Structural influence on in-situ stress and fracture variability within Walloon Subgroup, Surat Basin

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Project: Understanding Faults and Fractures in the Surat Basin

INTRODUCTION

Understanding the structural controls on the present day in-situ stress and fracture distribution is fundamental to recognize the permeability distribution within coal seam gas reservoirs. The Jurassic Walloon subgroup coal measures experienced subtle deformation associated with folds, faults; especially in the eastern part.

Significant variation of in-situ stress orientation and magnitude also observed within the Surat Basin. This has been attributed to either localised stress perturbations surrounding basement faults and associated stratigraphic juxtaposition, or to regional lithological variations and proximity to weaker but thicker sediments in the trough (Brooke – Barnett et al., 2015).

AIMS OF THE STUDY

The major aims of this study are

To examines the present day in-situ stress variations as well as fracture orientations and density within Walloon Subgroup in different structural domains (Figure 1) .

Map the in situ stress variation, fracture intensity and density near and away from major basement structures (MGFS, LBFS), folds (Undulla Nose, Kogan Anticline) associated with the deeper basement structures which will be used to build an index of fracture density and intensity proximal to structures.

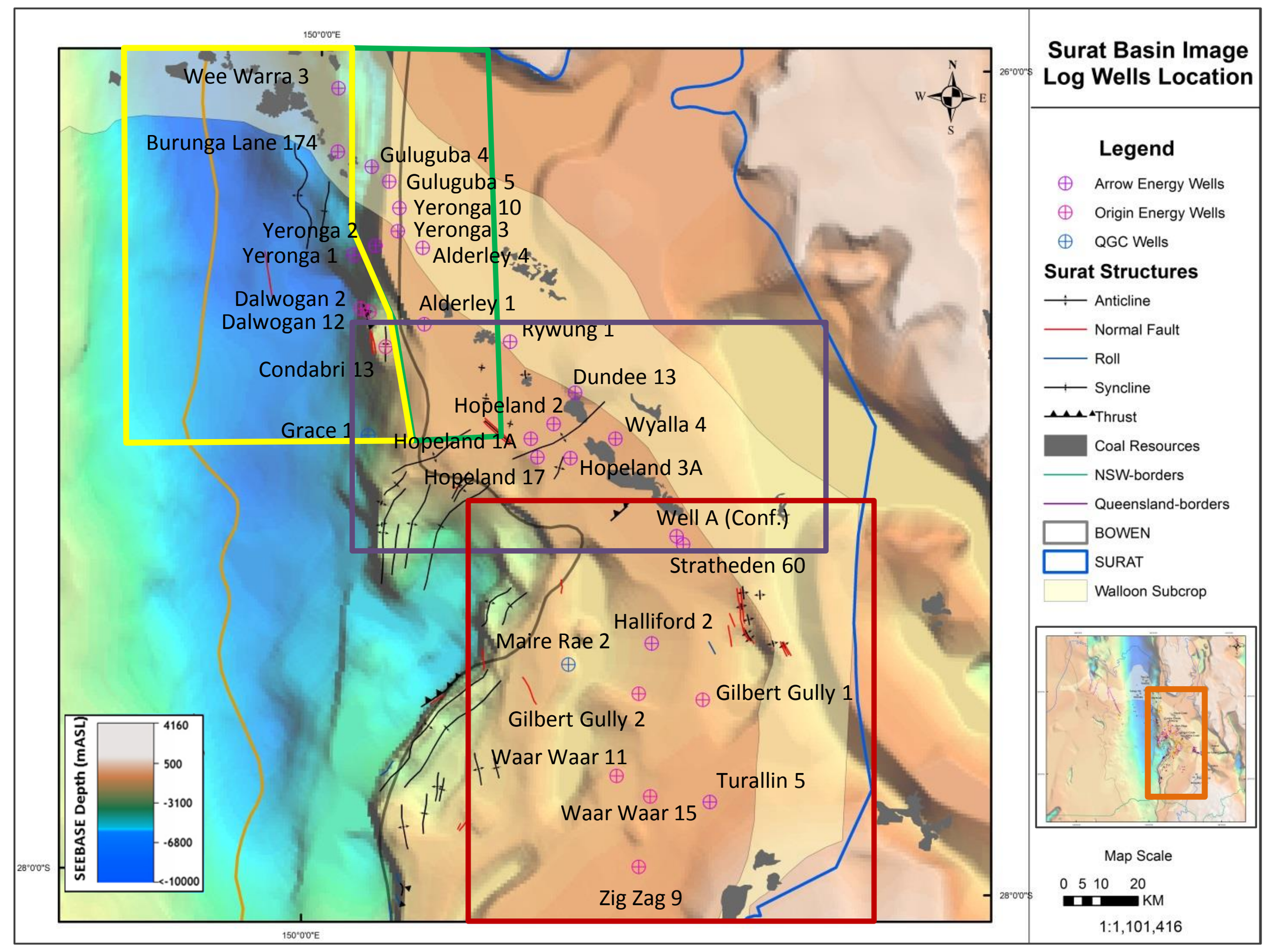

Figure 1 Map showing specific structural areas / domains [Mimosa syncline (1A), West of Leichhardt – Burunga Fault System (1B), Undulla Nose (2), Kogan anticline and SE of Moonie – Goondiwindi Fault system (3)]within study area, Eastern part of Surat Basin. Walloon subcrop Proterozoic depth to basement SEEBASE is an underlay; (Oz SEEBASE, 2005).

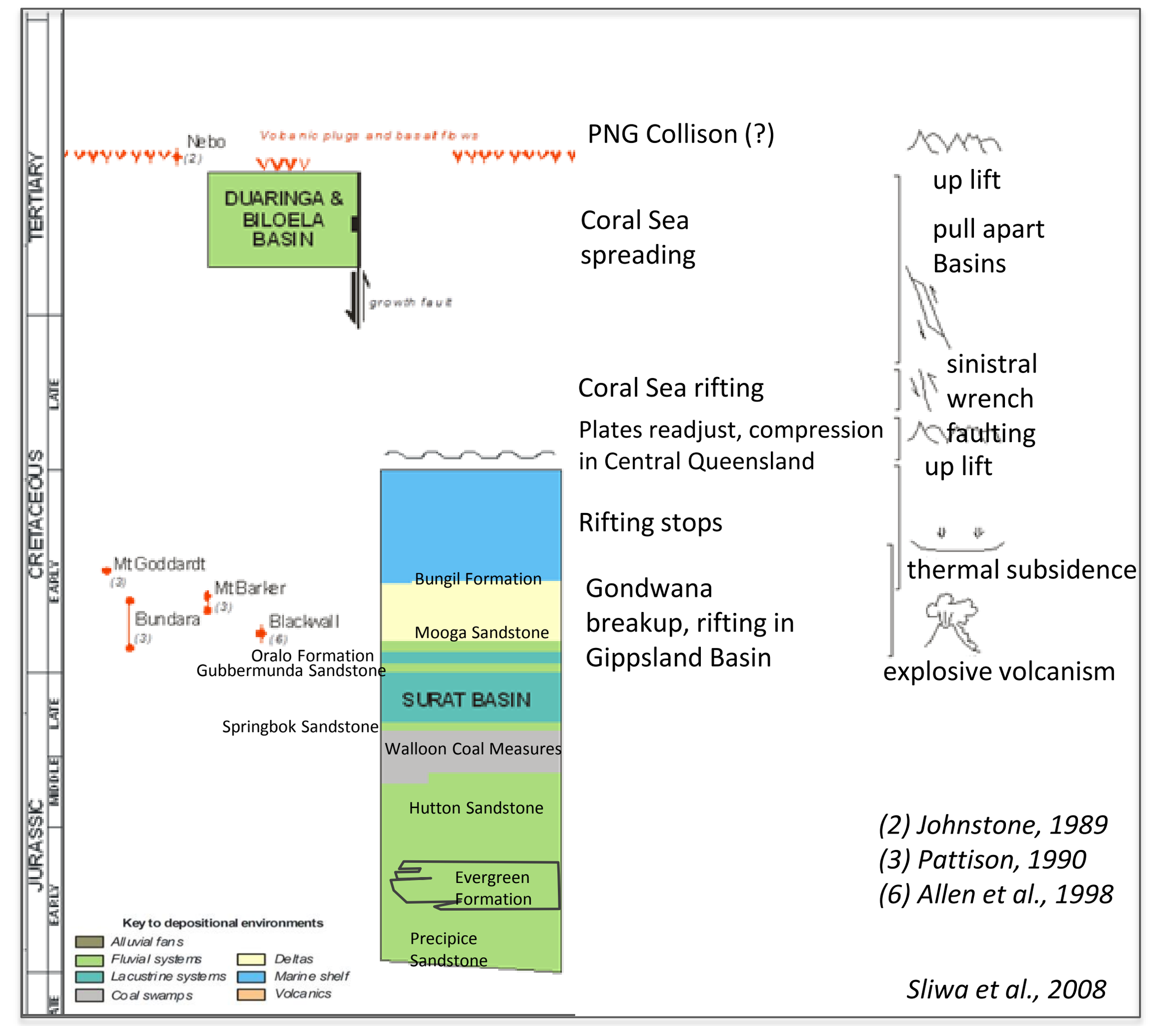

Figure 2 Stratigraphic and tectonic history of the Bowen and Surat Basin from Sliwa et al, 2008

