Developing a synthetic grid block model for coal seams in the Surat Basin

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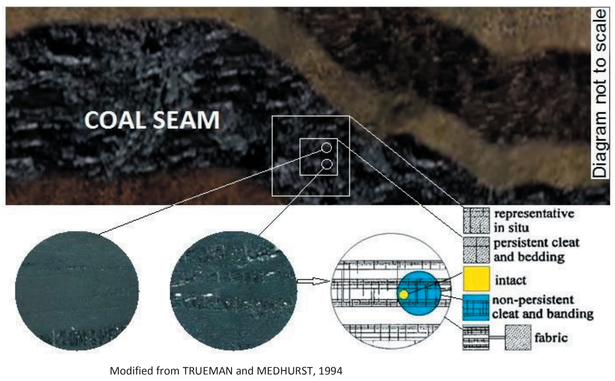
INTRODUCTION

The coals of the Surat Basin are texturally very different, consisting of multiple thin (< 0.5m to 2m) coal beds, stacked into groups of many metres. Within each bed, the coals can be subdivided into even thinner (centimetre to decimetre scale) lithotypes that are separated by claystones. These characteristics show distinct geotechnical and gas flow behaviours, which are yet to be clarified.

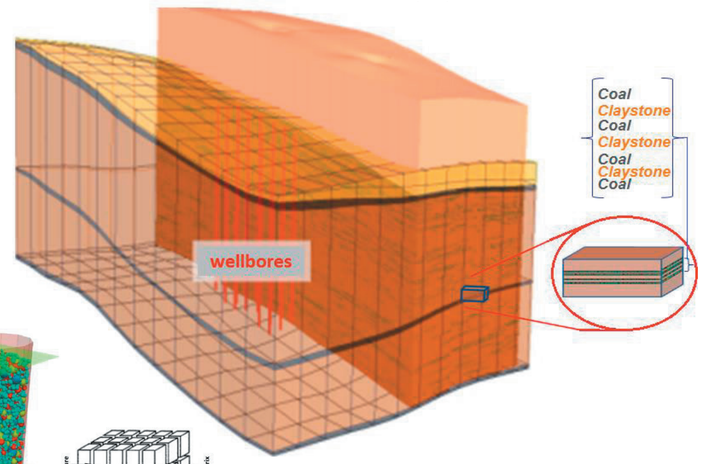
The coals are jointed and cleats are poorly developed at low rank, except for some incipient cleats in the few bright bands. The fracture toughness in low rank coals is very high relative to more brittle bituminous, high rank coals. However, strength data suggests that the low rank coals are weak, after all. The juxtaposition of thin, tough, but jointed coal lithotypes against greasy claystones makes the laboratory testing of the strength of intact rock a difficult task.

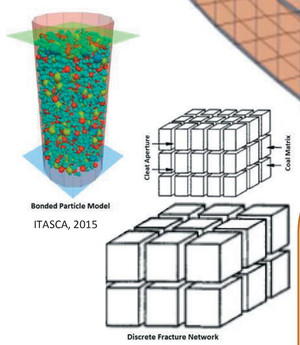


Modified from TRUEMAN and MEDHURST, 1994

METHODOLOGY

Numerical modelling approach (Potyondy and Cundall, 2004): a *synthetic grid block model* with better representation of coal geomechanical behaviour is proposed for the CSG reservoir.





B. Synthetic Grid Block Construction

Build a synthetic rock mass of a typical 25m*25m*1m grid block of Walloon coal including interburden.

Determine appropriate parameterisation for synthetic grid block to allow modelling of different regions of the Surat Basin.

COUPLED MODEL

PFC

COAL

DFN Properties: JOINTS and CLEATS: size distribution, densities, positions , and orientations plus DFN dimensions

DFN of coal per lithotype and its characteristics

FLAC

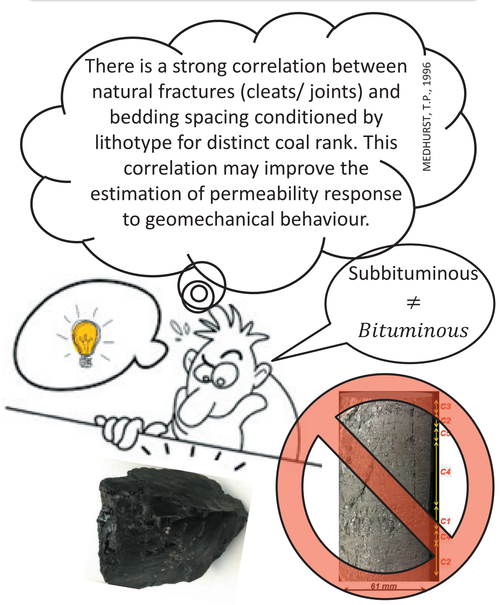
Interburden

C. Synthetic Grid Block Analysis

Numerical evaluation of the influence of natural fractures (cleats and/or joints) using the synthetic grid block model for the Surat Basin.

Calibration of the model by comparison with previous models, well tests and production profiles conducted for the Surat Basin.

HYPOTHESIS



KNOWLEDGE GAPS

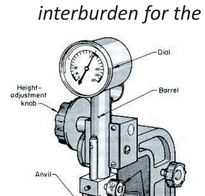
1. Coal parameters from "intact" samples… There is not a straightforward means to correlate the rock strength obtained from laboratory experiments or geophysical data to the strength of the rock mass, in particular for coals.

2. The higher moisture gas-bearing coals in the Surat Basin are of low rank and there is insufficient data to support that they should be treated the same as high rank coals, as is currently done.

3. There is little knowledge about the stress-strain relationships in the Surat Basin coal material, imparting specific also unstudied ground responses impacting in the reservoir performance.

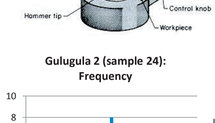
SCOPE OF WORK

A. Characterisation of coal and interburden for the Surat Basin



Scleroscope hardness

Gulugula 2 (sample 24): Frequency



Hopkinson pressure bar

Estimate interburden rock strength with geophysical well log - local calibration

ACKNOWLEDGEMENT

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