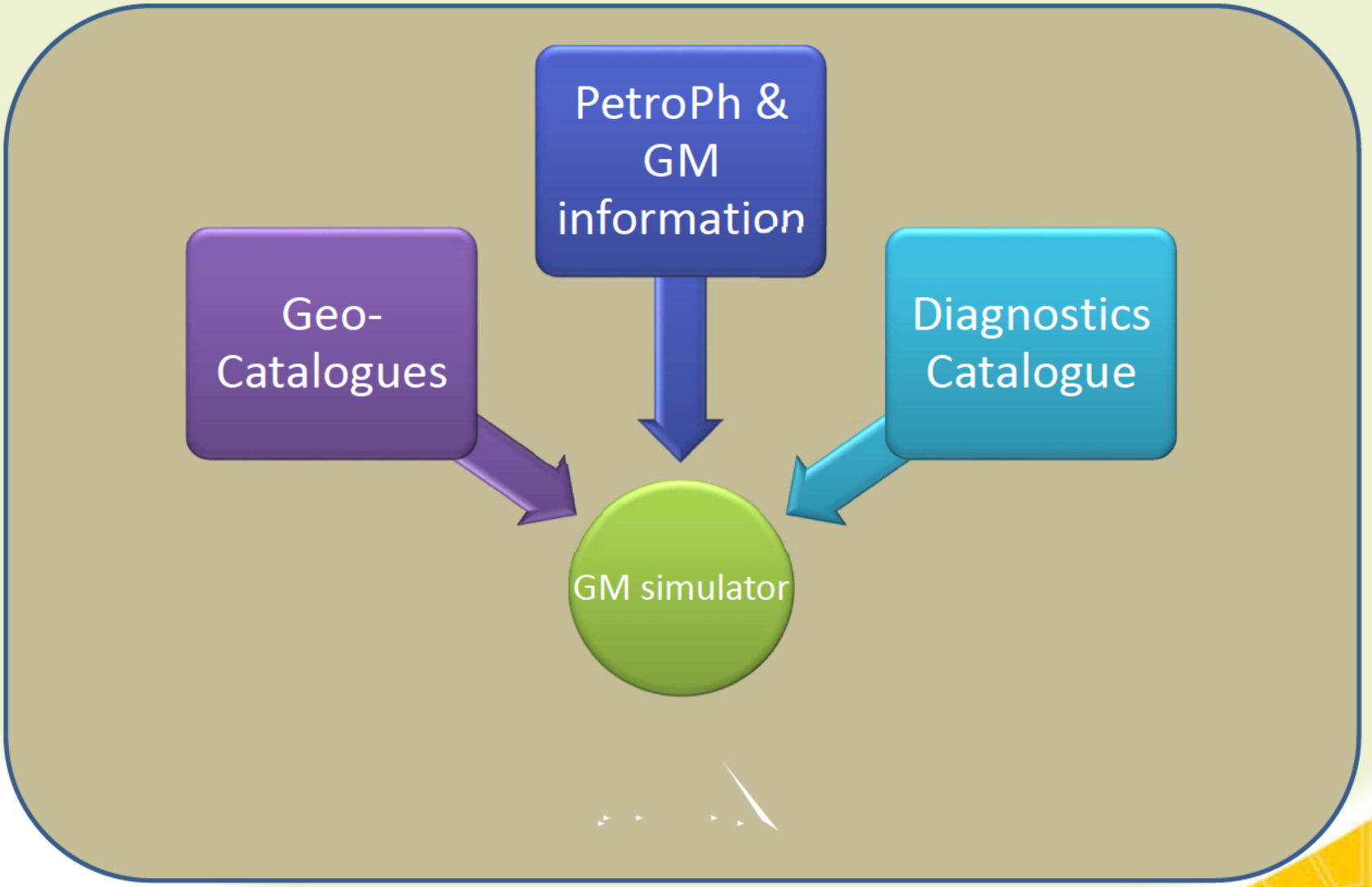
Geomechanics Workflow



Conclusions

- Refined geomechanics models are most beneficial in brown fields
- High uncertainty in model inputs can negate model sophistication
- For practical utilization it is beneficial to combine deterministic and probabilistic geomechanical analysis