CONCEPTUAL MODEL

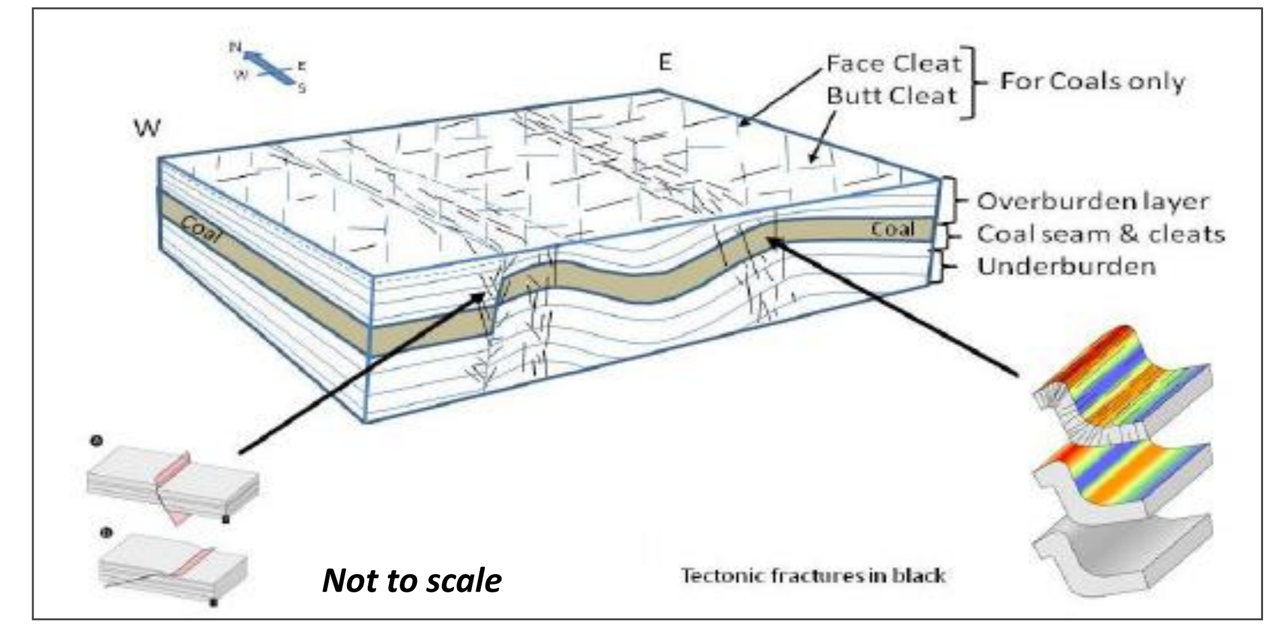

Figure 3 Conceptual Model

In the conceptual model the following assumptions made:

- Fractures will be parallel to axial plane at the crest and will be conjugate at the limb of the folded surface.
- The upper part of the anticline will have extensional structures (normal faults, radial extension veins etc.) and below neutral surface compressional features (folds, thrusts etc.)
- Fracture density will be higher near major faults with multiple orientations bur the fracture density will decrease away from the faulted area.

BOREHOLE IMAGE LOG ANALYSIS & PRELIMINARY RESULTS

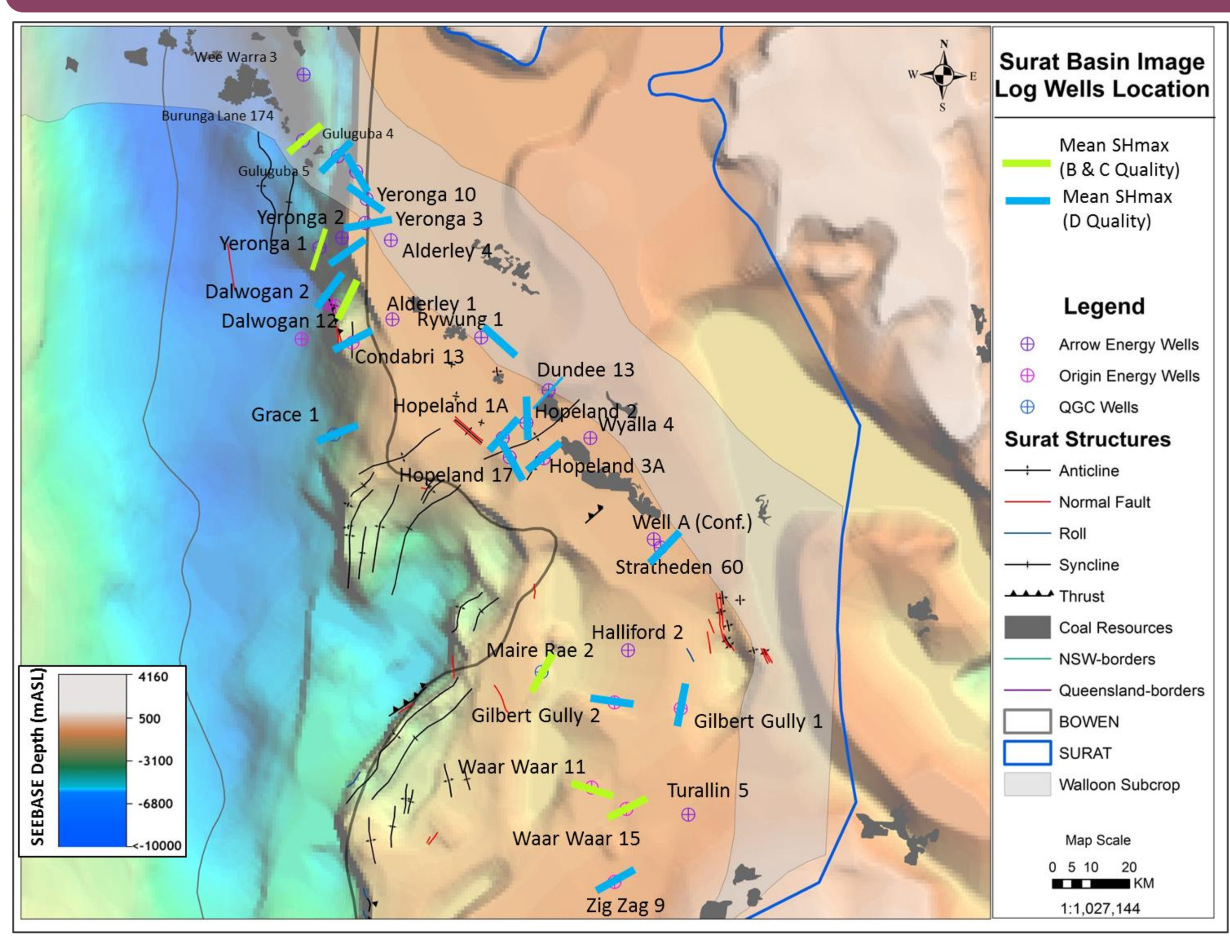

Figure 4 Map showing Mean Stress Orientations (SHmax) from the interpreted wells

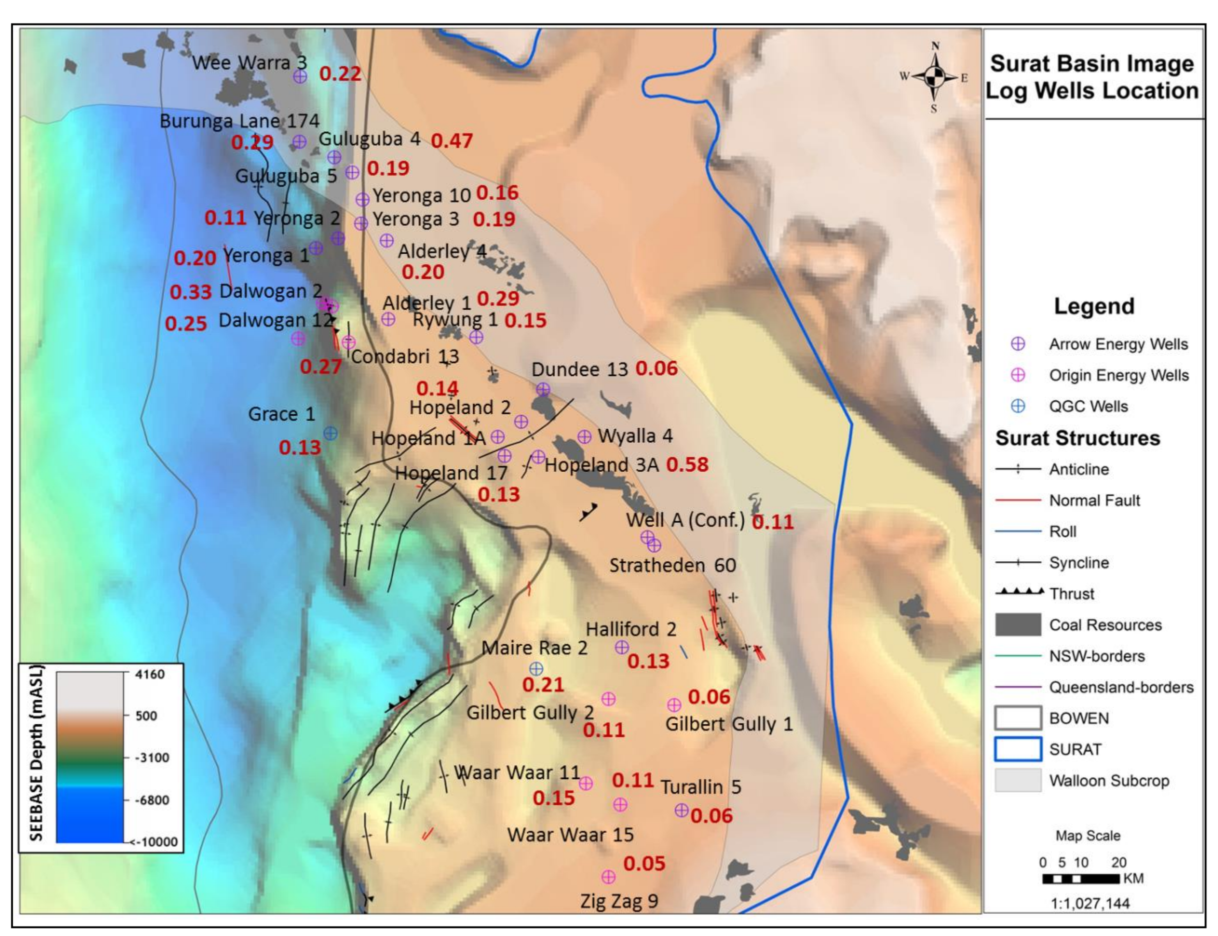

Figure 5 Map showing fracture density distribution (P10) from the interpreted wells

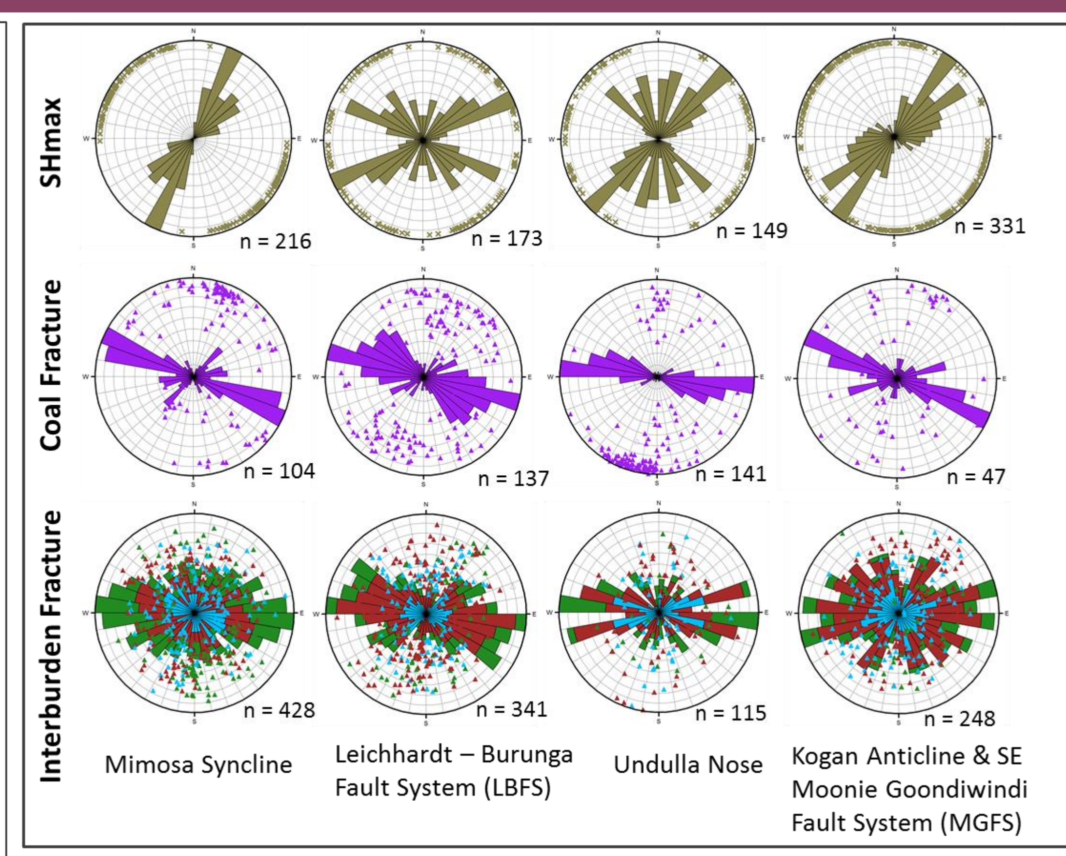

Figure 6 Orientation of SHmax, coal fracture, interburden fracture in the different structural domains (see Figure 1).

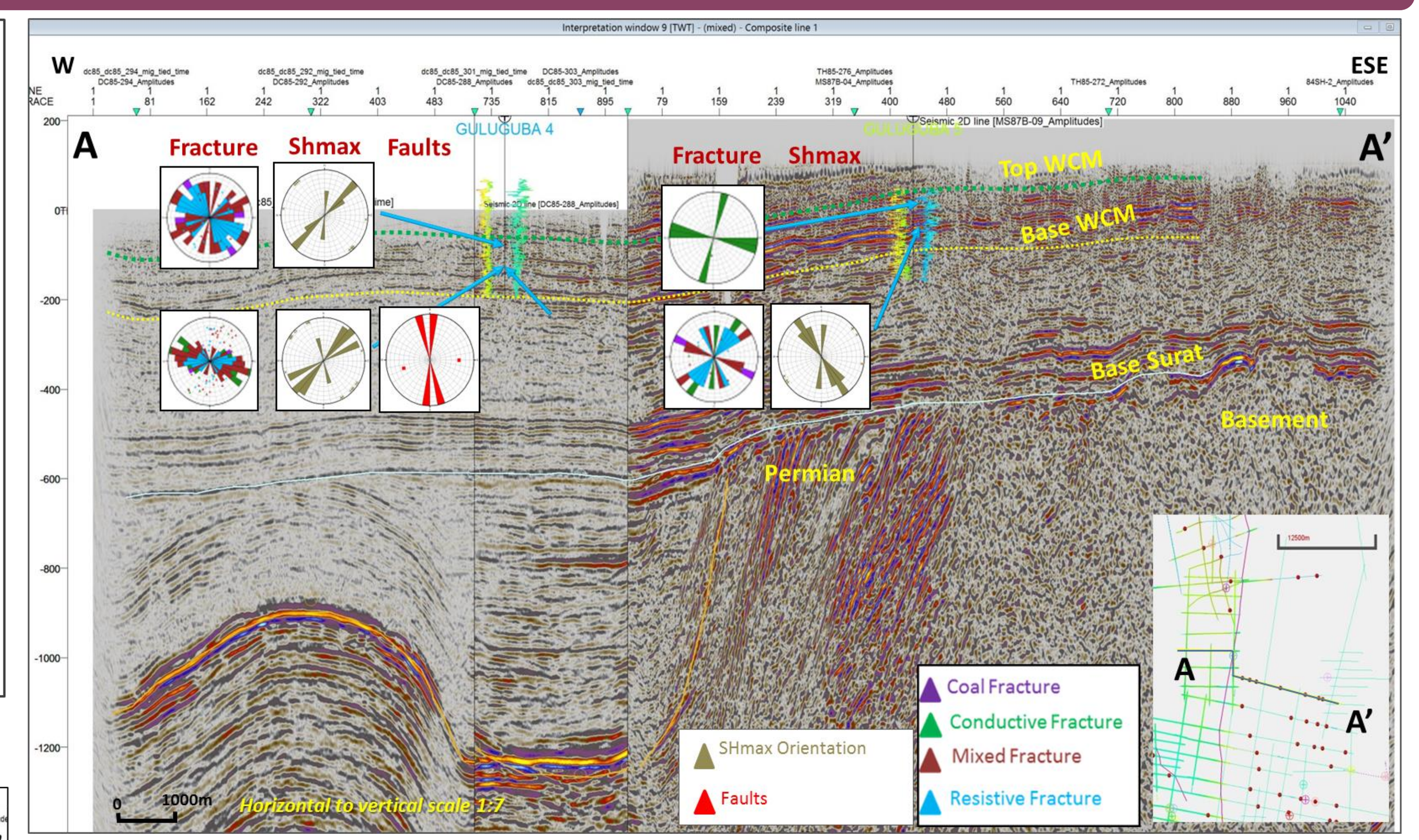

Figure 7 Seismic section showing in situ stress and fracture variation in the Leichhardt – Burunga Fault System

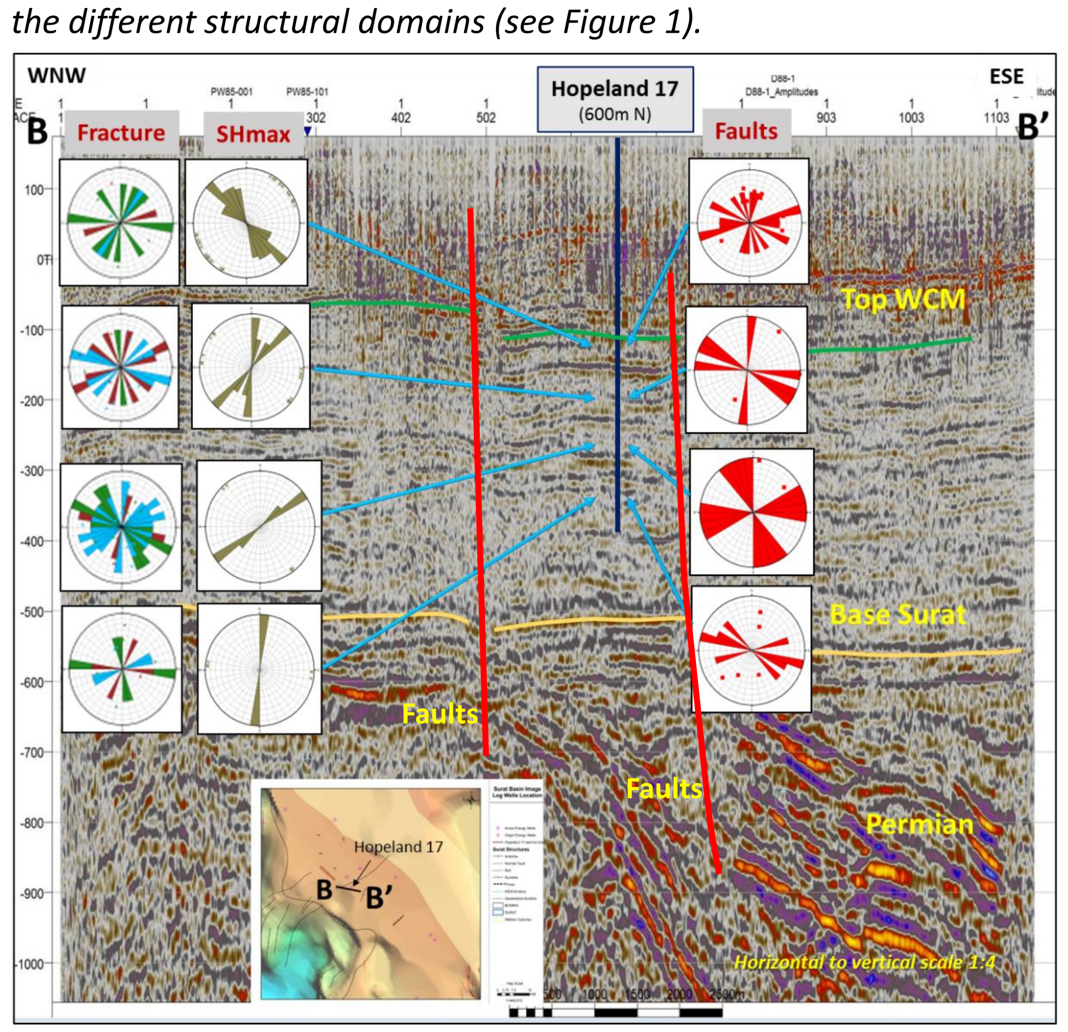

Figure 8 Seismic section showing in-situ stress and fracture variation in the Undulla Nose

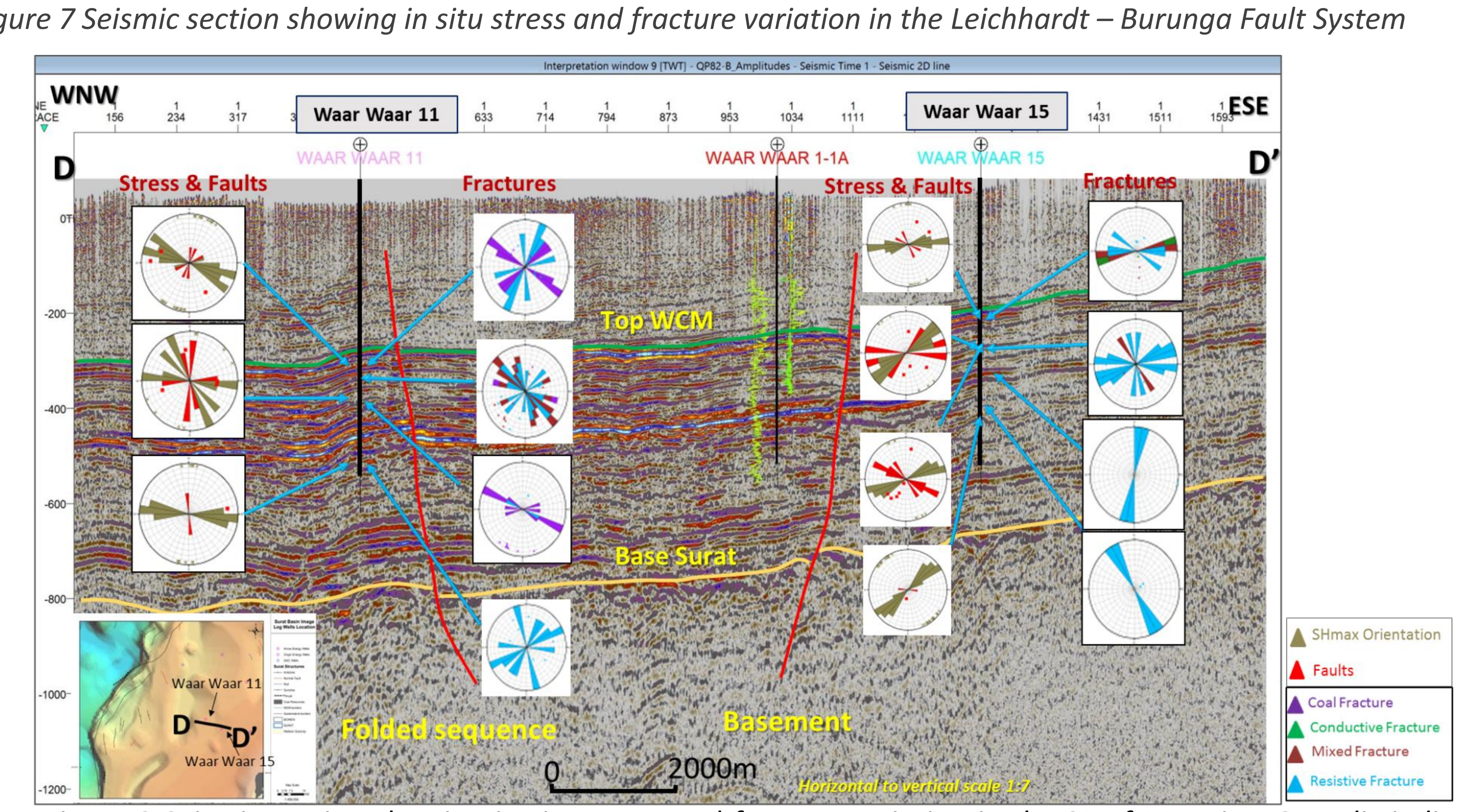

Figure 9 Seismic section showing in situ stress and fracture variation in the SE of Moonie - Goondiwindi Fault System

OBSERVATIONS

- Mean Maximum Principle Stress (SHmax) shows a ENE-WSW orientation but *in-situ* stress orientation varies spatially and along depth close major structures and faults.
- Fracture Density (P10) within Walloon Sub-group is significantly higher close to major basement and Surat structures.
- Coal fractures are dominantly oriented in NW-SE direction in Mimosa Syncline, LBFS, Kogan anticline and SE of MGFS. However, there is also a NE-SW to ENE – WSW coal fracture orientation observed. Coal fractures in the Undulla Nose area are dominantly WNW – ESE with a very small component oriented towards ENE-WSW.
- Interburden fractures in the Mimosa Syncline, LBFS, Undulla Nose area dominantly oriented in two orientations (WNW – ESE and ENE –WSW). There are two minor fracture orientations (NE-SW & NW-SE) present in the Mimosa syncline and Undulla Nose area. Interburden fractures are quite variable in the Kogan anticline and SE of MGFS area.
- Fractures within coal in most cases contained with the coal seam, didn't penetrate adjacent interburden.

REFERENCES

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Sliwa, R., 2013. Eastern Surat Basin structural framework from 2D seismic interpretation. Arrow Energy Limited, Confidential.

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